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Environmental Assessment

Hehe LSR Thin Project

Middle Fork Ranger District

Willamette National Forest

Lane County, Oregon

**Legal Location: T18S, R2E Sections 1, 2, 11, 12, 13, 14, 23, 24, 25, 26, 36,
T18S, R3E, Sections 1-23, 27-30, 33, 34,
T19S, R4E Section 36, W.M.**

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Hehe Late-Successional Reserve Thin Project Environmental Assessment

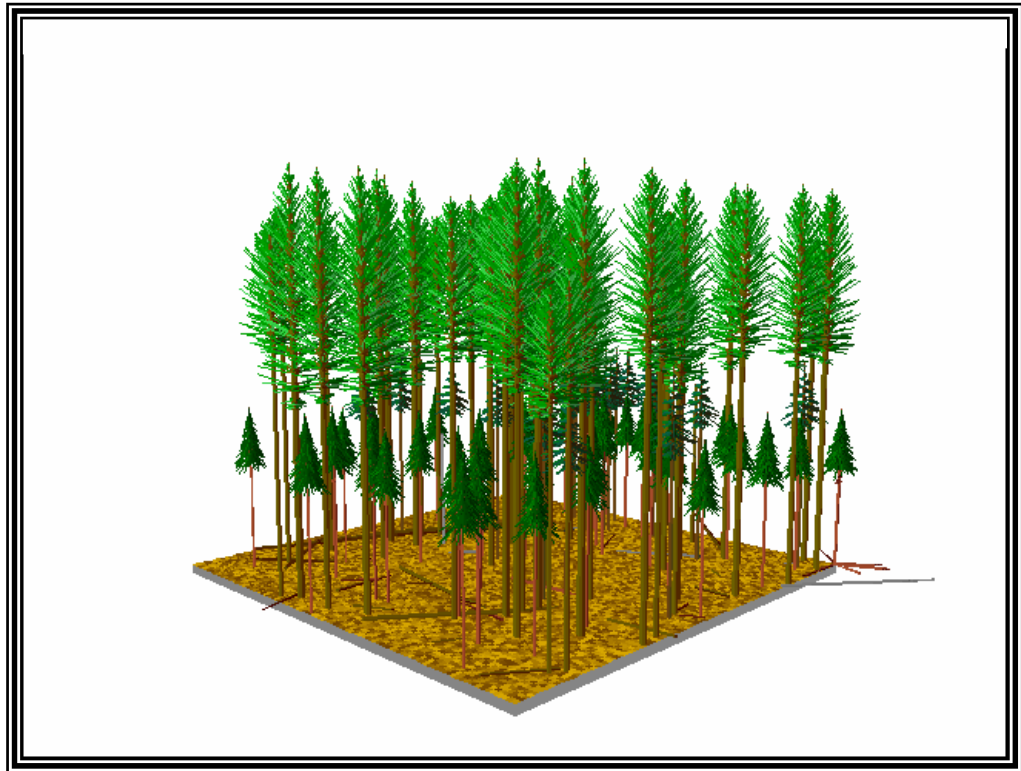


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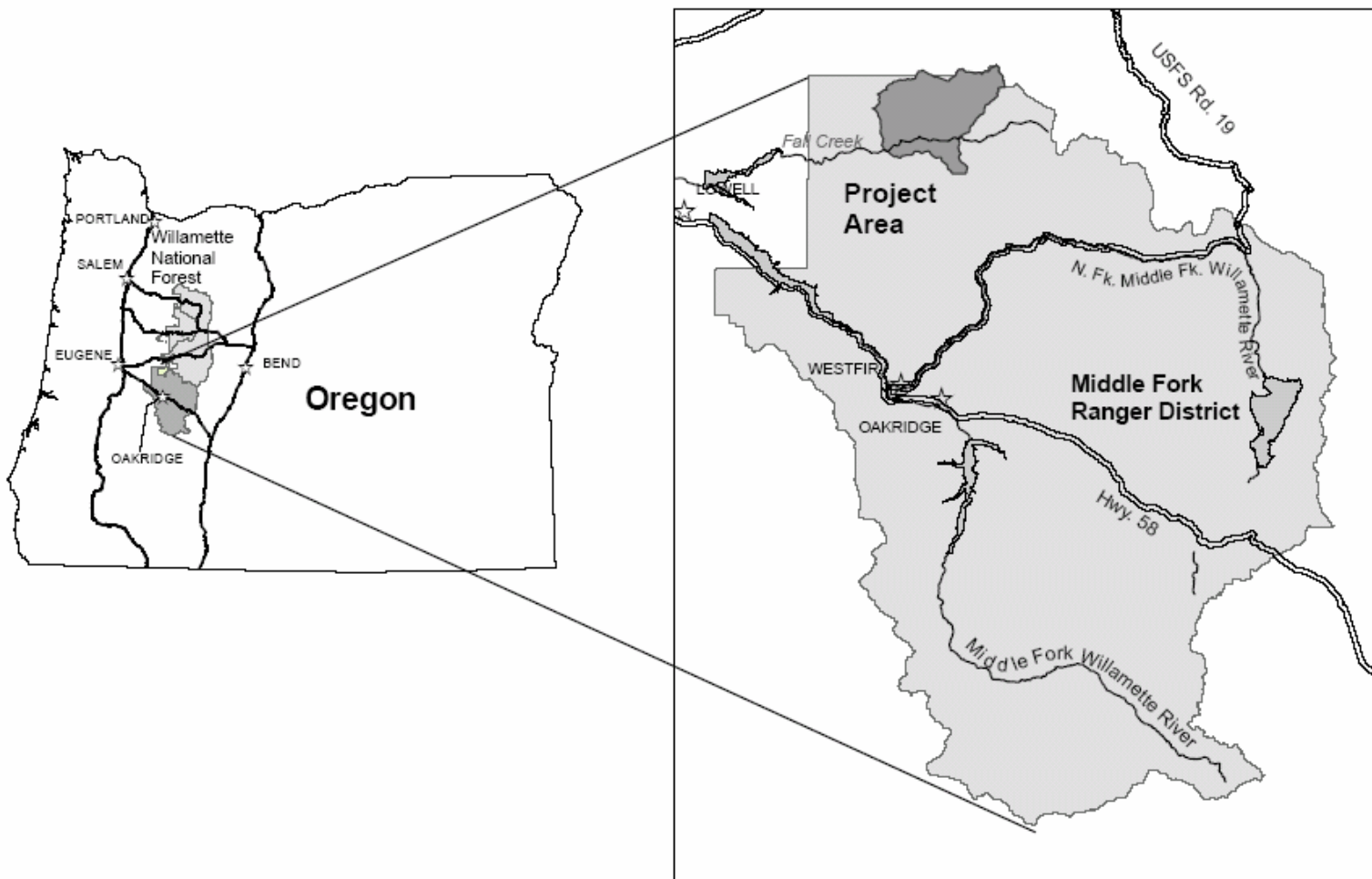
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Chapter 1 – Purpose and Need

Document Structure

The Forest Service has prepared this Environmental Assessment in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This Environmental Assessment discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized into four parts:

Chapter 1 – Purpose and Need: The chapter includes information on the history of the project proposal, the purpose of and need for the project, and the agency’s proposal for achieving that purpose and need. This chapter also details how the Forest Service informed the public of the proposal and how the public responded.

Chapter 2 - Alternatives, including the Proposed Action: This chapter provides a more detailed description of the agency’s proposed action as well as alternative methods for achieving the stated purpose. The alternatives were developed based on significant issues raised by the interdisciplinary team, from public comments, or from consultation with other agencies. This chapter also includes a listing of mitigation measures associated with the alternatives. Finally, this chapter provides a summary table of the environmental consequences associated with each alternative.

Chapter 3 - Environmental Consequences: This chapter describes the environmental effects of implementing the proposed action and other alternatives. This analysis is organized by resource area. Within each resource area, the current conditions of the resource is described first, followed by the effects of the Action Alternatives and concluding with the No Action Alternative that provides a baseline for evaluation and comparison of the other alternatives.

Chapter 4 – Consultation and Coordination: This chapter provides a list of preparers and agencies consulted during the development of the environmental assessment.

Appendices: The appendices provide more detailed information to support the analyses presented in the environmental assessment.

Additional documentation, including more detailed analyses of project-area resources, may be found in the project planning record located at the Middle Fork Ranger District Office in Westfir, Oregon.

Background

The Hehe LSR Thin Project area is defined by the Hehe Creek sub-watershed located in the Fall Creek watershed. The sub-watershed includes the Jones, Alder, Sunshine, Pernot, Hehe, Tiller, Puma, and Marine Creek drainages. This area is located approximately 16 miles northeast of the city of Lowell, Oregon. The legal description of the area is T18S, R2E, Sections 1, 12, 13, 24, 25, T18S, R3E, Sections 1-12, 14-18, 19-22, 27-30, and 34 of the Willamette Meridian.

The project area covers about 20,900 acres. The majority of area is in the western hemlock (*Tsuga heterophylla*) vegetation zone, including wet, moist and dry environments ((USDA 1995), p. 65). These environments are characterized by both low frequency (>200 years) stand-replacing disturbances (i.e. fire) with moderate frequency (80-200 years) partial burns. Insects, diseases, and windthrow play a small role as disturbance agents. The forest landscape pattern is typically fragmented, similar to adjacent federal watersheds, but still possessing large tracts of late-successional and old-growth forest. Landscape-level vegetation patterns have been altered through timber management and fire exclusion. During the 1950's, harvest activities increased in Hehe Creek, generally related to salvage from the Hehe Fire in 1951. The period of the 1960's through the 1980's was an era of extensive road construction and timber harvest activity.

Approximately 50% of project area supports late-successional forest, with 13% of that mature and 37% old-growth. The balance of the area consists of young, second growth plantations and non-forest special habitats such as small meadows openings and rocky outcrops.

The project area is located in Late-Successional Reserve (LSR) #219. This area is managed for late-successional habitat as directed by the Willamette Forest Plan (USDA, 1990) as amended by the Northwest Forest Plan (USDA and USDI, 1994) LSR-219 covers the upper two thirds of the Fall Creek watershed and extends into the North Fork of the Middle Fork Willamette River and Quartz Creek of the McKenzie River. LSR-219 is approximately 66,000 acres of federal lands managed by the Middle Fork and McKenzie River Districts of the Willamette National Forest. An assessment of the LSRs across the Forest (USDA, 1998) recommended LSR-219 as a priority for improving LSR conditions if possible without further compromising its current function. The Late-Successional Reserve assessment (LSRA) states "in LSR-219 it would make sense to close roads and treat stands that will enhance late-successional characteristics where interior habitat will benefit and apply treatments so that between LSR connectivity can be improved along the eastern and southeastern portions of the LSR".

Of the young second growth plantations, over 5,700 acres consist of dense, even-aged, single-story, 35 to 60 year old plantations with low species and structural diversity. The stocking levels and structure of these stands are beginning to exhibit symptoms of suppressed growth and reduction of crowns ratios that could delay the development of late-successional forest characteristics. Recent research (Tappeiner et al. 1997; Poage 2001) suggests that thinning may

be needed to increase diameter growth rates in dense young plantations where the management objective is to speed the development of old-growth characteristics.

Purpose and Need for Action

The purpose of this project is to accelerate the development of late-successional forest conditions and habitat structure in second-growth stands (less than 80 years old) through commercial timber sales. There is a need to:

1. Reduce stocking in managed stands to create late-successional habitat and increase habitat diversity,
2. Reduce road density to decrease road maintenance costs, rehabilitate debris slides, and improve wildlife habitat,
3. Manage fuels to provide for long-term benefits in the prevention or reduction of large – scale disturbances such as wildfires,
4. Enhance aquatic and wildlife habitat by adding wood to streams and creating snags and down in young forest stands.

The proposed action implements the direction from the Record of Decision (ROD) for the Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl (USDA & USDI, 1994). This document, which is better known as the Northwest Forest Plan (NWFP), established the standards and guidelines for activities within the Late-Successional Reserve (LSR) and Riparian Reserve land allocation. The objectives of LSRs are to protect and enhance conditions of late-successional and old-growth forest ecosystems which serve as habitat for late-successional and old-growth related species, including the northern spotted owl (ROD, C-11).

The basis and rationale for stand management in the LSRs is well established and referenced in the ROD. The following are some excerpts from the ROD that reiterates the ecological basis for stand management to obtain late-successional conditions: The standards and guidelines encourage the use of silvicultural practices to accelerate the development of overstocked young plantation into stands with late-successional and old-growth forest characteristics and to reduce the risk to the LSR from severe impacts resulting from large scale disturbances and unacceptable loss of habitat (ROD, B-1)

- Silvicultural systems proposed for LSRs have two principle objectives: (1) development of old-growth characteristic including snags, logs on the forest floor, large trees, and canopy gaps that enable establishment of multiple tree layers and diverse species composition; and (2) prevention of large-scale disturbances by fire, wind, insects, and disease that would destroy or limit the ability of the reserve to sustain variable forest species populations (ROD, B-2).

- The purpose of these silvicultural treatments is to benefit the creation and maintenance of late-successional forest conditions. Examples of silvicultural treatments that may be considered beneficial include thinning in existing even-aged stand and prescribed burning. For example, some areas within LSRs are actually young single-species stands. Thinning these stand can open up the canopy, thereby increasing diversity of plants and animals and hastening transition to a forest with mature characteristics (ROD, C-12)

As part of the NWFP strategy, Watershed Analysis and LSR Assessments were directed to assess the site-specific conditions and needs of the watersheds and LSRs prior to the design and implementation of habitat manipulation activities.

The first of these documents was the Fall Creek Watershed Analysis (FCWA) (USDA, 1995). This was the first document to identify the need and recommend treatments to young plantations that would enhance and accelerate development of late-successional forest habitat in the Fall Creek LSR (page 167). The FCWA also identified chronic road maintenance problems which were causing sedimentation in the stream systems.

The second of these documents was the Fall Creek Late-Successional Reserve Assessment (USDA, 1996). This document also identified the need for young managed stands, which were originally established to produce high yields of timber to receive silvicultural treatment in order to achieve LSR objectives. Consequently, guidance for prioritizing and prescribing treatments for these stands has been recommended in this LSR assessment. The LSR assessment also references the Fall Creek Access and Travel Management Plan which provides additional recommendations for management of the road systems in the LSR.

The third document is the Mid-Willamette LSR Assessment (USDA, 1998). This assessment provides an analysis of LSRs at a larger context within the Willamette Province. It evaluates all of the LSRs on the Willamette National Forest and how they relate to each other. The assessment provides additional treatment criteria and needs at the landscape level, LSR network, individual LSR and at the condition-specific or stands level.

As stated previously, the project area has over 5,700 acres of dense, even-aged, uniform, single-story, 35 to 60 year old plantations with low structural diversity. These existing conditions are a result of previous intensive management regimes to produce high yields of timber. The stocking levels and structure of these stands are beginning to exhibit symptoms of suppressed growth and reduction of crowns ratios that could delay the development of late-successional forest characteristics. Desired conditions for late-successional forest characteristics include the development of large trees, multi-storied canopies, horizontal patchiness, and species diversification. Thinning treatments could ensure the health and vigor of these stands, diversify the species composition and stand structure, and accelerate their development of late-successional forest characteristics.

The need to fund associated resource projects is based on the lack of consistent appropriated funding to accomplish resource restoration. The Knutson-Vandenberg (KV) Act of 1930 provides a stable funding mechanism to finance sale area improvement activities to protect and improve the future productivity of renewable resource of forest lands on timber sale areas. Activities include sale area improvement operations, maintenance and construction for reforestation, timber stand improvement, range, wildlife and fish habitat, soil and watershed, and recreation.

Proposed Action

The Middle Fork Ranger District of the Willamette National Forest proposes commercial thinning on about 3,800 acres of older plantations (35-60 years old) located in the Hehe Creek subwatershed of the Fall Creek Late-successional Reserve (#RO-219). The treatments would take place in the next 3-5 years after the decision is made.

The project would include the maintenance and reconstruction of existing classified road system and possible construction of short temporary roads to access some of the thinning units. After the project is completed, all temporary roads would be decommissioned. Some classified roads would also be closed to reduce the road density within the subwatershed.

The project would include fuel treatments to reduce the short-term hazard created during thinning activities and provide long-term benefits in the prevention or reduction of large scale disturbances such as wildfires.

The project would also provide funding for various wildlife habitat enhancements such as snag creation, forage plantings, seeding and fertilization; watershed improvements such as rehabilitation of debris slides and instream habitat enhancements; invasive weed surveys and control treatments; and interpretive signing.

Decision Framework

The Responsible Official for this proposal is the District Ranger of the Middle Fork Ranger District on the Willamette National Forest. After completion of the EA, there will be a 30-day public comment period. Based on the response to this EA and the analysis disclosed in the EA, the Responsible Official will make a decision and document it in a Decision Notice. The Responsible Official can decide to:

- • Select the proposed action, or
- • Select an action alternative that has been considered in detail, or
- • Modify an action alternative, or
- • Select the no-action alternative, and

- Identify what mitigating measures will apply.

The scope of the project and the decisions to be made are limited to whether these stands need to be commercially thinned, what type of log yarding system would be used to remove the trees, which roads need to be maintained or reconstructed to access the treatment units, which roads would be closed after the project, how to manage post harvest fuel loading, mitigation measures necessary to reduce the adverse effects of the project, what sale area improvement projects to fund, and what to monitoring during the implementation of the Hehe LSR Thin Project. The decision needs to be compatible with LSR objectives and meet environmental requirements for all resources as established in the Forest Plan as amended by the Northwest Forest Plan.

Planning and Management Direction

Development of this EA follows implementing regulations of the Forest and Rangeland Renewable Resources Planning Act of 1974; Title 36, Code of Federal Regulations, Part 219 (36 CFR 219); Council of Environmental Quality, Title 40; CFR, Parts 1500-1508, National Environmental Policy Act (NEPA).

Many federal and state laws, including the National Forest Management Act (NFMA), Endangered Species Act, Clean Air Act, and Clean Water Act also guide this analysis. A summary of how this project and the design of alternatives comply with the federal and state laws can be found in Appendix A.

The project implements the direction of the Forest Plan as amended by the Northwest Plan. Northwest Forest Plan land allocations amended the Forest Plan Management Areas in 1994. The Northwest Forest Plan supersedes any direction in the Forest Plan, unless the Forest Plan Management Area and or standards and guidelines are more restrictive.

The project area is allocated to two Management Areas – Late-successional Reserves and Riparian Reserves.

The LSR is overlaid with the Riparian Reserves system which protects and creates a corridor network along all streams.

Management goals and objectives, descriptions of each area, and applicable standards and guidelines can be found in the Forest Plan, Chapter IV, and the Northwest Forest Plan, Attachment A to the Record of Decision. Figure 1 displays the location of the Management Areas in context with the project area and surrounding area. Proposed activities would occur in both the Late-successional Reserve and Riparian Reserves Management Areas.

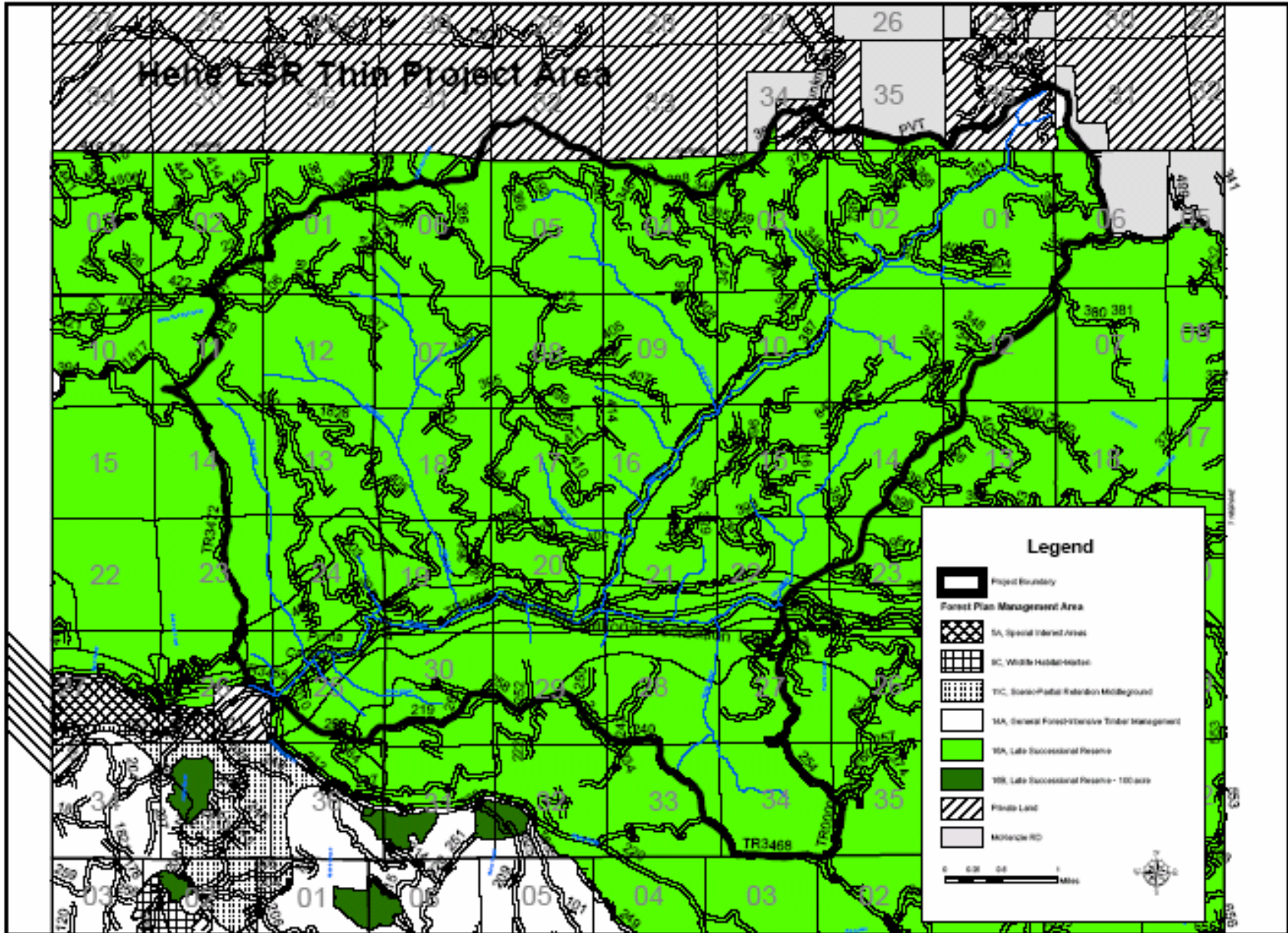


Figure 1 - Map of Forest Plan Management Areas for Hehe LSR Thin Project

Tiered Documents and Local Assessments

This EA is tiered to the Final Environmental Impact Statement (FEIS) for the Land and Resource Management Plan –Willamette National Forest (USDA, 1990) and the Final Supplemental Environmental Impact Statement (FSEIS) on the Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl (USDA, USDI, 1994) and applicable environmental analyses for subsequent Forest Plan Amendments. The Willamette National Forest Land and Resource Management Plan (USDA, 1990) as amended by the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl and S&Gs for Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl (USDA, 1994) are incorporated by reference. The Willamette Forest Plan, as amended, provides a forest-level strategy for managing land and resources and the Northwest Forest Plan provides a regional strategy for management of old-growth and late-successional forest ecosystems on federal lands. The plans provide direction, land allocations or management areas, and S&Gs for the management of National Forest lands within the project area as summarized in the preceding chapter.

The Fall Creek Watershed Analysis (USDA, 1995) is incorporated by reference. This document provides the Responsible Official with comprehensive information upon which to base land management decisions and establishes a consistent, watershed level context to project level analysis. The watershed analysis provides descriptions of the reference, historic, and existing conditions of the important physical, biological, and social components of the fifth field watersheds. The study analyzed activities and processes that cumulatively altered the Fall Creek landscape over time and recommends watershed management activities based upon landscape and ecological objectives. The watershed analysis is used to characterize elements of the watersheds, provided background information for the cumulative effects analyses, and provided recommendations for management activities that move the systems toward reference conditions or management objectives.

The Mid-Willamette Late-successional Reserve Assessment (USDA, 1998) is incorporated by reference. The assessment provides context at a landscape scale for disturbance regimes, connectivity, and functional roles of different elements as they pertain to Late-successional Reserves in the landscape. Used with other planning documents, the LSRA provides a landscape strategy for implementation of restoration activities by prioritizing treatment areas and listing types of appropriate treatments.

The LSRA provided help in evaluating treatment criteria and provided recommendations for coarse woody debris (CWD) in young managed stands

The Willamette National Forest Road Analysis Report (USDA, 2003) and the Middle Fork Ranger District Supplemental Road Analysis (USDA, 2004) are incorporated by reference. The Forest Road Analysis provides the responsible official with information needed to identify and manage a minimum road system that is safe and responsive to public needs and desires, is affordable and efficient, has minimal adverse effects on ecological processes and ecological health, diversity, and productivity of the land, and is in balance with available funding for needed management actions. The District road analysis evaluated each individual road segment on the District with criteria relating to terrestrial, aquatic, administrative, and public use factors. Based on the rating system, road closure recommendations for the District's transportation system were made.

The Forest Road Analysis Report provided recommendations for key roads to be kept open and maintained and for non-key roads that should be considered for closure. The District Supplemental Road Analysis Report provides specific road and closure recommendations for roads within the project area. Copies of these documents are available at the Middle Fork Ranger District office in Westfir, Oregon

Public Involvement

The public involvement process and planning for this project started with a scoping meeting in June of 2003. A Forest Service interdisciplinary team of resource specialists and Middle Fork Ranger District management staff defined the proposed action elements, identified preliminary issues and project opportunities, identified potentially interested and affected people, and assigned members to the interdisciplinary team. The results of the scoping meeting were used to guide the public involvement process, establish analysis criteria and explore possible alternatives and their probable effects.

The scoping record with the description of the proposed action and additional project area information was sent out on December 18, 2003 to the project's mailing list of 44 individuals, interest groups, and organizations, elected officials, tribal representatives, and other federal and state agencies. The cover letter explained the purpose and need for the project, provided a map of the project area, and solicited comments on the proposed action.

The Hehe LSR Thin Project has been included in the Annual Program of Work Review with the Confederated Tribes of the Grand Ronde and Siletz since 2002. No comments have been received specific to the Hehe LSR Thin Project.

The Hehe LSR Thin Project was listed in the Willamette National Forest's Schedule of Proposed Action (SOPA) starting in the Fall Quarter of 2003. The SOPA is mailed out to a Forest mailing list of people interested in the management activities of the Forest. The SOPA provides one of the means of keeping the public informed of the progress of individual projects. The SOPA is also made available to the public on the Willamette Forest website.

One written comment letter was received as a result of these notifications. A copy of the letter can be found in the Public Involvement section of the Analysis File. The one letter was from Oregon Wild (formerly Oregon Natural Resource Council). Comments included such topics as: construction of new roads, decommission of roads, roadless and Wilderness areas, avoiding harvest and mining in late-seral forest, impacts to old-growth related species, survey of special status species, water quality, Aquatic Conservations Strategy objectives,, and the range of alternatives.

The interdisciplinary team reviewed the comments and incorporated the concerns into the issues where applicable. Information related to these concerns was either addressed in the discussion of the issues and environmental consequences or can be found throughout the different sections of the EA, Analysis File or Decision Notice.

A public notice will be published in the local newspaper requesting comments on the proposed actions and EA. The comment period will be for 30 days. A letter will also be sent to the individuals and organizations who have previously submitted comments to notify them that the EA is available for review and a second chance to comment on the projects.

The responsible official will review all the comments along with their supporting reasons before making the final decision. The final decision on the selected alternative along with the rationale for that decision will be documented in a Decision Notice. This notice of the decision will be published in The Register Guard newspaper of Eugene, Oregon and sent out to members of the community who have submitted comments.

Additional information on public involvement can be found in the Chapter 4, Consultation and Coordination section of this document. Copies of these various documents and their attached mailing lists can be found in the Analysis File under Public Involvement.

Issues

Issues are points of concern about environmental effects that may occur as a result of implementing the proposed action. They are generated by the public, other agencies, organizations, and Forest Service resource specialists.

Significant issues describe a dispute or present an unresolved conflict associated with potential environmental effects of the proposed action. Significant issues are used to formulate alternatives, prescribe mitigation measures, and focus the analysis of environmental effects. Significant issues are also determined based on the potential extent of their geographic distribution, duration of their effects, or intensity of interest or resource conflict, if not mitigated or otherwise addressed. The significant issues for this project were identified by the interdisciplinary (ID) team after some preliminary analysis the project area, initial scoping by the ID team, and reviewing all the public comments. The significant issues were approved by the Responsible Official (Weber, 2006).

Significant issues are tracked through issue identification (Chapter 1), alternative development and description (Chapter 2), and Environmental Consequences (Chapter 3). Measurement criteria have been identified for the all the issues and are used to compare alternatives (Table 10 in Chapter 2).

In addition to the significant issues other issues or non-significant issues were raised by the public or Forest Service resource specialists. These issues were determined to be non-significant because they were; 1) outside the scope of the proposed action, 2) already decided by law or regulation, Forest Plan, or other higher level decision, 3) irrelevant to the decision to be made, or 4) conjectural and not supported by scientific or factual evidence. These issues are less focused on the elements of the Purpose and Need and did not influence the formulation of alternatives. Many of the non-significant issues are also included in the environmental effects analysis (Chapter 3) because of the relation to meeting Forest Plan S&Gs, laws, regulatory or policy direction, or relevant to resource analyses.

Significant Issue

Road Management

The current road system was built to access timber and other forest resources. Timber sale revenues paid for the majority of past construction and road maintenance. However, timber harvest has declined with the current emphasis on ecosystem management. The Northwest Forest Plan has designated this area as Late-Successional Reserve (LSR). An extensive road system is in conflict of the LSR objectives. The road network creates contrasting edges of forest habitat, fragments connecting habitat, creates barriers to species movement, and provides access and opportunities for human's to extract natural resources. The change in forest management has seriously reduced operating budgets and the ability to maintain an extensive road system. A consequence is that most roads are no longer annually inspected for maintenance requirements and deficiencies are not corrected, which could result in extensive resource damage. Some roads may need to be removed from the system, others closed until future access is needed, and many managed at the lowest maintenance level that still protects resources values.

Evaluation Criteria: Miles and levels of road maintenance, reconstruction, and construction, miles and levels of road closures; miles of wet weather and total haul route, number of culvert replacements, road density, cost in dollars.

This issue was determined to be significant due to the conflict of the extensive open road system with the LSR resource objectives. A consequence of no maintenance or closing and storing portions of the road system could be extensive resource damage. The duration of the effects to late-successional habitat and water quality could be as long as 50-100 years. The action alternatives provide a range of road closure prescriptions designed to reduce the conflict between the road systems and LSR objectives. Other important road work associated with the alternatives is the repair of several bridges on the main Fall Creek road and replacement of

numerous culverts throughout the project area and the decommissioning of roads. The discussion of this issue can be found in the Chapter 3 – Environmental Consequences under Road Management.

Interior Habitat

Various plant and animal species benefit from maintaining connectivity of late-successional forest stands and large continuous blocks of interior forest habitat. This connectivity facilitates movement, dispersal and migration of many forest species. Intensive management activity (road building and clearcut harvesting) has occurred in this project area over the past 40-50 years. This activity has created a fragmented forest landscape with significantly reduced interior habitat. These conditions are unfavorable to those species that rely on interior forest habitat for a portion or all of their life history. Stand density reduction in managed stands close to late-successional forest habitat may alter interior habitat conditions.

Evaluation Criteria: Linear distance in feet of proposed thinning boundary with late-successional forest stands.

This issue was determined to be significant due to the concern raised in the LSRA about disturbance of interior habitat in LSR-#219. The LSRA gave specific recommendations on treatment criteria for young stands. Those recommendations were considered but modified in the design of the action alternatives to make the project more operationally feasible and cost efficient while still meeting interior habitat objectives. The action alternatives present an array of thinning intensities based on the juxtaposition of the proposed units in the landscape. The discussion of this issue can be found in the Chapter 3 – Environmental Consequences under Interior Habitat.

Spotted Owl

The Northern spotted owl is well documented within the Fall Creek LSR and within the Hehe project area. Assessment of current habitat conditions indicate that foraging habitat conditions for owls can be improved through density management activities. Focusing treatments adjacent to some activity centers based on occupancy and reproductive rates may benefit owls by improving habitat and foraging condition around these sites.

Evaluation Criteria: Acres of stands treated within home range distances of activity centers

This issue was determined to be significant due to the concern of disturbing or modifying habitat for the listed Northern spotted owl. Spotted owls have become the indicator species for late-successional and old-growth forest ecosystems. The action alternatives were designed around different strategies including buffering certain distances from owl's activity sites or using different thinning intensities within those distances. The US Fish and Wildlife Service was consulted during the development of the alternatives and provided input into their design. Other mitigating measures include seasonal restriction of operations during the breeding season. The

discussion of this issue can be found in the Chapter 3 – Environmental Consequences under Spotted Owls.

Fire and Fuels

The proposed action would commercially thin about 3,800 acres. Implementing the proposed thinning along with the coarse woody debris strategies from the LSRA could create an accumulation of fine fuels (0-3 inch) that exceeds fuel loading recommended levels and could increase fire risk, cost to suppress fires, resource damage by wildfires, and risk to firefighters safety.

Several winter storms over the past years have caused considerable snow damage and blowdown that have contributed to the buildup of fuels within these plantations. Fuel prescriptions to reduce both management activity-created fuels and blowdown fuels have been difficult and costly to implement under certain thinning prescriptions. The cumulative fuel loading from these events are potentially in excess of fuel loading standards and guidelines.

Evaluation Criteria: Acres of prescribed fuel reduction treatments; post treatment fuel loading (0-3 inch) tons per acre, priority acres treated.

This issue was determined to be significant due to the conflict between managing to reduce the risk to the LSR from severe impacts resulting from a large scale wildfire and the need for silvicultural treatments to promote development of late-successional forest characteristics which increases fine fuel. The action alternatives provide different strategies to address the Forest Plan recommended levels (FW-252) for management created fuel, specifically fine fuels. The action alternatives were designed with difference types and amounts of mitigating fuel treatments. The alternatives present different levels of short-term risk and cost of treatments. The discussion of this issue can be found in the Chapter 3 – Environmental Consequences under Fire and Fuels.

Non-significant Issues

Vegetation Management

Stand management in Late-Successional Reserves will focus on stands that have been regenerated following timber harvest. These are stands that will acquire late-successional characteristics more rapidly with treatment, or are prone to fire, insect, disease, wind, or other disturbances that would jeopardize the reserve. Depending on stand conditions, treatments could include, but would not be limited to: 1) thinning or managing the overstory to produce large trees; releasing advanced regeneration of conifers, hardwoods, or other plants; or reducing the risk from fire, insect, diseases, or other environmental variables; 2) underplanting and limit understory vegetation control to begin development of multistory stands; 3) killing trees to make snags and coarse woody debris; 4) reforestation; and 5) limit use of prescribed fire to maintain non-forest special habitats. Thinning prescriptions will encourage development of diverse stands with large trees and variety of species in the overstory and understory (ROD, B-6).

Evaluation Criteria: Time to develop 5 TPA of 32 DBH Douglas fir, and years to develop 12 TPA of 16DBH shade tolerant species as modeled using Forest Vegetation Simulator.

This issue was not considered significant because all action alternatives would meet purpose and need for action established in the Forest Plan as amended. The basis and rationale for stand management in LSRs is well established and referenced in the Forest Plan as amended. All action alternatives include aspects of variable density thinning designed to promote the development of late-successional forest characteristics. The effects of the proposed action and the other alternatives on vegetation are addressed in Chapter 3.

Water Quality

There are four principal ways in which roads and timber harvest treatments interact with and may affect water resources: 1) Road and timber harvest treatments interact and influence the production of both fine and coarse textured sediments. If generated sediment is not collected by cross drain culverts and allowed to filter onto the hillside, then water quality may be negatively impacted; 2) Their position on steep hillsides often intercepts and daylight subsurface flow. This may route such flow more quickly to adjacent stream channels and potentially increasing peak flows. 3) Road location within Riparian Reserves can influence the meander patterns of adjacent streams affecting a stream's ability to move sediment. Finally, 4) roads within riparian areas potentially affect a host of processes and resources functions such as the availability of large wood.

Evaluation criteria: miles of road work and associated projects (i.e., culvert replacement, bridge repairs, road closures); Aggregate Recovery Percent; acres of Riparian Reserve thinned.

This issue was not considered significant because all alternatives would meet the law (Clean Water Act), regulations, and Forest Plan standards and guidelines. All action alternatives include mitigation measures such as the Riparian Reserve prescriptions and incorporate other Best Management Practices to maintain or reduce any impacts. Design features and mitigation measures address this issue in Chapter 2. The effects of the proposed action and the other alternatives on water quality are addressed in Chapter 3.

Fisheries

The project area contains habitat for spring Chinook salmon, a threatened fish species. The project area also contains numerous sites with unstable slopes, soil erosion, and sedimentation sources that can reach the stream network. During fall and winter rains major streams in the area such as Fall Creek and Hehe Creek currently carry a heavy suspended sediment load. Physical impacts from increased concentrations of suspended sediment can be detrimental to fish of various life stages, resulting in egg abrasion and direct mortality.

Evaluation Criteria: Changes in fish egg survival from increased sedimentation and turbidity, linear feet of fish-bearing streams affected.

This issue was not considered significant because all alternatives would meet the law (Endangered Species Act and Clean Water Act), regulations, and Forest Plan standards and guidelines. All action alternatives include mitigation measures such as the Riparian Reserve prescriptions and incorporate other Best Management Practices to maintain or reduce any impacts to levels which protect fish. Design measures and mitigation measures address this issue in Chapter 2. The effects of the proposed action and the other alternatives on aquatic habitat and water quality are addressed in Chapter 3.

Soil Erosion and Detrimental Soil Disturbance

Various soils types within the project area have high surface soil erosion potential and a high potential for land failures (mass wasting) which could be a source of fine grain sediments to the streams. Some level of soil disturbance (soil compaction and displacement) has occurred from past timber harvest activities. Various soils of the project area are susceptible to cumulative soil disturbance (soil compaction and displacement), which will affect the long-term potential for soil erosion and soil productivity of the project area.

Evaluation criteria: Acres of new detrimental soil disturbance.

This issue was not considered significant because all action alternatives would meet the Forest Plan standards and guidelines for detrimental soil conditions (FW-081). Only a small percentage of the project area was determined to be near the threshold of the standards and guidelines. The proposed action alternatives provide the mitigation measures of logging systems (i.e., skyline and helicopter options) which provide partial or full log suspension in meeting the intent of standards and guidelines for detrimental soil conditions. Associated with the alternatives are different restoration treatments (road closures) and other mitigation measures to rehabilitate the compacted soil around landings and temporary roads..

Big Game

All or portions of 4 big game emphasis areas occur within the project planning area. NW Forest Plan Standards and Guidelines for large LSR conflict with Willamette Forest Standards and Guidelines for big game management LSR objective is to protect and enhance conditions of late-successional and old-growth forest ecosystems. Management of these elk emphasis areas are based on a set of habitat effectiveness indices as identified in the Willamette Forest Plan, which encourages clearcutting and broadcast burning approach to provide optimal habitat conditions for big game.

Evaluation Criteria: Habitat Effectiveness Indices based on Wisdom model.

This issue was not considered significant because all alternatives would meet the Forest Plan standards and guidelines for big game emphasis areas (BGEA) (FW-135 – 146, 150-153). Commercial thinning in general has minimal impacts on big game and the proposed action alternatives establishes a trend to improve or maintain the “overall” Habitat Effectiveness Value for the given BGEAs. Mitigating measure include road closures and creation of forage areas

which would be seeded with a forage seed mix. The brief discussion of this issue can be found in the Chapter 3 – Environmental Consequences under Big Game Habitat.

Threatened, Endangered and Sensitive (TE&S) Species

Known sites for certain TE&S species do occur within the project area and potential habitat exists for other species that are suspected to occur. Harvest associated activities could affect T,E&S species and their habitats within, adjacent to and downstream of the project area.

Evaluation Criteria: An evaluation of effects on species that are known or have the potential to occur within project area.

This issue was not considered significant because all alternatives would meet the law (Endangered Species Act), regulations, and Forest Plan standards and guidelines. All actions that modify or disturb forest habitat would be required to follow conservation and protection guidelines provided by the Forest Plan and other consulted federal agencies. While there is a potential for short-term adverse due to the disturbance, impacts to habitat are essentially the same for all action alternatives. Disturbance impacts are mitigated in the action alternatives with the same measures that have been commonly prescribed and used on other timber project for several years. These mitigation measures are listed in Chapter 2. The effects of the proposed action and the other alternatives on TES species are addressed in Chapter 3.

Survey and Manage (S&M) and Protection Buffer Species

Numerous Survey and Manage and Protection Buffer species are known or suspected to occur within the project area. These include mollusk species, the great gray owl, red tree voles and numerous lichens, bryophytes and fungi. Harvest associated activities could affect known sites or habitat of S&M and Protection Buffer species.

Evaluation Criteria: Evaluation of species that are known or have the potential to occur within the project area and impacts.

This issue was not considered significant because it is addressed by the by Forest Plan standards and guidelines. All actions that modify or disturb forest habitat would be required to follow conservation and protection guidelines provided by the Forest Plan. Design measures and mitigation measures address this issue in Chapter 2. The effects of the proposed action and the other alternatives on S&M and Other ROD species are addressed in Chapter 3.

Economics

Economic efficiency is the determination of the cost of planning and implementing forest management treatments and the benefits or revenues those treatments generate. Forest Service Manuals (2430-2432) and Handbook (2409.18 Chapters 10-30) require financial and economic efficiency information be available to the decision maker prior to substantial investment of capital and resources in timber sales. The proposed action of thinning treatments in an LSR achieves forest stewardship objectives; therefore the sale of timber is secondary to achieving those

objectives. Revenue produced from this timber is considered an offset to the cost of accomplishing the project.

Evaluation Criteria: Financial Present Net Value, Revenue Cost Ratio.

This issue was not considered significant because all alternatives meet Forest Service Manual direction. Forest Service Manuals (2430-2432) and Handbook (2409.18 Chapters 10-30) require that financial and economic efficiency information be available to the decision maker prior to substantial investment of capital and resources in timber sales. All the action alternatives would have a positive economic benefit and are economical viable but there is a difference in costs due to the logging cost, and fuel treatment costs, mitigation measures, and potential sale improvement area project costs. The discussion of this issue can be found in the Chapter 3 – Environmental Consequences under Economics.

Invasive Weeds

Timber sale activities may contribute to the spread of invasive weeds. The spread of invasive weeds displaces native plants, which may have an effect on biotic communities.

Evaluation criteria: Acres of potential disturbed areas.

This issue was not considered significant for designing alternatives because specific mitigating measures would be used in all action alternatives to prevent expansion of existing invasive weed populations. See Mitigation Measures in Chapter 2. The affects of the proposed action and other alternatives on invasive weeds are discussed in Chapter 3 under Vegetation.

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Chapter 2 - Alternatives, including the Proposed Action

This chapter describes and compares the alternatives considered for the Hehe LSR Thin Project. It includes a description and map of each alternative considered. This section also presents the alternatives in comparative form, defining the differences between each alternative and providing a clear basis for choice among options by the decision maker. Some of the information used to compare the alternatives is based upon the design of the alternative (i.e., acres of skyline logging versus helicopter logging, miles of temporary roads construction) and some of the information is based upon the environmental, social and economic effects of implementing each alternative (i.e., percentage of treatment units in projected detrimental soils classes, big game habitat variables, number of log truck loads, logging cost per mbf, and present net values).

Alternative 1 – No Action

Alternative 1 is the No Action alternative where the proposed project does not take place. No further activities would take place to manage the stands by thinning. The No Action alternative provides a benchmark, or a point of reference for describing the environmental effects between the action alternatives.

Action Alternatives

The action alternatives were developed based on the purpose and need for the action and the significant issues. The purpose and need for the project was established by the Responsible Official (i.e. District Ranger). The significant issues were identified by the interdisciplinary team (IDT) after preliminary analysis and review of public comments from scoping. Significant issues are approved by the Responsible Official. The significant issues as used to formulate the alternatives which meet the purpose and need, prescribe mitigation measures, and focus the analysis of environmental effects. The significant issues for the project are: road management, interior habitat, effects on spotted owls, and fuel loadings

Alternative 2

Alternative 2 is designed to provide a high level of public access to the area by keeping most of the roads open. This alternative would implement only some of the road closures proposed in the Middle Fork District Supplemental Road Analysis. Any road closures would be low cost and low intensity designs to allow for re-opening of the roads in the short-term. This alternative would thin the least amount of acres of second growth plantations. Thinning acres were chosen based upon open road access and stand densities. The alternative includes the most protection (least disturbance) around spotted owl sites. Post-thinning fine fuel treatments were designed to meet Forest Plan guidelines on about 50 percent of the treatment areas.

This alternative would commercially thin about 3,186 acres of 35-60 year old stands. The stands would be thinned to a variety of densities ranging from about 50-100 trees per acre.

Approximately 650 acres would receive a light thinning, about 1,573 acres moderate thinning, and 963 acre a heavy thinning. Various prescription elements of variable density thinning would be employed such as leaving un-thinned patches, maintaining no thin buffers and protection for riparian areas and special habitats, creating small openings by clearing around and releasing dominant trees and from landing areas, and varying the tree spacing among the units. The thinning has the silviculture objective of accelerating development of late-successional forest conditions in the LSR.

Log removal would be accomplished by two types of yarding systems. This alternative would yard about 1,996 acres with skyline and 1,189 acres with helicopters.

The proposed yarding systems would require the new construction of about 3.9 miles of temporary roads to access the thinning areas, and the maintenance and reconstruction of about 102.1 miles of haul route roads. This alternative would replace numerous culverts on perennial and non-perennial streams and ditch relief drainages throughout the project area. One large fish bearing stream culvert at Pernot Creek on Road #1831 would also be replaced. This alternative would close about 4.4 miles of road after thinning operations. The road closures would rehabilitate and store the roads in a hydrologically stable condition by berming the roads closed and installing waterbars. This alternative would leave about 27 miles of roads which have been blocked by fallen trees or road failures in the current closed conditions. These roads include the end of Road #1831, #1831-382, and the #1834-390.

The alternative would mitigate the post-thinning fuels by yarding tops and machine piling at landings on about 1,996 acres. The alternative would also machine pile and burn about 190 acres within 40 feet of open roads and landings in or adjacent to thinning areas.

Alternative 2 would thin about 1,138 acres of Riparian Reserves. The no thin (no-cut) portion of the Riparian Reserves would be established at approximately 200 feet on Hehe and Alder Creeks to provide additional protection to these listed fish streams. Table 1 displays and compares the Riparian Reserve prescriptions between the action alternatives.

This alternative would protect established spotted owl sites with less than 40 percent of their 1.2 mile radius home range in suitable habitat by not thinning within 0.7 miles of the sites. All three thinning intensities, light, moderate, or heavy would be allowed beyond the 0.7 miles. If the owl sites are established and have greater than 40 percent suitable habitat conditions within 1.2 mile home range, light to moderate thinning is allowed within 0.25 to 0.7 miles of owl sites. If the owl sites are resident single owls and suitable habitat conditions are less than 40 percent within 1.2 mile radius home range, light to moderate thinning is still allowed within 0.25 to 0.7 miles.

The alternative includes the creation of snags and down woody debris in the thinned stands, invasive plant surveys and control measures along roads and landing areas, decommissioning of

roads, instream habitat enhancements on the portions of Hehe, Alder, Tiller, and Fall Creeks, disassemble the Hehe Creek log collection rack, and firewood administration.

A listing and summary of the unit prescriptions for Alternative 2 can be found in Appendix C.

Table 1 - Riparian Reserve Prescriptions

Stream Type	Riparian Prescriptions		
	Alternative 2	Alternative 3	Alternative 4
Listed fish segments on Hehe and Alder Creeks	200 ft. wide no-cut buffers, 200-340 ft. thinned to meet riparian objectives	170 ft. wide no-cut buffers, 170-340 ft. thinned to meet riparian objectives	170 ft. wide no-cut buffers, 170-340 ft. thinned to meet riparian objectives
Fish-bearing Class I	100 ft. wide no cut buffers, 100-340 ft. thinned to meet riparian objectives	100 ft. wide no-cut buffers, 100-340 ft. thinned to meet riparian objectives	100 ft. wide no-cut buffers, 100-340 ft. thinned to meet riparian objectives
Fish-bearing Class II	100 ft. wide no-cut buffers, 100-340 ft. thinned to meet riparian objectives	100 ft. wide no-cut buffers, 100-340 ft. thinned to meet riparian objectives	60 ft. wide no-cut buffers, 60-90 ft. thinned to 50% canopy closure, 90-340 ft. thinned to meet riparian objectives
Non fish-bearing (Class III) permanently flowing streams, ponds and small wet areas less than 1 acres	100 ft. no-cut buffers, 100-170 ft. thinned to meet riparian objectives	100 ft. no-cut buffers, 100-170 ft. thinned to meet riparian objectives	60 ft. no-cut buffers, 60-90 ft. thinned to 50% canopy closure 90-170 ft. thinned to meet riparian objectives
Non- fish-bearing (Class IV) intermittent flowing streams, small wet areas	60 ft. no-cut buffers, 60-170 ft. thinned to meet riparian objectives	60 ft. no-cut buffers, 60-170 ft. thinned to meet riparian objectives	25 ft. no-cut buffers on areas with stream side slopes < 30 %, 25-90 ft. thinned to 50% canopy closure, 90-170 thinned to meet riparian objectives, 60 ft. no-cut on >30% slopes, 60-90 ft. thinned to 50% canopy closure, 90-170 ft. thinned to meet riparian objectives

The no-cut buffers would include all of inner gorge and the entire primary shade zone. Adjacent trees would be felled away from the no-cut buffer. Underburns would be discouraged from entering the no-cut zones on the smaller Class III and IV streams, but some low intensity backing fires would be permitted.

The outer portion of the Riparian Reserves would be thinned to meet riparian and terrestrial objectives. These objectives include maintaining and restoring species composition and structural diversity, and providing for habitat to support well-distributed populations of native plants, invertebrates and vertebrate riparian-dependent species.

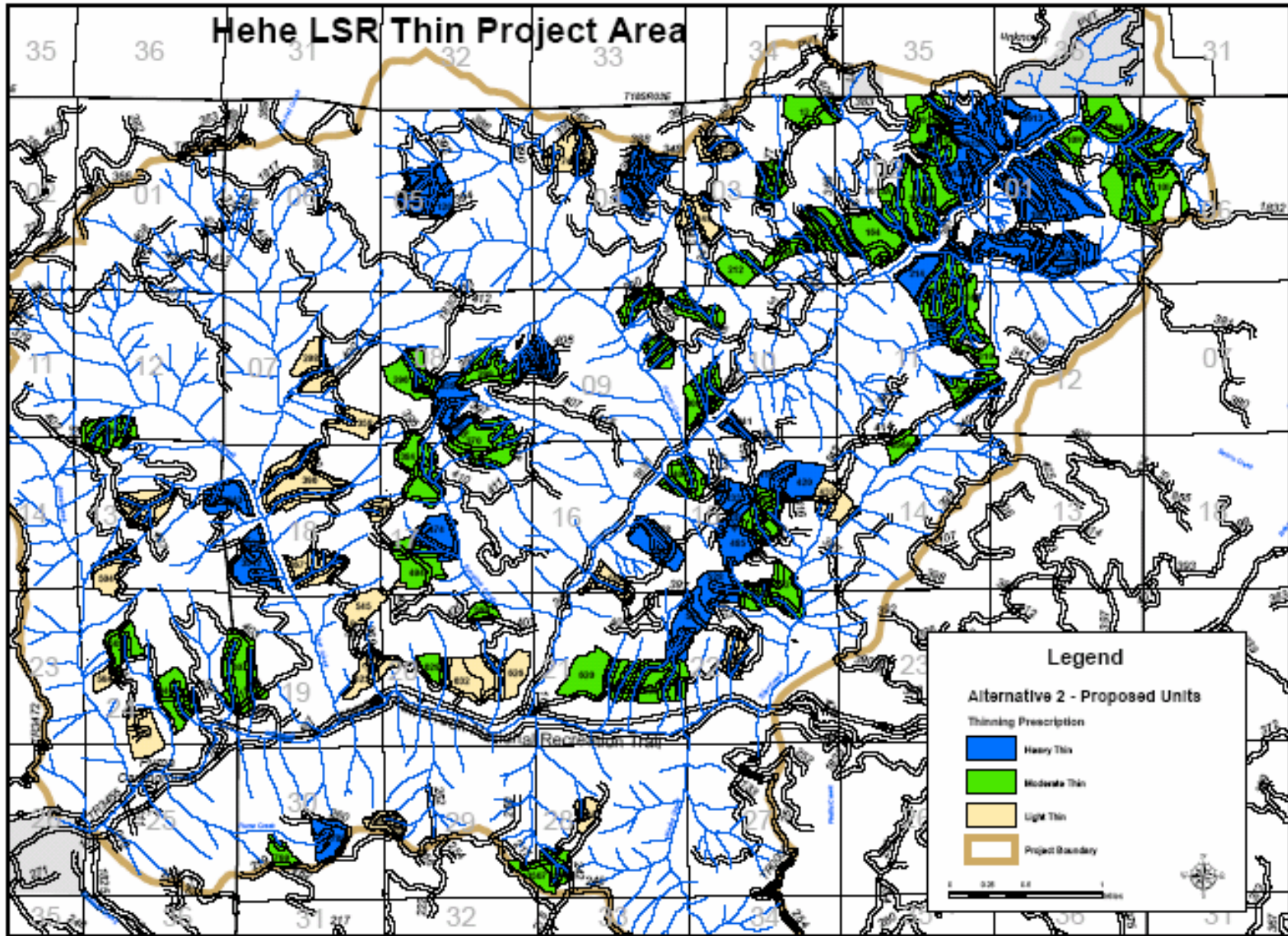


Figure 2 - Map of Alternative 2

Alternative 3 – Proposed Action

Alternative 3 is designed to maintain access for fire protection, recreation, and administrative use while implementing the proposed road closures in the Middle Fork District Supplemental Road Analysis. Road closures would employ a mixture of closure designs appropriate for given road conditions. This alternative would thin a moderate amount of acres of second growth plantations. Thinning acres were chosen based on stand densities without regard of open road access. The alternative includes a protection strategy designed in consultation with USFWS for the spotted owl sites. Post-thinning fine fuel treatments were designed to meet Forest Plan guidelines on about 74% percent of the treatment areas.

This alternative would commercially thin about 3,762 acres of 35-60 year old stands. The stands would be thinned to a variety of densities ranging from about 50-100 trees per acre. Approximately 842 acres would receive a light thinning, about 1,846 acres moderate thinning, and 1,074 acre a heavy thinning. Various prescription elements of variable density thinning would be employed such as leaving un-thinned patches, maintaining no thin buffers and protection for riparian areas and special habitats, creating small openings clearing round and releasing dominant trees and from landings areas, and varying the tree spacing among the units. The thinning has the silviculture objective of accelerating development of late-successional forest conditions in the LSR.

This alternative would yard about 2,576 acres with skyline and 1,186 acres with helicopters.

The proposed yarding systems would require the new construction of about 3.8 miles of temporary roads to access the thinning areas, and the maintenance and reconstruction of about 115.3 miles of haul route roads. This alternative would replace numerous culverts on perennial and non-perennial streams and ditch relief drainages throughout the project area. One large fish bearing stream culvert at Pernot Creek on Road #1831 would also be replaced. This alternative would close about 38 miles of road to passenger vehicles after thinning operations. These roads would be rehabilitated and stored in a hydrologically stable condition using low level closure (see pages 54-55 for description) techniques on 20.3 miles of road and moderate levels closure techniques on 17.7 miles. About 6.2 miles of roads would be decommissioned including the last 3.4 miles of Road #1831.

The alternative would mitigate the post-thinning fuels by yarding tops and machine piling at landings on about 3,660 acres. The alternative would also machine pile and burn about 130 acres within 40 feet of open roads and landings in or adjacent to thinning areas. This alternative also includes 281 acres of prescribed underburning.

Alternative 3 would thin 1,387 acres of Riparian Reserves with the no thin (no-cut) portion of the Riparian Reserves being established at approximately 170 feet away for the listed fish streams of Hehe and Alder Creeks (See Table 1)

This alternative would protect established spotted owl sites with less than 40 percent of their 1.2 mile radius home range in suitable habitat by not thinning within 0.5 miles of the sites, light to moderate thinning from 0.5 to 0.7 miles. All three thinning intensities, light, moderate, or heavy would be allowed beyond the 0.7 miles. If the owl sites are established and have greater than 40 percent suitable habitat conditions within 1.2 mile home range, light to moderate thinning is allowed within 0.25 to 0.5 miles of owl sites and the three thinning intensities would be allowed beyond 0.5 miles. If the owl sites are resident single owls and suitable habitat conditions are less than 40 percent within 1.2 mile radius home range, light to moderate thinning is still allowed within 0.25 to 0.5 miles of owl sites and the three thinning intensities beyond 0.5 miles.

The alternative includes the creation of snags and down woody debris in the thinned stands, invasive plant surveys and control measures along roads and landing areas, decommissioning of roads, instream habitat enhancements on the portions of Hehe, Alder, Tiller, and Fall Creeks, disassemble the Hehe Creek log collection rack, and firewood administration.

A listing and summary of the unit prescriptions for Alternative 3 can be found in Appendix C –

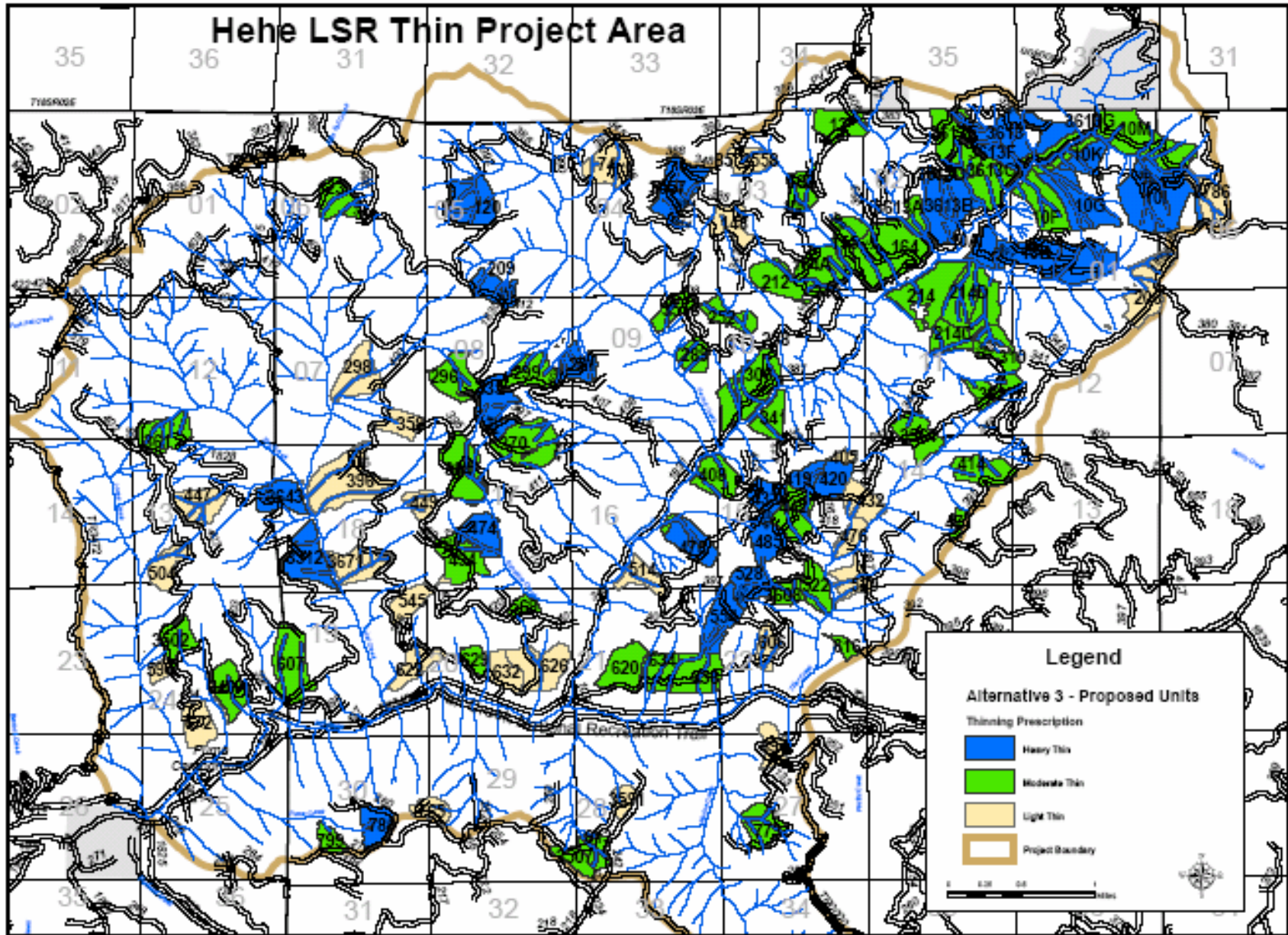


Figure 3 - Map of Alternative 3 (Proposed Action)

Alternative 4

Alternative 4 is designed to implement the proposed road closures from the Middle Fork District Supplemental Road Analysis. Road closures would be designed for the long-term. This alternative would thin the highest number of acres of second growth plantations. Thinning acres were chosen based on stand ages and seral conditions. The alternative includes the minimum amount of protection for the spotted owl sites among the action alternatives. Post-thinning fine fuel treatments were designed to meet Forest Plan guidelines on 98 percent of the treatment areas.

This alternative would commercially thin about 4,179 acres of 35-60 year old stands. The stands would be thinned to a variety of densities ranging from about 50-100 trees per acres.

Approximately 990 acres would receive a light thinning, about 1,676 acres moderate thinning, and 1,513 acre a heavy thinning. Various prescription elements of variable density thinning would be employed such as leaving un-thinned patches, maintaining no-thin buffers to protect riparian areas and special habitats, creating small openings by clearing around and releasing dominant trees and from landings areas, and varying the tree spacing among the units. The thinning has the silvicultural objective of accelerating development of late-successional forest conditions in the LSR.

This alternative would yard about 2,926 acres with skyline and 1,253 acres with helicopters.

The proposed yarding systems would require the new construction of about 4.8 miles of temporary roads to access the thinning areas, and the maintenance and reconstruction of about 127.5 miles of haul route roads. This alternative would replace numerous culverts on perennial and non-perennial streams and ditch relief drainages throughout the project area. One large fish bearing stream culvert at Pernot Creek on Road #1831 would also be replaced. This alternative would close about 38.1 miles of road to passenger vehicles after thinning operations. These roads would be rehabilitated and stored in a hydrologically stable condition using low level closure techniques on 7.2 miles of road and moderate-level closure techniques on 29.2 miles (includes 1.7 miles of decommission road). A total of 12.6 miles of road would be decommissioned. This alternative includes the reconstruction of the end of Road #1831 to access helicopter landing sites and subsequent decommissioning of the road after thinning operations.

The alternative would mitigate the post-thinning fuels by yarding tops and machine piling at landings on about 4,101 acres. The alternative would also machine pile and burn about 141 acres within 40 feet of open roads and landings in or adjacent to thinning areas. This alternative also includes about 362 acres of prescribed underburning and about 1,196 acres of supplemental hand piling and burning.

Alternative 4 would thin about 1,597 acres of Riparian Reserves. The no thin (no-cut) portion of the Riparian Reserves has been decreased to approximately 60 feet away for the Class II fish bearing and perennial streams, thinned to 50 % canopy closure 60-90 feet away from streams, and

then thinned to meet riparian objectives in the rest of the Riparian Reserves. On non-fish bearing intermittent stream, the no thin (no-cut) buffers were decreased to 25 feet on areas with stream side slopes less than 30 percent (See Table 1).

This alternative would protect established spotted owl sites with less than 40 percent of their 1.2 mile radius home range in suitable habitat by not thinning within 0.5 miles of the sites. All three thinning intensities, light, moderate, or heavy would be allowed beyond the 0.5 miles. If the owl sites are established and have greater than 40 percent suitable habitat conditions within 1.2 mile home range, light to moderate thinning is allowed within 0.25 to 0.5 miles of owl sites and any of the three thinning intensities beyond 0.5 miles. If the owl sites are resident single owls and suitable habitat conditions are less than 40 percent within 1.2 mile radius home range, light to moderate thinning is still allowed within 0.25 to 0.5 miles of owl sites and any of three thinning intensities beyond 0.5 miles.

The alternative includes the creation of snags and down woody debris in the thinned stands, invasive plant surveys and control measures along roads and landing areas, decommissioning of roads, instream habitat enhancements on the portions of Hehe, Alder, Tiller, and Fall Creeks, disassemble the Hehe Creek log collection rack, and firewood administration.

A listing and summary of the unit prescriptions for Alternative 4 can be found in Appendix C.

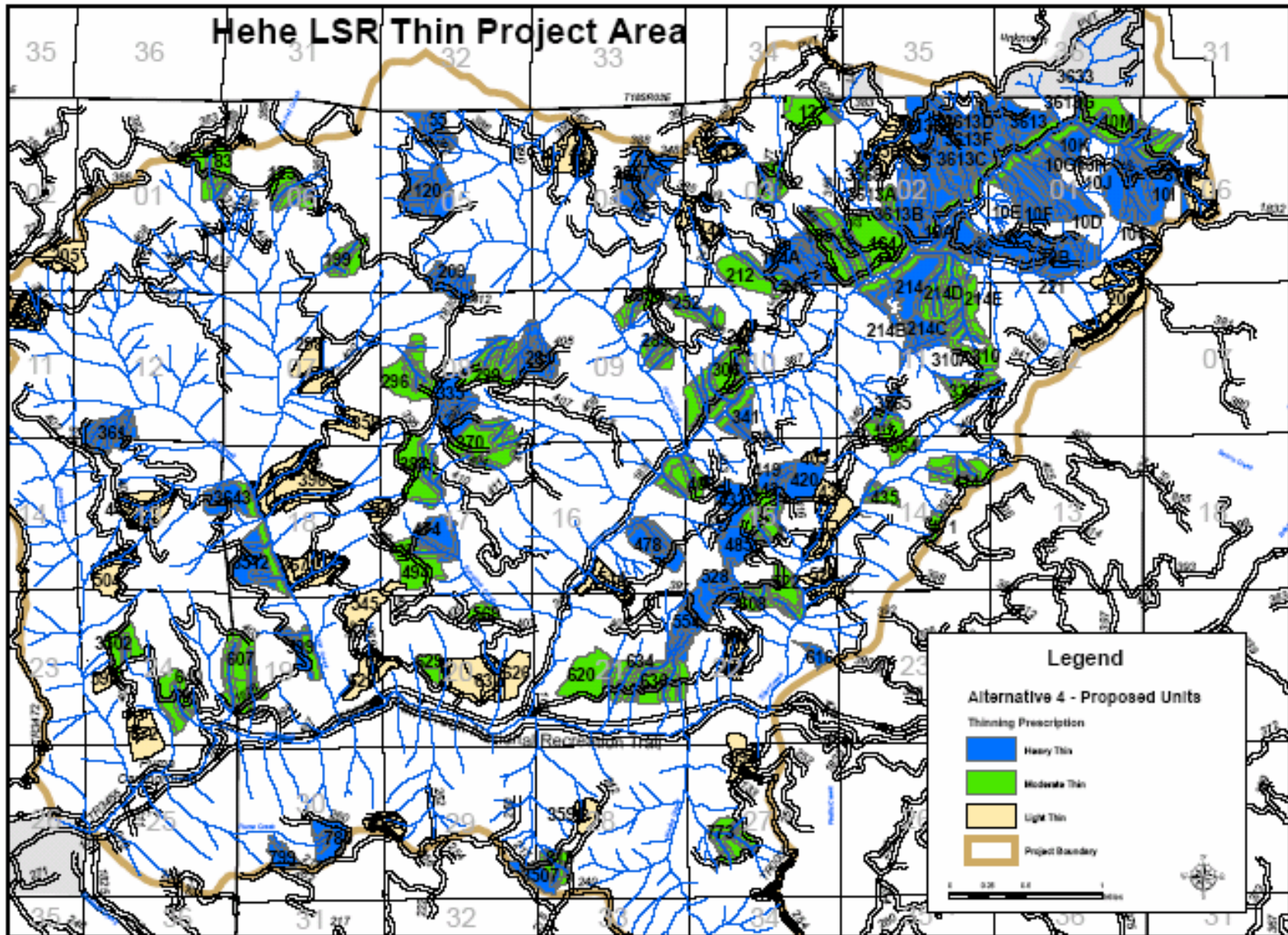


Figure 4 - Map of Alternative 4

Alternative Considered But Eliminated from Detailed Analysis

Thinning without Timber Removal – An alternative was considered that would not remove the timber from the thinning. Leaving such a large quantity of cut trees on the ground would pose an unacceptable risk of wildfire and Douglas–fir bark beetle infestation and thus would be ineffective at protecting late-successional and old-growth ecosystems, and fostering development of late-successional characteristics in young stands. Applying such a prescription across the landscape without timber removal would result in young stands in the very high risk fuel models for more than 40 years.

Mitigation Common to All Action Alternatives

In response to Forest Plan S&Gs, laws and regulations, and public comments on the proposal, mitigation measures were developed to ease some of the potential adverse impacts the various alternatives may cause. The mitigation measures applied to all of the action alternatives.

Timber harvest felling and yarding

Trees in riparian buffers that need to be cut to facilitate harvest operations should be dropped into the stream if possible and left to aid in wood recruitment.

Protect unstable areas identified by field visits in the early planning stages (units/partial units were dropped where necessary early in the planning process) as well as those identified during project implementation with adequate no-cut buffers.

Where cable yarding is planned, logging systems will be designed to generally yard away from stream channels to minimize soil disturbance in adjacent stream buffers.

No yarding corridors are anticipated to cross perennial stream channels in this project, but if any areas are identified during project implementation, full suspension will be achieved and yarding corridors will not exceed 15 feet wide.

Log suspension requirements and fuel reduction operations are prescribed to minimize soil disturbance within FW-081 and FW-084 (from Forest Plan) limits. In the case where mineral soil is exposed in specific locations beyond the level of maximum allowable disturbance, the site would be waterbarred, seeded, and fertilized immediately following harvest.

If the total oil or oil products storage at a worksite exceeds 1,320 gallons, or if a single container (i.e., fuel truck or trailer) exceeds a capacity of 660 gallons, the purchaser shall prepare and implement a Spill Prevention Control and Countermeasures (SPCC) Plan. The SPCC Plan will meet applicable EPA requirements (40 CFR 112), including certification by a registered professional engineer.

Helicopter yarding with Type I (i.e., heavy) helicopters is not allowed to operate within 0.25 miles of any activity centers of spotted owls during the entire breeding season (March 1 to September 30). If Type I helicopters are used it may trigger a Likely to Adversely Affect (LAA) determination, due to the terms associated with the Biological Opinion. If this were to occur it would require re-consulting with the US Fish and Wildlife Service

Type II-IV helicopters (as well as KMAX helicopters) are not allowed to operate within 120 yards of any activity center during the critical breeding season (March 1 to July 15). No restriction on Type II-IV (and KMAX) during the latter part of the breeding season (July 16 – September 30)

The project area has been surveyed to protocol, therefore seasonal restrictions do not apply to activities such as chainsaws use during falling, skyline yarding, and operation of other heavy equipment that are beyond 0.25 mile of known activity centers. Activities within the defined disruption distances of known spotted owls (see Table 2) are restricted during the critical breeding period (March 1 to July 15). The disruption distance for log truck hauling is 0 yards for all times of the year.

Table 2 - Disturbance and disruption distances for the northern spotted owl during the breeding period

Activity	Disturbance Distances	Disruption Distances	
		Critical Breeding Period (March 1 to July 15)	Latter Breeding Period (July 16 to Sept 30)
Aircraft –fixed wing	440 yards (0.25 mile)	120 yards	0 yards
Blasting	1,760 yards (1 mile)	1,760 yards (1 mile)	440 yards (0.25 mile)
Burning	440 yards (0.25 mile)	440 yards (0.25 mile)	0 yards
Chainsaw use	440 yards (0.25 mile)	65 yards	0 yards
Heavy Equipment	440 yards (0.25 mile)	35 yards	0 yards
Helicopter - Type 1*	880 yards (0.5 miles)	440 yards (0.25 mile)	440 yards (0.25 mile)
Helicopter – Type II,III, or IV*	440 yards (0.25 mile)	120 yards	0 yards
Pile Driving	440 yards (0.25 mile)	60 yards	0 yards
Rock Crushing	440 yards (0.25 mile)	180 yards	0 yards
Hauling	440 yards (0.25 mile)	0 yards	0 yards

*Type 1 helicopters seat at least 16 people and have a minimum capacity of 5,000 lbs. Both a CH-47 (Chinook) and UH-60 (Blackhawk) are Type I helicopters

Type II helicopters seat at least 10 people and have a minimum capacity of 2,500 lbs. Both Bell UH1 and Bell 212 are Type II helicopters

KMAX helicopters are considered Type 1 helicopters for ICS definition, but are considered Type II for the purposes of disturbance

Type III helicopter seat at least 5 people and have a minimum capacity of 1,200 lbs. Both a Bell 206 and Hughes 500 are Type III helicopter

Type IV helicopter seat at least 3 people and have a minimum capacity of 600lbs.

Road Work

Best Management Practices (BMPs), including placement of sediment barriers, provision of flow bypass, and other applicable measures, will be included in project design as necessary to control off-site movement of sediment.

For any perennial stream crossing culvert replacement, a specific dewatering plan shall be included with the contract design provisions

Any in-stream activity such as culvert replacement or in-stream wood placement occurring within fish bearing and other perennial streams will comply with Oregon Department of Fish and Wildlife (ODFW) seasonal restrictions on in-stream work activities. For the main stem of Fall Creek, in-stream work must occur between July 1 and August 31, and for Fall Creek tributaries, in-stream work must occur from July 1 to October 15 unless otherwise approved by ODFW.

All road reopening, reconstruction and temporary road building will occur during the dry season between June 1 and October 31 to avoid potential surface erosion of exposed soil.

All temporary roads shall be winterized if not being used for extended periods of wet weather.

To prevent sedimentation to the greatest extent possible, apply rock surfacing on all native surfaced roads to be used in the wet season between November 1 and May 31.

Any road maintenance along haul routes, including placement of additional surface rock, blading, brushing, ditch relief culvert cleaning or addition of ditch relief culverts shall occur prior to project implementation.

At the completion of harvest activities, reopened roads and new temporary roads shall be water barred, seeded with approved forest mix design and closed to vehicle travel to reduce potential for surface erosion and sedimentation.

Wet weather haul will be monitored by the Timber Sale Administrator and the Hydrologist.

When necessary, haul may be suspended during heavy rainfall to prevent breakdown of road surface structure, pumping of fine sediment and potential mobilization of sediment to streams.

Haul will be prohibited on native-surfaced roads during the wet season between November 1 and May 31.

Winter haul will be allowed on roads 1800, 1824, 1825, 1825-217 (mp 0.00-3.17), 1825-218 (mp 0.00-0.64), 1825-219, 1825-240, 1825-242m 1828 (mp 0.00-0.47), 1828-402, 1828-407, 1830 (mp 0.00-4.34), 1832 (mp 0.00-5.38), 1832-396 and 1832-397 between November 1 and May 31. Haul will not cause damage to roads or National Forest resources.

Erosion control booms or straw mulch would be installed near road and stream crossings when sediment is generated from winter haul road.

Erosion prevention and control measure would implement during timber sale operation. Areas disturbed by harvest operations and road maintenance or reconstruction would be re-vegetated where needed and completed in a timely manner.

All temporary spur roads used on the project would be closed by berming, scarifying, waterbarring, seeding, and fertilizing.

Water-bars would be installed where needed to minimize water runoff on tractor skid trails, landings; the modified low level closed roads, and closed temporary roads.

Dry season operating restrictions would be applied to all native surface temporary spur roads. If the purchaser requests to operate outside the dry season period, then the purchaser would rock/gravel the spur upon approval of the FS official.

Fuels Treatment

Fuel treatments are prescribed to mitigate the fine fuel loadings created from the commercial thinning. Fuel treatments include yarding tops and branches and grapple piling and burning at landings, grapple piling within 40 feet of most roads left open, hand piling and burning, and underburning. The underburning would occur during spring-like conditions to minimize impacts to the soils, existing coarse woody debris, and mortality to green leaf trees.

Planned, deliberate ignition of under burning should be kept outside of the designated no-cut buffers.

Restoration Activities (In-stream wood placement, road closure, decommission, bridge abutment repair)

Any in-stream activity such as culvert replacement or in-stream wood placement occurring within fish bearing and other perennial streams will comply with Oregon Department of Fish and Wildlife (ODFW) seasonal restrictions on in-stream work activities. For the main stem of Fall Creek, in-stream work must occur between July 1 and August 31, and for Fall Creek tributaries, in-stream work must occur from July 1 to October 15 unless otherwise approved by ODFW.

Stream crossings removed as part of road decommissioning or closure shall lay back side slopes to 1½:1, and extent of fill removal should be done to match natural topography of hill slopes and floodplains above and below the fill removal.

Apply native grass seed to all bare mineral soil left after road decommission or road closure. On laid back side slopes of fill removals, apply coverage of native slash or weed free straw to prevent surface erosion from direct raindrop impact during the first storms after fill removal.

On segments of decommissioned roads in between fill removals, either build waterbars to divert surface drainage or de-compact the road surface to a depth of 30” to ensure infiltration of surface runoff.

Bridge Abutment Repair

Keep continuous stream flow around work site, i.e. no dewatering of the channel. All work must be isolated from any flowing water. Concrete will not be poured if any of the uncured concrete or contaminated wash water could enter the stream.

If proposed bridge work along Fall Creek, Hehe or Alder Creeks are carried forward 2-3 days prior to initiating work have bridges surveyed for bat maternity colonies, if colonies found await species determination (by Regional bat expert-P.Ormsbee) prior to proceeding with bridge work. If bats species are found at bridge sites, but no maternity colonies are present, no conflicts are expected (P.Ormsbee Pers. Comm, 2007).

Coarse Woody Debris

No yarding of existing coarse woody debris shall occur in these stands. Protecting the existing coarse woody debris ensures adequate nutrient cycling for maintenance of long-term site potential and provides valuable habitat structure for a diversity of species. The majority of the coarse woody debris is remnant debris from the previous harvest entry.

For most of the unit's stand conditions, there is an opportunity to begin creating large woody debris where it is deficit and meet minimum standards for diameters of pieces and linear feet established in the Northwest Forest Plan (Reference Appendix F for individual unit prescriptions).

When it is feasible to do so, consider "high stumping" trees or snags ≥ 24 " diameter during the falling of coarse woody debris. Creating stumps 3- 6 feet in height would mitigate the loss of some existing roosting habitat more quickly than the delayed snag creation for bats and some existing perch, foraging, and potentially nesting habitat for land birds/neo-tropical migrants.

Road closure

Up to about 38 miles of classified roads would be closed by blocking the entrance to the road to reduce the density of open road miles. These roads are blocked primarily to reduce disturbance to big game habitat, to rehabilitate them for long-term storage which minimizes sediment contribution to streams, and to reduce the cost of maintenance. The road block devices would be maintained over time to ensure the effectiveness of the closure. All temporary roads would be closed after harvest activities.

Deer and Elk

Openings associated with proposed activities such as landings, burn piles, and road closure would be seeded with approved forage seed mix and fertilized.

Invasive Weeds

Require cleaning of all timber harvest equipment, culvert replacement machinery, and road maintenance equipment prior to entering the work area, especially those that would be working off-road.

Use weed-free aggregate material for road restoration/reconstruction and helicopter landing construction.

Re-vegetate the project area with native species following disturbance. This could include California brome, California fescue and blue wild rye in openings such as landings and the forested understory; desired herbaceous species such as big deer vetch (*Lotus crassifolius*) in openings; blue wild rye in culvert replacements, and in closed road beds.

Clean up quarries, notably the Porcupine Rock Pit and helicopter landings prior to use. This could mean scalping the top six inches of soil and depositing it in an area where weed infestations can be monitored and treated or it could mean removal of weeds via manual or chemical methods.

Try to conduct work during the dry season when mud and seed would be less likely to be transported on vehicle undercarriages.

Monitor road systems and disturbed areas for new localized populations for three years following treatment.

Determine appropriate site(s) for vehicle cleaning site. Monitor any sites for invasive weed infestations for three years following treatment to ensure weeds are eradicated and do not spread from this site. This would also be a good site for removal of helicopter landing material if soil removal is the preferred option.

Although care should be taken to treat existing slender false brome sites prior to thinning, there remains a seed bank in the soil of unknown longevity. Roads infested with false brome should be re-surveyed prior to project implementation to document new false brome sites. Pre-treat all sites prior to project implementation and document in Project File.

Air Quality

Air quality would be maintained by adhering to the Oregon Smoke Management Plan and additional monitoring of low level winds to insure that burning occurs when the risk of smoke intrusions into designated areas and Class I airsheds is low. Various fuel treatments methods such as yarding tops, grapple piling along roads, and hand piling and burning, and underburning during spring-like conditions would be used. The slash piles would be covered and dry when burned which reduces the amount of smoke produced. Only units and fuel concentrations which exceed FW-212 and FW-252 guidelines would be piled and burned.

Cultural Resources

Proposed harvest units were surveyed for cultural resources and no sites were discovered in the project area. If any cultural sites are found during any proposed activity, the activity would be discontinued, and contract provisions would be invoked until the site is evaluated for significance and appropriate mitigation measures are performed.

Recreation

Safety concerns would be mitigated by advisory signing (Truck Traffic Ahead), and temporary road closures when falling or yarding activities adjacent to roads could create unsafe conditions, as would occur per standard timber sale contract clauses.

Comparison of Alternatives

This section provides a summary of the effects of implementing each alternative. Information in the table is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives. The table should be used in conjunction with the discussion of issues in Chapter 3 – Environmental Consequences in order to fully understand the implications and differences of the alternatives

Table 3 - Comparison of Alternative

	Alternative 1 (No Action)	Alternative 2	Alternative 3 (Proposed Action)	Alternative 4
Commercial Thinning Acres				
Heavy Thin	0	963 ac.	1,074 ac.	1,513 ac.
Moderate Thin	0	1,573 ac.	1,846 ac.	1,676 ac.
Light Thin	0	650 ac.	842 ac.	9,90 ac.
Totals	0	3,186 ac.	3,762 ac.	4,179 ac.
Road Management	Significant Issue			
Temp. Road Construction	0	3.9 mi	3.8 mi	4.8 mi
Road Maintenance & Reconstruction				
Low	0.0 mi	74.6 mi	94.7 mi	103.9 mi
Moderate	0.0 mi	27.2 mi	20.3 mi	22.5 mi
High	0.0 mi	0.3 mi	0.3 mi	1.1 mi
Totals	0 mi	102.1 mi	115.3 mi	127.5 mi
Wet Weather Haul	0 mi	42.3 mi	45.6 mi	45.6 mi
Culverts Replaced	0	78	100	100
New Road Closures				
Low	0 mi	4.0 mi	20.3 mi	7.2 mi
Moderate	0 mi	0.4 mi	17.7 mi	29.2 mi
High (Decommission)	0 mi	0 mi	0	1.7 mi
Totals	0 mi	4.4 mi	38.0 mi	38.1 mi
Existing Closed to be Decommissioned	0 mi	0.5 mi	6.2 mi	12.6 mi
Road Density miles/sq mile	2.5	2.4	1.2	1.0
Road Work Costs	0	\$2,687,370	\$3,323,795	\$3,764,060
Interior Habitat	Significant Issue			
Linear feet of thinning edge adjacent to Interior habitat	0	36,115	42,014	61,509

	Alternative 1 (No Action)	Alternative 2	Alternative 3 (Proposed Action)	Alternative 4
Spotted Owls	Significant Issue			
Acres of thinning within home range of activity centers	0	2,960 ac	3,514 ac	3,854 ac
Fuel Management	Significant Issue			
Treatment Types				
Yard tops and Limbs	0 ac	1,996 ac	3,660 ac	4,171 ac
Underburn	0 ac	0 ac	281 ac	362 ac
Hand Piling	0 ac	0 ac	0 ac	1,196 ac
Roadside Piling	0 ac	190 ac	130 ac	141 ac
Treatment Costs	0	\$999,820	\$2,400,8470	\$4,168,670
Post Thin fine fuel loadings tons/acre	7			
Heavy Thin	0	12-16	12-16	12-16
Moderate Thin	0	9-12	9-12	9-12
Light Thin	0	7-9	7-9	7-9
Priority Acres	0	370 ac	553 ac	1,832 ac
Vegetation				
Stand age to develop 5 DF TPA >32"DBH				
Heavy Thin	> 150 years	122 years.	122 years.	122 years.
Moderate Thin	> 150 years	131 years	131 years	131 years
Light Thin	> 150 years	143 years.	143 years.	143 years.
Stand age to develop 16 Shade Tolerant TPA >16"DBH				
Heavy Thin	> 150 years	122 years	122 years	122 years
Moderate Thin	53 years	107 years	107 years	107 years
Light Thin	> 150 years	143 years	143 years	143 years
Acres of additional LS forest in 150 years	0	3,186 ac.	3,762 ac.	4,179 ac.
Water Quality				
See Road Management criteria above				
Acres of Riparian Thinning	0 ac	1,138 ac	1,387 ac	1,597 ac

	Alternative 1 (No Action)	Alternative 2	Alternative 3 (Proposed Action)	Alternative 4
Aggregate Recovery Percentages				
Upper Hehe	95.8	90.3	89.4	88.3
Sunshine-Pernot	91.9	88.6	87.9	87.6
Alder	93.7	92.8	92.5	91.7
East Hehe	93.3	92.1	90.8	90.6
Tiller	89.3	87.1	85.9	85.7
Jones	88.9	87.7	87.7	87.7
Puma	95.9	94.9	94.9	94.9
Pacific Marine	91.4	91.3	90.8	90.8
Hehe Sixth Field Subwatershed	91.4	91.3	90.9	90.4
Fisheries				
Change in survival of salmon eggs	Decrease and continual from road failure	Smallest decrease of action alternatives	More decrease than Alt 2 but less than Alt 4	Greatest decrease of all action alternatives
Linear feet of fish-bearing streams affected	0	2,820 feet	3,820 feet	3,820 feet
Soil Erosion and Detrimental Soil Conditions				
Acres of new detrimental soils	0 ac	45.0 ac (1%)	51.7 ac (1%)	59.2 ac (1%)
Big Game Habitat				
Habitat Effectives Index				
Alder BGEA	0.43	0.44	0.46	0.46
Platt BGEA	0.42	0.43	0.45	0.45
Sunshine-Pernot BGEA	0.41	0.46	0.48	0.48
Logan BGEA	0.45	0.47	0.48	0.48
Threatened, Endangered, and Sensitive Species				
Wildlife Species				
Northern Spotted Owl				
Habitat Mod.	NI	MA, NLAA	MA, NLAA	MA, NLAA
Disturbance	NI	MA, NLAA	MA, NLAA	MA, NLAA
Northern Bald Eagle	NI	NI	NI	NI
Harlequin Duck	NI	NI	NI	NI

	Alternative 1 (No Action)	Alternative 2	Alternative 3 (Proposed Action)	Alternative 4
American Peregrine Falcon	NI	NI	NI	NI
Baird's Shrew	NI	MIH	MIH	MIH
Pacific Shrew	NI	MIH	MIH	MIH
Fisher	NI	NI	NI	NI
Pacific Fringe-tailed Bat	NI	MIH	MIH	MIH
Oregon Slender Salamander	NI	MIH	MIH	MIH
Cascade Torrent Salamander	NI	MIH	MIH	MIH
Crater Lake Tightcoil	NI	NI	NI	NI
Fish Species				
Spring Chinook Salmon	NI	MA, LAA	MA, LAA	MA, LAA
Survey and Manage Species				
Plant Species				
<i>Botrychium minganense</i>	NI	NI	NI	NI
<i>Botrychium montanum</i>	NI	NI	NI	NI
<i>Bridgeoporus nobillissimus</i>	NI	NI	NI	NI
<i>Carex livida</i>	NI	NI	NI	NI
<i>Cimicifuga elata</i>	NI	NI	NI	NI
<i>Corydalis aqua-gelidae</i>	NI	NI	NI	NI
<i>Dermatocarpon luridum</i>	NI	NI	NI	NI
<i>Eucephalis(Aster) vialis</i>	NI	NI	NI	NI
<i>Iliamna latibracteata</i>	NI	NI	NI	NI
<i>Hypogymnia duplicata</i>	NI	NI	NI	NI
<i>Leptogium burnetiae</i> var. <i>hirsutum</i>	NI	NI	NI	NI
<i>Leptogium cyanescens</i>	NI	NI	NI	NI
<i>Lycopodium complanatum</i>	NI	NI	NI	NI
<i>Montia howellii</i>	NI	NI	NI	NI
<i>Mycorrhizal Fungi</i>	NI	MIH	MIH	MIH
<i>Nephroma occultum</i>	NI	NI	NI	NI
<i>Pannaria rubiginosa</i>	NI	NI	NI	NI
<i>Peltigera neckeri</i>	NI	NI	NI	NI
<i>Peltigera pacifica</i>	NI	NI	NI	NI
<i>Pseudocyphellaria rainierensis</i>	NI	NI	NI	NI
<i>Ramalina polinaria</i>	NI	NI	NI	NI

	Alternative 1 (No Action)	Alternative 2	Alternative 3 (Proposed Action)	Alternative 4
Saprophytic on Litter fungi	NI	NI	NI	NI
<i>Romanzoffia thompsonii</i>	NI	NI	NI	NI
Saprophytic on wood	NI	MIIH	MIIH	MIIH
<i>Scouleria marginata</i>	NI	MIIH	MIIH	MIIH
<i>Tetraphis geniculata</i>	NI	NI	NI	NI
Wildlife Species				
Great Gray Owl	NI	NI	NI	NI
Red Tree Vole	NI	NI	NI	NI
Economics				
Present Net Value	(-\$200,286)	\$9,516,807	\$10,891,190	\$11,376,434
Revenue Cost Ratio	0	1.46	1.44	1.41
Invasive Weeds				
Acres of Potential Soil Disturbance	0 ac	3,383 ac	4,181 ac	5,888 ac
Air Quality				
PM 25 & 10 Emissions	0	82	306	599
Post-Sale Area Improvement Projects				
Riparian Tree Falling	No	Yes	Yes	Yes
Instream Habitat Improvements	No	Yes	Yes	Yes
Disassemble Log Collection Rack	No	Yes	Yes	Yes
Firewood Admin	No	Yes	Yes	Yes
Logging Ac.				
Skyline	0 ac	1,996 ac	2,576 ac	2,926 ac
Helicopter	0 ac	1,189 ac	1,186 ac	1,253 ac
Timber Volume				
Wood products	0	48 mmbf	56 mmbf	63 mmbf

DF= Douglas Fir, TPA=Trees per acre, DBH= Diameter Breast Height, LS=Late-Successional, PM=Particular Matter, CWD=Coarse Woody Debris

NI=No Impact, MIIH=May Impact Individuals or Habitat, but will not likely contribute to a trend toward federal listing or loss of viability for the population or species, MA, NLAA=May Affect, Not Likely to Adversely Affect, MA, LAA=May Affect, Likely to Adversely Affect

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Chapter 3 - Environmental Consequences

This section summarizes the physical, biological, social and economic environments of the affected project area and the potential changes to those environments due to implementation of the alternatives. It also presents the scientific and analytical basis for comparison of alternatives presented in the chart above.

The cumulative effects discussed in this chapter include an analysis and a concise description of the identifiable present effects of past actions to the extent that they are relevant and useful in analyzing whether the reasonably foreseeable effects of the proposed action and its alternatives may have a continuing, additive and significant relationship to those effects. The cumulative effects of the proposed action and the alternatives in this analysis are primarily based on the aggregate effects of the past, present and reasonably foreseeable future actions. Individual effects of past actions have not been listed or analyzed and are not necessary to describe the cumulative effects of this proposal or alternatives (CEQ Memorandum, Guidance on the Consideration of Past Actions in Cumulative Effects Analysis, June 24, 2005). A listing of all past, present, and reasonably foreseeable future actions known of in the watershed are listed in Appendix B.

Road Management

Significant Issue – Road Management

The current road system was built to access timber and other forest resources. Timber sale revenues paid for the majority of past construction and road maintenance. However, timber harvest has declined with the current emphasis on ecosystem management. The Northwest Forest Plan has designated this area as Late-Successional Reserve (LSR). An extensive road system is in conflict of the LSR objectives. The road network creates contrasting edges of forest habitat, fragments connecting habitat, creates barriers to species movement, and provides access and opportunities for human's to extract natural resources. The change in forest management has seriously reduced operating budgets and the ability to maintain an extensive road system. A consequence is that most roads are no longer annually inspected for maintenance requirements and deficiencies are not corrected, which could result in extensive resource damage. Some roads may need to be removed from the system, others closed until future access is needed, and many managed at the lowest maintenance level that still protects resources values.

Existing Conditions – Road Management

This project area contains 121.4 miles of classified system road, including 4.9 miles of arterial road, 29.2 miles of collector road and 87.2 miles of local roads. About 5.2 miles are asphalt surfaced, 103.9 miles are surfaced with crushed rock aggregate, 6.3 miles have a native pit run surface and 5.9 miles are native surfaced.

The road density in the project area is 2.5 miles/square mile. There are currently about 39.5 miles of roads in the project area that are closed. These road closures include roads actively closed by the District and roads that have closed due to trees blown down across the road, road failure and/or disuse.

Road 1800 (Fall Creek Road) is the major east west corridor in this watershed. Road 1800 is a double lane, paved road used year round for recreation (heavy use in the summer season) and provides access to private residences immediately west of this project area and to a large private timber tract adjacent to the north project boundary. In addition, it is the major haul route for commercial thinning and other commodity extraction activities that occur in the watershed.

Many of the culverts on this road were installed 30-50 years ago. The design life for galvanized steel pipe is about 25-30 years. Many of the culverts on this road and throughout the entire project area are in need of replacement before they fail and cause extensive resource damage. Many of these roads have not been maintained for timber haul in the past 15 - 20 years which has created a backlog of needed road work. There are deficiencies identified on Alder Creek and Hehe Creek bridges requiring a need for pier foundation stabilization.

The other roads in this project area have a wide range of conditions and reconstruction needs. During the Clark Fire of 2003 many roads in the west end of the project area were used in the fire suppression effort. These roads had their drainage maintenance needs brought up to date (pipe replacement did not occur) or were hydrologically closed during fire rehabilitation activity. See the Road Report (Sayre, 2007) in the Analysis File for a description of the individual road conditions throughout the project area.

Management Direction - Road Management

This project incorporates by reference the Willamette National Forest Road Analysis Report (USDA, 2003). The Road Analysis Report (RAR) meets the requirements for a science-based analysis process envisioned by the new transportation policy. It was based on the six-step analysis process published in Forest Service Misc. Rep. FS-643, Road Analysis: Informing Decisions about Managing the National Forest Transportation System. The RAR was recently updated with a social assessment relating to forest roads and the key forest roads were updated to reflect adjustments in management emphasis and land allocations.

One of the key findings that the RAR document is the dilemma of managing an extensive forest road system with limited operating funding. There is an estimated budget shortfall for necessary annual maintenance and the projected Forest maintenance funding. The direction in Forest Service Manual 7730, states that it is our policy to determine and provide for the minimum forest transportation systems that best serves forest management objectives as identified in appropriate land and resource management plans. The policy also states that it is important that road analysis consider access needs in relation to realistic funding levels. Based on the funding levels and annual maintenance costs, there is a budget shortfall even if the network of Key Forest Roads is fully maintained to their current objective maintenance levels.

Some of the other findings or results from the RAR that pertain to the Hehe Project area are:

- Economics alone (financial efficiency) does not support large scale road closures or decommissioning in spite of the current imbalance in funding available for forest roads. Road decommissioning is a capital investment, just as road construction was, and decisions regarding these investments must be based on a sound analysis of resource values.
- The analysis shows that access for recreation, vegetation management (including timber harvest), and other administrative uses is adequate and not likely to be a concern.
- As shown by the aquatics and wildlife analyses, roads create many potential hazards that can be displayed spatially and analyzed quantitatively in a variety of ways. Even the limited number of potential hazards identified in the assessment, when overlaid spatially, indicates that some type of hazard exists wherever there is a road.
- The Hehe Creek subwatershed is listed as a Subwatershed of Concern in the RAR. The RAR provides a listing of Forest sub-watersheds prioritized by an evaluation of overlapping the hazards (quaternary landslides and high road densities) and resource values (T&E fish, impacts to LSRs and high emphasis big game areas). This subwatershed has the presence of quaternary landslides which are large, deep-seated, slow moving earthflows that move in a slow, episodic manner, historic fish habitat which denotes areas now blocked by dams that were once occupied by either winter steelhead, spring chinook or bull trout, high big game emphasis areas with greater than 1 mile/mile² road density, and moderate impacts to late-successional forest connectivity.

There are 33.79 miles of key forest roads identified in the Roads Analysis Report for this project area. These roads are the 1800, 1817, 1825, 1830, 1831, 1832, and the 1833. The Roads Analysis Report identified a need for these roads for long-term management of the Forest. They are the priority roads that are maintained open for vehicular traffic. They provide the long-term linkages and inter-forest connection necessary to meet forest management objectives.

There are about 39 miles of existing closed road within the project area. Each alternative would be opening some of these roads to access timber stands for thinning. Roads that are opened would be closed or decommissioned in a hydrologically stable condition after harvest activities are completed.

The roads that would remain open for long-term use would be upgraded to meet Standards and Guides and to meet the Aquatic Conservation Strategy Objectives set forth in the Northwest Forest Plan. All reconstruction and maintenance work would meet project mitigation, BMPs and design criteria as listed on page 31.

Direct and Indirect Effects – Road Management

Alternative Design

Alternative 1 (No Action) represents the no action alternative where none of the proposed activities would take place.

Alternative 2 was designed to provide a high level of public access to the area by keeping most of the roads open. This alternative would only implement some of the proposed road closures in the Middle Fork District Supplemental Road Analysis. Most closures would use low cost and low intensity designs to store the roads in a hydrologically stable condition, but would allow for easy re-opening. This alternative would maintain and/or reconstruct the least amount of haul route roads, construct least amount of temporary road, and decommission the least amount of classified road. The road work in this alternative would cost the least among the action alternatives.

Alternative 3 (Proposed Action) was designed to maintain access for fire protection, recreation and administrative use while implementing the proposed road closures in the Middle Fork District Supplemental Road Analysis. Road closures would employ a mixture of closure designs appropriate for given road conditions. This alternative would close roads using low to moderate levels of closure techniques. This alternative would maintain and/or reconstruct a mid range amount of haul route roads, construct a mid range amount of temporary roads, and decommission a mid range amount of classified roads compared to Alternatives 2 and 4. The road work cost would also fall in the mid range between the action alternatives.

Alternative 4 is designed to implement the proposed road closures from the Middle Fork District Supplemental Road Analysis. Road closures would employ a mixture of closure designs appropriate for given road conditions with an emphasis on long-term closure. The difference between closures with this Alternative and Alternative 3 is that more high level (decommissioning) closure would be used. This alternative would maintain and/or reconstruct the most haul route roads, construct the most temporary road, and decommission the most classified roads. The road work cost would also be the greatest among the action alternatives.

Summary of Effects

The extensive road system in the project area is in conflict with LSR objectives. Alternative 2 closes the least amount of road (4.4 miles) whereas Alternative 3 and 4 closes approximately one half the roads (38 miles) and moves the project area toward the desired future conditions and the LSR objectives. Alternative 4 has more moderate and high level road closure than Alternative 3. Alternative 2 maintains the least amount of road (102.1 miles) whereas Alternative 4 maintains a

few more miles of roads than Alternative 3 (127.5 versus 115.3 miles). The road work costs would be greater for Alternative 4 than Alternative 3.

All action alternatives would do essential bridge repair work, replace a major culvert to extend fish passage, and repair chronic fill and cut slope failures.

Effects of Alternatives

Haul route

Alternative 1 (No Action) – Alternative 1 would not use haul routes because the proposed project does not take place.

Alternatives 2, 3, and 4 - Surface types for haul routes identified for timber haul for the three action alternatives consist of asphalt pavement, crushed aggregate, improved native (unprocessed pit run surfacing) and native material. The interdisciplinary team established which roads could be used to haul during wet weather. These wet weather roads would have surfacing depth to hold up to wet weather haul and all drainage maintenance would be completed prior to any haul. See Appendix D for specific roads designated for wet weather haul.

Table 4 - Haul Route Summary

Surfacing Type	Alternative 1 (No Action)	Alternative 2	Alternative 3 (Proposed Action)	Alternative 4
Asphalt pavement	0	11.22	13.58	13.58
Aggregate	0	85.02	94.38	106.09
Improved Native	0	3.82	4.13	4.22
Native	0	2.04	3.25	3.60
Total Haul Miles	0	102.10	115.34	127.49
Wet weather Haul Miles	0	42.25	45.61	45.61

Maintenance and reconstruction

Alternative 1 (No Action) – Alternative 1 would not maintain or reconstruct any roads because the proposed project does not take place. The environmental effects of no road maintenance are discussed in the water quality and soils sections.

Alternatives 2, 3, and 4 - All haul routes in the three action alternatives would receive maintenance and/or reconstruction work. Each haul route has been assigned a level of maintenance/reconstruction needs described below:

- Low: Work may consist of brushing of roadside vegetation, falling of danger trees, blading of roadbed, cleaning of ditches and culvert inlets and outlets, removing slough and slide material and placing aggregate and/or asphalt surfacing. In addition, culverts in dry, intermittent channels and ditch relief pipes would be replaced as needed. These standard maintenance activities occur on all roads when commercial activity occurs or on a rotating basis determined by use and need.
- Moderate: Includes work mentioned above with the addition of replacing culverts in non-fish bearing perennial streams. The need to place a high number of culverts in close proximity to fish bearing streams could result in placing a road segment in this classification.
- High: All the above-mentioned work items could be included with the addition of replacing culverts or other in-stream work in fish bearing, perennial streams, repairing of major road failures in riparian areas and road realignments.

Table 5 displays the miles of haul route roads by maintenance/reconstruction for each of the alternatives.

Table 5 - Maintenance / Reconstruction Summary

Maintenance Levels	Alternative 1 (No Action)	Alternative 2	Alternative 3 (Proposed Action)	Alternative 4
Low	0 mi	74.6 mi	94.7 mi	103.9 mi
Moderate	0 mi	27.2 mi	20.3 mi	22.5 mi
High	0 mi	0.3	0.3 mi	1.1 mi
Totals	0 mi	102.1 mi	115.3 mi	127.5 mi

Alternative 2 - Maintenance and reconstruction of 102.1 miles of existing roads would extend their functional life, and provide better surface drainage, reducing erosion and potential sediment delivery to the stream network. Road maintenance would occur in the dry season prior to haul, and during/after haul if necessary. This would result in improved road drainage and reduced sediment delivery to the stream network compared to the current condition.

Winter haul would only be allowed on roads 1800, 1824-163, 1825-217, 1825-218, 1825-219, 1825-240, 1828-402, 1828-407, 1830 and 1832 (Appendix A) between November 1 and May 31 (BMPs T-5, R-18, 20). This would require road upgrades such as the addition of surface aggregate, and additional cross drain culverts. This would result in an improved road system in place after the project is implemented.

Alternative 3 (Proposed Action): This alternative would affect the road system in much the same way as Alternative 2. Maintenance and reconstruction of 115.3 miles of existing roads would extend their functional life, and provide better surface drainage, reducing erosion and potential sediment delivery to the stream network.

Alternative 4 - Maintenance and reconstruction of 127.5 miles of existing roads would extend their functional life, and provide better surface drainage, reducing erosion and potential sediment delivery to the stream network. However this alternative would reconstruct road 1831 to provide access for timber yarding and haul, and then decommission the road after use. The work to decommission this portion of the 1831 road is expected to reduce and prevent the delivery of sediment to Hehe Creek, however during reconstruction and use of the road proposed by this alternative there would be short-term increased risk of sediment delivery to Hehe creek. Over the long-term there would be a reduction in road related sediment delivered to streams. This benefit would be partially offset by the short-term delivery of sediment to the stream network, including the main stem of Hehe Creek, during reconstruction. In order to use this currently failing road equipment and road fill would have to be brought in and the road would essentially need to be rebuilt for approximately ½ mile along and across Hehe Creek. This work is not implemented in the other alternatives.

Appendix D displays the assigned maintenance/reconstruction levels for each road that would be used as a haul route for each alternative.

The following associated road work is included in all action alternatives except for the opening of road 1831 above mp 5.43. That work is only proposed for Alternative 4.

5. Pernot Creek fish passage culvert replacement:
6. Alder Creek and Hehe Creek bridge pier foundation stabilization
7. Road 1831 shoulder failure
8. Reconstruction of 1831
9. Road 1832 retaining wall:

For more details on these road projects refer to the Road Management Report (Sayre, 2007) in the Project File.

Stream culvert installation or replacement

Alternative 1 (No Action) – Alternative 1 would not replace any culverts because the proposed project does not take place. The environmental effects of no culvert replacement are discussed in the water quality and soils sections.

Alternative 2 would replace about 78 culverts; **Alternatives 3 and 4** would replace 100 culverts. For all the action alternatives, 8 culverts are on perennial streams, two of which are within 500 feet of listed fish habitat. Appendix D lists the proposed culverts to be replaced, the size of culverts, and their location. Maps in Appendix D depict the location of these 8 culvert sites.

Appendix D includes a listing of all culverts replacements within ½ mile of listed fish habitat, all intermittent replacements within in 1 mile of listed fish habitat and all perennial culverts proposed to be replaced throughout the entire in the project area. In addition to these replacements,

culverts in dry, intermittent channels outside a 1 mile buffer of listed fish habitat and ditch relief pipes outside a ½ mile buffer of listed fish habitat would be replaced as needed.

Temporary road construction

The original road system was constructed to accommodate large yarding towers that were used to log large tracts of lands. Thinning activity uses small, mobile, land-based yarders that have limited reach. Temporary road construction has been kept to a minimum in all alternatives, utilizing the existing system wherever possible.

Alternative 1 (No Action) – Alternative 1 would not construct any new temporary roads because the proposed project does not take place. The environmental effects are discussed in the water quality and soils sections.

Alternative 2 and 3 - Access to landings and yarding sites would require the construction of 3.8 miles of new temporary road. These new roads pose little risk to water quality as they are located on stable slopes, do not cross any streams or wetlands, and have no hydrologic connection to the stream network. They would be built, utilized for the sale, and decommissioned after the end of the project.

Alternatives 4 – This alternative would construct 4.8 miles of new temporary roads.

Table 6 -Temporary Road Summary

Surface Type	Alternative 1 (No Action)	Alternative 2	Alternative 3 (Proposed Action)	Alternative 4
Existing Native	0	0.4	1.2	1.1
Existing Aggregate	0	0.4	0.6	0.7
Subtotal		0.8	1.8	1.8
New Native	0	2.7	2.8	3.6
New Aggregate	0	1.1	1.0	1.2
Subtotal		3.8	3.8	4.8
Total Miles	0	4.6	5.6	6.6

Road closure

The interdisciplinary team reviewed each road in the project area that was recommended for closure by the Supplemental District Roads Analysis. The team assigned closure levels to each of these roads based primarily on the aquatic risk rating assigned to the road. The aquatic risk rating was determined by:

1. Critical Habitat Areas (proximity to fish stocks),
2. Stream Crossing/Road Surface Type,
3. Geologic/Road Failure Hazard.

Criteria were established for each category and given a numerical risk rating. Risk rating and closure levels generally correspond with each other. The group also considered access needs to large blocks of managed stands where thinning could be accomplished in the future to promote late-successional reserve habitat. Closure levels were low in these cases to allow for future access with minimal impact to resources.

- Low level closure: Close with a physical barrier and water bar as needed. Water bars would not be drivable. Cost: \$2,000 - \$5,000/mile.
- Moderate level closure: Close with a physical barrier and water bar as needed. Water bars would not be drivable. Include following work items listed below as needed. Cost: \$5,000 - \$15,000/mile.
 1. Remove culverts from stream channels with fills of shallow to moderate depth.
 2. Reduce fill depth for culverts in deep fill locations.
 3. Pull back side-cast material.
- High level closure (Decommissioning): Close with a physical barrier and water bar as needed. Water bars would not be drivable. Include work items described at the moderate level and as listed below as needed. Costs: \$15,000 - \$30,000/mile.
 1. Remove culverts from stream channels in deep fills
 2. Re-contouring
 3. Sub-soiling

Table 7 - New Closed Road Summary

Closure level	Alternative 1 (No Action)	Alternative 2	Alternative 3 (Proposed Action)	Alternative 4
Low	0	4.0	20.3	7.2
Moderate	0	0.4	17.7	29.2
High - Decommission	0	0.0	0.0	1.7
Totals	0	4.4	38.1	38.1
Existing Closed Road to be Decommissioned	0	0.5	6.2	12.6

Alternative 1 (No Action) – This alternative would not maintain or close any roads which would likely cause future resource damage to the water quality and soil productivity. Generally, funding is not readily available to repair or upgrade aging and damaged roads in the Hehe Creek sixth field sub watershed. Chronic erosion of the existing problem roads would continue. Additional failures are likely to occur over time, potentially delivering large volumes of sediment to the stream network.

Alternative 2 - Alternative 2 was designed to provide a high level of public access to the area by keeping most of the roads open. Of the action alternatives, this alternative does the least in

moving toward the LSR objectives. The majority of roads would remain open in this alternative and these roads would continue to require road maintenance funding in the future to prevent resource damage.

There would be about 0.5 miles of road decommissioning, reducing road density and restoring proper hydrologic function to the affected areas. However, about 38 miles of high aquatic risk roads would remain open and connected to the stream network. This would continue to pose a risk for road failure and subsequent delivery of sediment to the stream network.

Alternative 3 (Proposed Action) - This alternative would close 38 miles of road in the project area that were identified as potential high aquatic risk roads in the Middle Fork District Supplemental Road Analysis (see Appendix D, Table D5). High aquatic risk roads would have a moderate level of closure to address any aquatic concerns and be stored. Decommissioning of several roads would occur to address aquatic concerns and remove them from the road system.

Decommissioning the upper portion of the 1831 road would include removal of the fill/culverts at several stream crossings. Surface erosion from laid back slopes would be mitigated with mulching or placing of slash to reduce the effect of direct raindrop impact from the first winter storms. Sediment produced is dependent on the amount of road fill excavated to remove the culvert. It is estimated that a culvert with a small fill would generate <1 cubic yards of sediment, for a medium fill < 3 cubic yards and for large fill < 5 cubic yards over the first winter. Segments of the decommissioned road in between fill/culvert removals would either be waterbarred to disperse surface drainage and prevent connection to streams or sub-soiled to cause sediment-laden runoff to infiltrate. Berm closures would prevent further use that could cause more rutting and erosion in winter. All unstable sidecast would be pulled from above steep slopes below and placed against the hill slope side of the road bed. All waste from fill removals would also be compacted and shaped on the hill slope side of the road bed. All bare mineral soil would be seeded with grass to prevent surface erosion. There would also be an immediate and long-term reduction in sediment erosion potential due to this work, and therefore a net decrease in road-related stream turbidity throughout the watershed over time. This work is expected to reduce and prevent the delivery of sediment to Hehe Creek from this portion of failing road. The result of this work would be a road system that would be much less likely to have chronic or episodic sediment delivery to the stream network.

Alternative 4 -This alternative would close the same roads identified for Alternative 3.

Table 8 - Project Area Road Closure Summary

	Alternative 1 (No Action)	Alternative 2	Alternative 3 (Proposed Action)	Alternative 4
Project Area - Open road miles	81.9 existing	77.0	38.6	33.8
Project Area - Closed road miles	39.5 existing	44.4	82.8	87.6

Material Sources

Road reconstruction and maintenance work proposed for this project would involve use of crushed aggregate, pit run and riprap for multiple construction practices. Commercial sources for crushed aggregate or crushing from either Cowhorn or Porcupine Rock pits would be considered at the project design phase.

Cowhorn Rock Pit is located on road 1817433, T. 18 S., R. 2 E., Sec. 3, SE, SE. Material for producing crushed aggregate, pit run and riprap is available from this source. This source has not been surveyed for invasive weeds but would be prior use and mitigated if found.

Porcupine Rock Pit is located on road 1824163, T. 19 S., R. 2 E., Sec. 12, SE, NW. This source is heavily used in the Fall Creek watershed due to its high quality of rock and central location. Pit also contains a wide range of riprap classes. Invasive weed surveys indicate large populations of invasive weeds that would require treatment prior to use of this material. Treatment would meet guidelines established in the Willamette National Forest Noxious Weed Prevention Guideline, March 2005.

Costs for road work

The tables below summarize cost for all road work and haul collections. The miles of closure differ in Table 7 because of roads that would be opened and then closed after thinning operations are completed. For road details, see Appendix D. Estimates are based on projects completed in the past 3 years. No inflation factor is applied.

Table 9- Road Work Costs Alternative 2

Road Work Type			
Maintenance & Reconstruction Levels	\$/Mile	Miles	Total
Low	\$12,000	74.60	\$895,200
Moderate	\$20,000	27.15	\$543,000

Road Work Type			
Maintenance & Reconstruction Levels	\$/Mile	Miles	Total
High	\$60,000	0.35	*\$225,000
Subtotal			\$1,66,200
Maintenance Collections	\$/MBF	MBF	Total
	\$20.00	45,856	\$917,120
Maintenance & Reconstruction Total			\$2,580,320
Closure Levels	\$/Mile	Miles	Total
Low	\$3,500	17.30	\$60,550
Moderate	\$10,000	3.57	\$35,700
Decommission	\$24,000	0.45	\$10,800
Total Closure Costs			\$107,050
Alternative 2 Total			\$2,687,370

*Cost is derived from 2 bridge sites @ \$30,000 each plus \$150,000 for Pernot Ck. pipe replacement and \$60,000/mile for .25 mile.

Table 10 - Road Work Cost Alternative 3 (Proposed Action)

Road Work Type			
Maintenance & Reconstruction Levels	\$/Mile	Miles	\$
Low	\$12,000	94.70	\$1,136,400
Moderate	\$20,000	20.29	\$405,800
High	\$60,000	0.35	*\$225,000
Subtotal			\$1,767,200
Maintenance Collections	\$/MBF	MBF	\$
	\$20.00	53,596	\$1,071,920

Road Work Type			
Maintenance & Reconstruction Total			\$2,839,120
Closure Levels	\$/Mile	Miles	\$
Low	\$3,500	36.05	\$126,175
Moderate	\$10,000	23.25	\$232,500
Decommission	\$24,000	5.25	\$126,000
Total Closure Costs			\$484,675
Alternative 3 Total			\$3,323,795

*Cost is derived from 2 bridge sites @ \$30,000 each plus \$150,000 for Pernot Ck. pipe replacement and \$60,000/mile for .25 mile.

Table 11 - Road Work Costs Alternative 4

Road Work Type			
Maintenance & Reconstruction Levels	\$/Mile	Miles	Total
Low	\$12,000	103.90	\$1,246,800
Moderate	\$20,000	22.49	\$449,800
High	\$60,000	1.10	*\$270,000
Subtotal			\$1,966,600
Maintenance Collections	\$/MBF	MBF	Total
	\$20.00	60,598	\$1,211,960
Maintenance & Reconstruction Total			\$3,178,560
Closure Levels	\$/Mile	Miles	Total
Low	\$3,500	23.62	\$82,670
Moderate	\$10,000	30.47	\$304,700
Decommission	\$24,000	11.70	\$280,800

Road Work Type			
Total Closure Costs			\$585,500
Alternative 4 Total			\$3,764,060

*Cost is derived from 2 bridge sites @ \$30,000 each plus \$150,000 for Pernot Ck. pipe replacement and \$60,000/mile for 1 mile.

Cumulative Effects – Road Management

The cumulative effects analysis area for road management was the Hehe Creek subwatershed which defined the project area. All past present and future roads were included in the analysis. See Appendix B for a summary of the history of road development in the watershed. The current open road density is 2.5 miles per square mile which would represent the result of the No Action Alternative. Alternative 2 would reduce the open road density to 2.4 miles per square miles in the sub-watershed, Alternative 3 would reduce the open road density to 1.2 miles per square miles, and Alternative 4 would reduce it to 1.0 miles per square miles.

Interior Habitat

Significant Issue – Interior Habitat

Various plant and animal species benefit from maintaining connectivity of late-successional forest stands and large continuous blocks of interior forest habitat. This connectivity facilitates movement, dispersal and migration of many forest species. Intensive management activity (road building and clearcut harvesting) has occurred in this project area over the past 40-50 years. This activity has created a fragmented forest landscape with reduced interior habitat. These conditions are unfavorable to those species that rely on interior forest habitat for a portion or all of their life history. Stand density reduction in managed stands close to late-successional forest habitat may alter interior habitat conditions.

Existing Conditions – Interior Habitat

Interior forest habitat plays a critical role in maintaining healthy populations for many wildlife species (Chen 1991, Chen et al. 1993, Hagar et al 2007). Along edges of strongly contrasted habitats (i.e. old-growth habitat adjacent to stand initiation), edge effects could extend up to 400 meters in the Central Cascades (Chen et al. 1993). Large blocks of interior habitat provide for sustainability of a larger number of species. The edge effect to micro-climatic conditions is typically short-term in duration (7-10 years) and can degrade the remaining quality of the interior habitat (Chen et al. 1993). It should be noted that the contrast of edge of these 35-60 years old plantations with trees heights up to 120 feet tall adjacent to old-growth stands with trees heights up to 200 feet tall is different in comparison with research on the edges between young

plantations trees 3-4 feet tall and old growth 200 feet tall. The micro-climate effects are evaluated to be of a much lesser magnitude.

Interior forest habitat in the project area was analyzed by calculating acres of late-successional forested stands no closer than 400 feet from a managed stand (Chen et al 1991). Approximately 2,462 acres of interior forest habitat exists in the project area.

Management Direction - Interior Habitat

The Willamette Late-Successional Reserve Assessment (USDA, 1998) identified criteria to consider in the design and location of silvicultural prescriptions to avoid the potential to adversely affect interior forest function in nearby stands. In early-mid and mid seral stands, prescriptions for thinning that substantially open canopies to wind and solar radiation, could have lasting detrimental effects to interior habitat conditions. The LSRA suggested using approach of prescribing different width bands of varying thinning intensities adjacent to existing mature and old-growth stand to eliminate or reduce the affects of microclimate changes to interior forest functions. The interdisciplinary team (IDT) evaluated these techniques to be difficult to layout on the ground and very costly to implement. The LSRA also provided an option to modify the application of these principles given due considerations of landscape features that alter the effects of edges (seral stages, aspect, slope, elevation, prevailing wind directions, etc.) and other site-specific management goals for late-successional forests and associated species.

Direct and Indirect Effects – Interior Habitat

Alternative Design

The IDT developed a decision matrix which evaluated the percentage of each unit contained within a 400 foot buffer away from late-successional forests, aspects of the units, percent slope, and position on the slope to determine the general thinning intensity (low, moderate, and heavy) for each unit. The thinning prescriptions are further designed to incorporate elements of variable density thinning concepts to vary the spacing tolerances, creation of gaps and openings, retention of un-thinned areas, tree selection characteristics (deformities and decadence), species selection (protect hardwoods), and coarse woody debris. Table 12 displays the mixture of thinning intensities by alternative which addressed the effects to interior habitat.

Table 12 - Thinning Prescription by Alternative

Thinning Prescription	Alternative 1 (No Action)	Alternative 2	Alternative 3 (Proposed Action)	Alternative 4
Heavy Thin	0	963 ac.	1,074 ac.	1,513 ac.
Moderate Thin	0	1,573 ac.	1,846 ac.	1,676 ac.
Light Thin	0	650 ac.	842 ac.	9,90 ac.

Thinning Prescription	Alternative 1 (No Action)	Alternative 2	Alternative 3 (Proposed Action)	Alternative 4
Totals	0	3,186 ac.	3,762 ac.	4,179 ac.

Heavy Thin = Residual 55 trees per acre, Moderate Thin = Residual 80 trees per acre, Light Thin = Residual 105 trees per acre

Summary of Effects

The proposed thinning in each of the action alternatives would have a short-term effect on the micro-climate in the buffer zone between the units and interior habitat. The long-term beneficial effect would be the development of late-successional forest conditions which would eventually increase the amount of interior habitat with in the LSR.

Effects of Alternatives

Alternative 1 (No Action) - No effects on interior habitat area expected under the Alternative 1 (No Action) as no actions would take place. The current interior conditions would be maintained in the short-term and slowly increase in the long-term with the development of late-successional forest conditions. There is a slight risk to the interior habitat due to wildfire risks associated with not thinning these dense stands as mentioned in the fuel loading section.

Alternatives 2, 3, and 4 - The effects of the three action alternatives on interior habitat are displayed in

Table 13 below. Overall, there would be no effect on interior habitat by the proposed thinning and associated activities because the areas of interior habitat are not physically disturbed by the action alternatives. There would be a minor short-term (7-10 years) effect to the micro-climate in the buffer zone along the edge between the plantations proposed for thinning and the adjacent late-successional forest stands. The linear feet of affected edge are correlated to the size of the unit or quantity of acres (Chen, 1991). Alternative 2 proposes to thin the least amount of acres and therefore affects the least amount of linear feet adjacent to the late-successional forest interior habitat. Alternative 4 proposes to thin the most acres, therefore affects the most linear feet of edge. Alternative 3 would affect an amount of edge between Alternative 2 and 4. The intensity of thinning (light, moderate, heavy) also influences the degree of effects. Light thinning intensities that create a post thin canopy closure of 45-55 percent would have the least affect to the edge. Heavy thinning intensities that create post thin canopy closure of 25-35 percent would have the most effect on the edge. And the moderate thinning intensities that create post thin canopy closure between 35-45 percent would fall in between the range of the light and heavy thinning. The percentage of light thinning intensities among the three action alternatives are within 1-2 percent of each other for the proportion of edge affected. The moderate intensity thinning intensity proposed in Alternative 4 is about 7 percent less of the proportion of total affected edge than with the two other action alternatives. Alternative 4 would have about twice the linear feet of edge adjacent to heavy thinning as Alternative 2 and 3 (about 7 percent more).

Table 13 - Alternative Effects to Interior Habitat

	Alternative 1 (No Action)	Alternative 2	Alternative 3 (Proposed Action)	Alternative 4
Linear Feet of Edge adjacent to Heavy Thin	0	5,154 (14%)	6,150 (14%)	12,891 (21%)
Linear Feet of Edge adjacent to Moderate Thin	0	16,345 (45%)	18,563 (44%)	23,231 (37%)
Linear Feet of Edge adjacent to Light Thin	0	14,616 (40%)	17,301 (41%)	25,387 (41%)
Total Linear Feet of Edge adjacent to Thinning	0	36,115	42,014	61,509

Cumulative Effects – Interior Habitat

The cumulative effects analysis area for interior habitat was the Late-Successional Reserve (#RO-219). The LSRA estimated 16,475 acres of interior habitat in the LSR – #RO-219. That amount of interior habitat represents about 52% of the late-successional forest within the LSR. The total amount of late-successional forest in LSR-#RO-219 is about 31,379 acres (48% of the total LSR 65,928 acres). About 79% of the late-successional forest is old growth and about 21% in the mature stand type. Past timber management practices (see Appendix B) have contributed to the decrease in interior habitat. The practice of dispersing clearcuts to maximize forest edge and cover for big game management resulted in the fragmentation the large contiguous stands of old growth. The last clearcut to occur in LSR-#RO-219 was in early 1990’s. No present of foreseeable actions would affect the amount of current interior habitat within LSR-#RO-219.

Alternative 1 (No Action) would have no cumulative effects to interior habitat because no actions would take place. Alternative 2, 3, and 4 would not physically affect any interior habitat within LSR-#RO-219, therefore would not have any cumulative effects to interior habitat conditions. The amount of interior habitat within the project area (2,462 acres) represents about 15 percent of the total interior habitat in the LSR.

Spotted Owls

Significant Issue – Spotted Owls

The Northern spotted owl is well documented within the Fall Creek LSR and within the Hehe project area. Assessment of current habitat conditions indicate that foraging habitat conditions for owls can be improved through density management activities. Focusing treatments adjacent to some activity centers based on occupancy and reproductive rates may benefit owls by improving habitat and foraging condition around these sites.

Existing Conditions – Spotted Owls

Knowledge of spotted owl activity centers locations within the project area is a result of past surveys efforts associated with Regional population monitoring, District timber sale planning, and recent LSR owl and activity center site monitoring done through the HJ Andrews Experimental Forest (Anthony and Ackers, 2006). Based on these surveys, the project area is considered surveyed to protocol (USDA, 1993).

Table 14 lists Northern spotted owl habitat and owl activity center conditions within the Hehe Project spotted owl analysis area. Spotted owl home ranges in the Willamette Province have typically been considered to incorporate a 1.2 mile radius around an owl activity center, and that at least 40% of the area within that home range should provide suitable habitat in order to support successful nesting. The 40% suitable owl habitat within 1.2 miles of an activity center was once considered a viability threshold. But along with suitable capability and protection status it is now recognized as a measure of fitness for owls (Courtney et al. 2004).

The Middle Willamette LSR Assessment (USDA, 1998) states that maintaining and increasing occupancy of spotted owls is a priority and that activities within LSRs should avoid incidental take of spotted owls due to disturbance or habitat modification. Moreover, it states that in Fall Creek LSR where a large amount of currently not suitable habitat exists, restoration prescriptions should be considered. Within the Hehe LSR Thin project area, most of the owl activity center exceed the >40% thresholds as previously discussed (23 of 27) and only 3 of the owl activity centers are below the <30% thresholds. The general trend for spotted owls within the Central Cascades study area and the Hehe LSR Thin project area is a slight increase in the overall population (Anthony, et al., 2006).

Table 14 - Status of Northern Spotted Owls and its Habitat within the project area.

	Acres Within Project Area	Percent of Project Area
Suitable Habitat	11,286 ac.	54 %
Dispersal Habitat	7,106 ac.	24 %
Unsuitable Habitat	1,881 ac.	9 %
Federal Ownership	20,482 ac.	98%
Private Ownership	418 ac.	2%
Total # Spotted Owl Activity Centers¹	27	
Spotted Owl Activity Centers with > 40 % Habitat²	23	
Spotted Owl Activity Centers with 30-40 %³	1	
Spotted Owl Activity Centers with < 30 %⁴	3	

¹Spotted owl activity center data based on current HJ Andrews studies, GIS coverage and prior (2003) protocol survey results

²Spotted owl activity centers with greater than or equal to 1182 acres of suitable habitat within a 1.2 mile radius.

³Spotted owl activity centers that have between 886 and 1182 acres of suitable habitat within a 1.2 mile radius.

⁴Spotted owl activity centers with less than 886 acres of suitable habitat within a 1.2 mile radius.

Table 14 shows that 27 activity centers are known to exist within the overall analysis area. Based on activity center locations relative to locations of proposed harvest units within the planning area, commercial thinning activity would occur within a 1.2 mile home range radius for 14 of the 27 activity centers.

Thinning within 1.2 miles of activity centers represents about 78% of all thinning proposed under any of the Action Alternative. About 43% of the proposed thinning occurring within a 1.2 mile radius would also occur within a 0.7 mile radius for 6 of the 17 historic activity centers. A 0.7 mile radius is considered to be the core home range for spotted owls in this portion of their range, and an area where the amount and quality of suitable habitat is particularly important for supporting resident owls.

Management Direction – Spotted Owls

This project is consistent with current standards established for projects that would specifically affect the northern spotted owl and its habitat. The standards were established for the Willamette Province by the Level 1 Consultation Team and are listed in both the Batched Biological Assessment (BA) (USDA et al, 2006) addresses spotted owl habitat modification projects proposed for implementation during FY 2007 and 2008. The Hehe Project is among the projects identified in the BA, which also considered new information from the 5-year species status review and other recent documents (USDI 2004, Anthony et al. 2004, Courtney et al, 2004). The literature updates our knowledge related to northern spotted owl biology, ecology, and connected issues such as climate change on regional vegetation patterns, sudden oak death syndrome, West Nile virus, wildfire, barred owls, timber harvest, and range wide population decline as presenting individual and cumulative threats to the species.

Of those concerns and threats listed above, it may be that in the vicinity of the Hehe Project area past timber harvest, wildfires, and barred owls influence spotted owls and their habitat to a greater degree than the other factors. This analysis reviews, incorporates, and addresses new information to the extent appropriate for the scope and scale of this project. Effects not specifically discussed in this document pertain to issues that cannot be addressed at the project scale, but are further discussed and analyzed in the 2007 – 2008 Habitat Modification BA and BO which provide a thorough analysis of new information pertaining to potential threats to this species in the Willamette Province (USDA et al. 2006, USDI 2006).

Direct and Indirect Effects – Spotted Owls

Alternative Design

Alternative 1(No Action) is where no proposed activities would take place.

Alternative 2 would protect known (as determined by the survey protocol) spotted owl activity centers with less than 40 percent of their 1.2 mile radius home range in suitable habitat by not thinning within 0.7 miles of the activity centers and any type of thinning greater than 0.7 miles

away. If the owl activity centers are known and have greater than 40 percent suitable habitat conditions within 1.2 mile home range, light to moderate thinning is allowed within 0.25 to 0.7 miles of owl activity centers and any type of thinning greater than 0.7 miles away. If the owl activity centers are resident single owls and suitable habitat conditions are less than 40 percent within 1.2 mile radius home range, light to moderate thinning is still allowed within 0.25 to 0.7 miles of owl activity centers and any type of thinning greater than 0.7 miles away.

Alternative 3 would protect known spotted owl activity center with less than 40 percent of their 1.2 mile radius home range in suitable habitat by not thinning within 0.5 miles of the activity centers, light to moderate thinning from 0.5 to 0.7 miles, and any type of thinning greater than 0.7 miles away. If the owl activity centers are known and have greater than 40 percent suitable habitat conditions within 1.2 mile home range, light to moderate thinning is allowed within 0.25 to 0.5 miles of owl activity centers and any type of thinning greater than 0.5 miles away. If the owl activity centers are resident single owls and suitable habitat conditions are less than 40 percent within 1.2 mile radius home range, light to moderate thinning is still allowed within 0.25 to 0.5 miles of owl activity centers and any type of thinning greater than 0.5 miles away.

Alternative 4 would protect known spotted owl activity centers with less than 40 percent of their 1.2 mile radius home range in suitable habitat by not thinning within 0.5 miles of the activity centers and any type of thinning greater than 0.5 miles away. If the owl activity centers are known and have greater than 40 percent suitable habitat conditions within 1.2 mile home range, light to moderate thinning is allowed within 0.25 to 0.5 miles of owl activity centers and any type of thinning greater than 0.5 miles away. If the owl activity centers are resident single owls and suitable habitat conditions are less than 40 percent within 1.2 mile radius home range, light to moderate thinning is still allowed within 0.25 to 0.5 miles of owl activity centers and any type of thinning greater than 0.5 miles away.

Summary of Effects

The activities associated with Alternatives 2, 3, and 4 are a “may affect, but is not likely to adversely affect” for the northern spotted owl. In addition, the activities associated with all action alternatives may have a short-term negative effect, but long-term beneficial effect as these thinning projects move the Fall Creek Late-Successional Reserve (LSR) habitat towards a more sustainable and fire safe late seral condition within the LSR and the designated Critical Habitat (CHU).

Effects of Alternatives

Alternative 1 (No Action) – This Alternative would have no effect on federally listed threatened, endangered, or proposed species, and is also expected to have no impact on sensitive species identified by the Regional Forester.

The No Action proposal would have no effect/impact on TES terrestrial wildlife species based on the following assumption – that habitat within and adjacent to the project area would continue to

provide existing habitat for wildlife species that may be present as it evolves without human management. The evolution of habitat and associated dynamic nature of habitat suitability that may be subject to an unknown frequency and variety of stochastic events is considered beyond the scope of this evaluation. The potential effects or impacts from proposed Action Alternatives are discussed in this document. References used to support discussion, determinations, and recommendations are provided in Biological Evaluation (Quintana, 2007) located in the Project File.

Alternative 2, 3 and 4 - Alternative 2 thins the least amount of acreage of the action alternatives within 1.2 miles radius home range of owl activity centers. Alternative 3 thins 100 acres less than Alternative 4 and Alternative 4 thins the most acreage within 1.2 mile radius home range.

Table 15 – Acres of thinning within 1.2 miles of Owl Activity Center

	Alternative 1 (No Action)	Alternative 2	Alternative 3 (Proposed Action)	Alternative 4
Total Acres of thinning within 1.2 miles of all Activity Centers (AC)	0 ac	2,960 ac	3,514 ac	3,854 ac

Effect Common to the Action alternatives 2, 3, and 4

Habitat Modification

Direct effects associated with habitat modification activities are considered as short-term, and summarized as follows:

- No suitable habitat is proposed for thinning in the Hehe LSR Thin project area.
- Within the Hehe LSR Thin project area 4500 acres of LSR/Riparian Reserve Dispersal habitat was consulted on in the Willamette Province “batched” Habitat Modified Biological Assessment in Spring of 2006 and concurred upon in Biological Opinion (BO) FW-1-7-06-F-0179 which was signed on 09/22/06. In that BO the US Fish & Wildlife Service concurred with our finding of:
 - Dispersal Removed (Heavy Thin): 2,315 acres downgraded in OR-18 with a Not Likely to Adversely Affect (NLAA) determination in LSR and Riparian Reserve habitat.
 - Dispersal Degraded (Lt/Mod Thin): 2,185 acres degraded in OR-18 with a Not Likely to Adversely Affect determination in LSR and Riparian Reserve habitat.
 - Modification of dispersal habitat as proposed may affect, but is not likely to adversely affect (NLAA) spotted owls across all action alternatives.

Indirect effects associated with habitat modification activities are considered beneficial for spotted owls for the following reasons. Estimates of down wood size and distribution for the project area when compared to DecAid data (Mellen et al. 2006) indicate conditions are approaching or exceed the 50% tolerance level exist throughout the area. Data are limited, but

suggest that dispersal habitat throughout the project area is approaching suitability as foraging habitat.

Implementing the silvicultural prescription as proposed would result in accelerating the transition from dispersal to foraging habitat as released trees respond by increasing size and structural diversity, and as additional levels of larger down wood continue to accumulate. Current suitable habitat would respond favorably to propose thinning as structural diversity increases among younger live trees in stands where existing components such as large down wood, snags, and remnant overstory trees are protected.

Based on the silvicultural prescription and growth response projections, dispersal or suitable capability in thinned stands across the project area should recover within approximately 10 years.

Disturbance

Direct effects associated with project activities that may result in disturbance to spotted owls are considered as short-term, and summarized as follows.

Any activity proposed by the Hehe LSR Thin Project conducted beyond disturbance distances described in the Provincial BA (USDA et al. 2006), would have no effect on spotted owls regardless of the time period relative to the spotted owl breeding season.

Disturbance activities such as use of chainsaws, use of heavy equipment, and hauling associated with proposed thinning activities are considered to may affect, but is not likely to adversely affect (MA-NLAA) spotted owls if conducted from March 1 to September 30 outside the disruption distances and within the disturbance distances described in the Provincial BA (USDA et al. 2006).

Helicopter yarding proposed under all action alternatives would also result in a MA-NLAA situation during this timeframe as long as the activity involved a Type I KMAX or any Type II-IV helicopter. If other Type I helicopters are used it may trigger a Likely to Adversely Affect (LAA) determination depending on their flight paths. Due to the terms associated with the Biological Opinion, it would require re-consulting with the US Fish and Wildlife Service.

Prescribed underburning is proposed in both Alternative 3 (281 acres) and Alternative 4 (362 acres) of dispersal habitat. All prescribed underburning units are greater than 0.25 miles away from known activity centers. Prescribed burning conducted beyond the disturbance distances described in the Provincial BA (USDA et al. 2006), would have no effects on spotted owls.

There are no recognized indirect effects to spotted owls related to disturbance associated with this thinning project as currently proposed.

Critical Habitat

Direct effects associated with habitat modification activities in designated Critical Habitat for the northern spotted owl are considered short-term, and described below.

Critical Habitat is designated to provide for the conservation and eventual recovery of the species. The primary constituent elements of spotted owl Critical Habitat are those physical and biological habitat features which support nesting, roosting, foraging, and dispersal. The Hehe LSR Thin Project proposes 2,315 acres of heavy thinning in Critical Habitat. The affected acres are currently considered dispersal spotted owl habitat based on stand age and structural characteristics. Thinning would result in a short-term downgrade of this dispersal habitat due the reduction in canopy closure.

The silvicultural prescription for thinning this area involves a variable density thinning component along with measures to protect existing snags, down wood, and any remnant overstory trees. This prescription would speed the attainment of late-successional characteristics and the desired future condition for this area. Thinning these acres as proposed may affect, but is not likely to adversely affect Critical Habitat because the effects are considered discountable and entirely beneficial when evaluated at the stand scale.

Indirect effects associated with habitat modification activities in Critical Habitat are considered beneficial for spotted owls for the same reasons stated pertaining to habitat modification in general.

Cumulative Effects – Spotted Owls

The cumulative effects analysis area for spotted owls was the area covered by any owl's activity center 1.2 mile radius home range which overlapped into the project area. Timber harvest activity has occurred within the Hehe LSR Thin project area extending back approximately 100 years. Since the 1910's about 48 % of the project area has been subject to some type of harvest activity. The majority of that harvest activity was fire salvage following the large Hehe burn. A summary of all the past, present, and foreseeable actions in the watershed can be found in Appendix B. No harvest activity has occurred on Federal land in the project area since the inception of Fall Creek LSR.

A small amount of private lands occur within the project area boundary (about 110 acres). In addition, there are private lands adjacent to the project area to southwest and north. These areas have generally been cleared of forested vegetation. Private lands currently provide non-forested habitat in active forest regeneration management (private logging company) on the northern boundary and rural residential and agricultural settings adjacent to the project area on the southwestern boundary.

Overall, past management activities (timber harvest) that have affected habitat throughout the project area on a measurable scale have had a mixed effect on terrestrial wildlife species. The

maintenance and development of habitat associated with old-growth characteristics on approximately 52% of the area has favored one group of species, while the conversion of approximately 48% of the area to early or mid-seral habitat set in a mosaic across the landscape has favored another group of species.

There are no reasonably foreseeable actions that would affect current seral class conditions in stands throughout the planning area. The overall effect of the Hehe Project under any action alternative would not result in a consequential post thinning change in seral class, and would therefore have no measurable contribution to cumulative effects from past actions. Although this project would not demonstrably change seral conditions, areas thinned under all action alternatives (2, 3, & 4) should respond with an increase in vegetative growth rate that would improve structure and composition within the plant community. This effect should result in a positive qualitative improvement in biodiversity on all of the previously harvested stands throughout the project area and provide a recognizable cumulative effect in those areas.

Habitat Modification and Critical Habitat

Beyond the direct/indirect effects addressed associated with proposed activities under all action alternatives, there are no future State or private activities that are reasonably certain to occur within the action area that would result in cumulative effects to spotted owl habitat – including Critical Habitat.

Current Standards and Guidelines governing management of this and surrounding areas provide direction that should provide for the long-term maintenance of amount and distribution of potentially suitable habitat for the spotted owl. The changing trend in forest management that has occurred within the past decade, and projected for the future, should positively influence occupancy of suitable habitat for the spotted owl as previously harvested stands redevelop and more emphasis is placed on recruitment of key structural components missing from harvested stands, retention of key structural components present in unharvested stands, and restoration/maintenance of special habitats as key components of biodiversity at a landscape level. The cumulative effect of the Hehe Project to habitat throughout the analysis area covering both the action area and project area is considered positive in this regard.

Because of the present condition and location of current non-harvest allocations, cumulative effects of past or present actions such as the Hehe LSR Thin Project would not influence the ability of local populations to persist, or become known, by eliminating demographic linkages beyond the species dispersal capabilities. There is about 15% difference in acres treated between Alternative 2 and 3 and about 9 % difference between Alternative 3 and 4 in the cumulative effects with regard to this species

Consultation –Spotted Owls

Spotted owls consultation with USFWS is required based on analysis of proposed actions. Consultation for effects from proposed activities has been incorporated into the Willamette Province FY 2007-2008 Batched BA for Habitat Modification Projects dated July 2006 and concurred upon on September 22, 2006 (FWS 1-7-06-F-0179).

The USFWS has issued their BO for calendar years 2007-2008 habitat modification activities within the Willamette Province (FWS Reference Number 1-7-06-F-0179). The Hehe LSR Thin Project is listed in the BO and will comply with the reasonable and prudent measures, plus terms and conditions pertaining to project activities described therein.

Compliance with stated conditions ensures consultation requirements under the ESA have therefore been met regardless of which Action Alternatives (Alt 2, 3, or 4) may be selected for implementation.

Fire and Fuels

Significant Issue - Fuel Loadings

The proposed action would commercially thin about 3,800 acres. Implementing the proposed thinning along with the coarse woody debris strategies from the LSRA could create an accumulation of fine fuels (0-3 inch) that exceeds fuel loading recommended levels and could increase fire risk, cost to suppress fires, resource damage by wildfires, and risk to firefighters safety.

Several winter storms over the past years have caused considerable snow damage and blowdown that have contributed to the buildup of fuels within these plantations. Fuel prescriptions to reduce both management activity-created fuels and blowdown fuels have been difficult and costly to implement under certain thinning prescriptions. The cumulative fuel loading from these events are potentially in excess of fuel loading standards and guidelines.

Existing Conditions – Fuel Loading

Fuel Models

Three major Fire Behavior Prediction System fuel models are represented within the Hehe project area. Field observations have indicated that fuels in the planning are primarily a mosaic/mix of fuel models 5, 8 and 10 (see Table 16). These three fuel models are distributed rather evenly throughout the project area. Fuel model 5 is characterized by conifer stands where the primary carrier of fire is understory brush. Under the right conditions, understory brush fires spread quickly with high intensity, and may lead to the development of crown fires in the overstory trees.

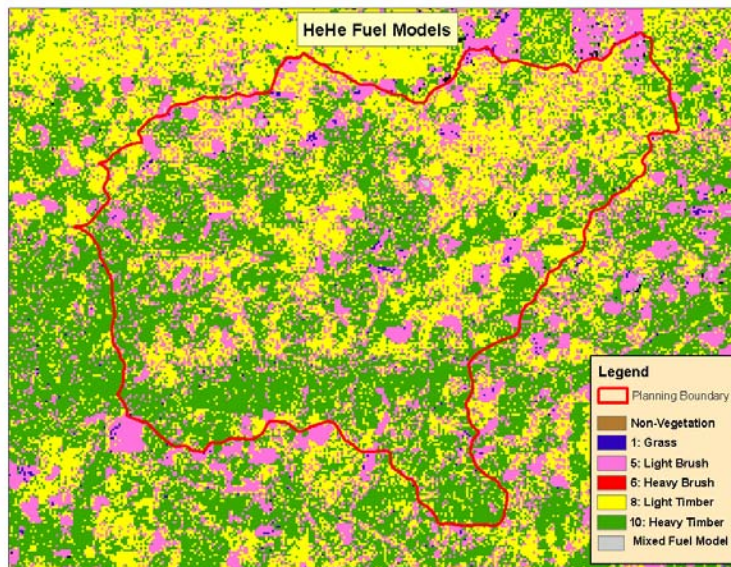
Fuel model 8 is characterized by closed conifer stands where fires spread primarily through litter and light fuels on the forest floor. Under normal conditions, fires in fuel model 8 burns with low intensity and do not spread quickly.

Fuel model 10 is characterized by closed conifer stands with a component of dead and down fuels. Fires in this fuel type spread primarily through dead/down fuels on the forest floor, and generally burn with greater intensity than fires in fuel model 8. Fires in this fuel model have a higher probability of developing into crown fires, which may lead to large fires with high percentage of mortality when hot, dry and windy conditions persist. The following table (

Table 16) gives descriptions of Fire Behavior Prediction System (FBPS) fuels models commonly used in fuels/fire modeling.

Table 16 - Fuel Models

Fuel Model	Description
1	Short Grass
2	Open Timber (grass understory)
3	Tall Grass
4	Chaparral
5	Timber (w/understory brush)
6	Tall Brush
7	Southern Rough
8	Timber (w/ light litter)
9	Hardwood Litter
10	Timber (w/heavy dead/down)
11	Light Logging Slash
12	Medium Logging Slash
13	Heavy Logging Slash



Source: Willamette NF GIS

Figure 5 – Hehe LSR Thin project area Fuel Model map

Because landscape fuels mapping is done at a coarse scale, it is not as accurate as observations in the field. However, the above map does give an indication of how fuel models exist in a mosaic in the Hehe Project Area (Fuel modeling sources: GTR-INT-122, Willamette NF GIS and field obs.).

Fuel Loading

Fixed area plots were established throughout the project area to determine existing surface and crown fuel loads. Table 17 represents existing surface fine and coarse fuel loads in the project area.

Table 17 - Current Fine (0-3") and Coarse (>3") Fuel Loadings (mean tons/acre)

0-3" Fuels	3-6" Fuels	6-9" Fuels	9-20" Fuels	>20" Fuels	Total Fuel Load
6.7	2.6	2.7	9.6	34.9	56.5

Source: Field Surveys

Table 18 represents current and predicted (post-harvest) fuel loads for the project area.

Table 18 - Current Predicted Surface Fine Fuel Loading Estimates (0-3"fuels)

Thinning Prescriptions	Current Fine Fuel Load Average (tons/acre)	Post-Harvest Fine Fuel Load Total (without yarding tops/limbs)	Post-Harvest Fine Fuel Load Total (with yarding tops/limbs)
Light	6.7	9-12	7-9
Moderate	6.7	12-15	9-12
Heavy	6.7	15-20	12-16

Source: Field Surveys/PREDICT Spreadsheet

*Post-harvest fuel load varies depending on harvest prescription.

Direct and Indirect Effects – Fuel Loading

It is well documented that coarse woody fuels have little influence on the spread and intensity of initiating surface fires (Brown et al, 2003). Fine fuels are required for fires to spread and gain the intensity needed to ignite heavier fuels. Harvest activities primarily generate fine fuels and create relatively small amounts of coarse woody fuels. In addition, treating coarse fuels on the landscape without treating fine fuels is not feasible. For all of these reasons, coarse woody fuels will not be considered further in this analysis. Snag and down wood requirements for wildlife are addressed in the wildlife section. Predictions for fine fuels generated as a result of harvest in the project area will be discussed in detail in this section.

Fine fuel loadings were measured against the guideline levels established in FW-252. Forest Plan Update No 2 (10/18/1993) clarified that the tons per acre of fuel established in FW-252 were not an acre by acre or unit level standards, but thresholds for a certain level of fire intensity.

Individual unit fuel loadings can be lower or higher than guidelines levels based on a larger area analysis of short-term and long-term fuel conditions.

Alternatives Design

Alternative 2 was designed to yard tops and limbs on all skyline logged acres. No yarding of tops and limbs would occur on the helicopter logged acres. Roadside grapple piling and burning cleanup would be prescribed on all open classified roads (post project) that are adjacent to harvest units. As a result of these treatments, approximately 50% of the treatment acres would have residual fuel loadings which would meet the recommendations for 0-3" fine fuels. Fuel loadings in the other 50% of the treatment acres would be above forest guidelines for about 5-10 years, depending on the pre-harvest fuel loads, pre-harvest trees per acre, and thinning prescription.

Alternative 3 was designed to yard tops and limbs on all skyline logged acres and on the moderate and heavy thinning units which would be helicopter logged. Roadside grapple piling and burning would occur on all open classified roads (post project). In addition to these treatments, prescribed underburning would be done on approximately 281 acres. As a result of these treatments, approximately 74% of treatment acres would meet recommended levels. The remaining 26% of the treatment acres would remain above guidelines for about 5-10 years.

Similar to Alternative 3, Alternative 4 would yard tops and limbs on all skyline logged acres and on the moderate and heavy thinning units which would be helicopter logged. Roadside grapple piling and burning would occur on all open classified roads (post project). Underburning would also be prescribed on 362 acres. In addition to these treatments, handpiling and burning would be prescribed to achieve additional fuels reduction on most heavily thinned harvest units. As a result of these treatments, approximately 98% of the treatment acres would meet recommended for fine fuels. The remaining 2% of acres would remain above guidelines for 5-10 years.

Summary of Effects

Under the No Action Alternative, no fuels would be generated from harvest activity and forested stands would continue on a path of natural succession. Due to fire suppression practices, the buildup of fuels would continue to occur as stands grow older. Eventually, a large, intense wildfire may escape fire control efforts and damage stands in the project area. Recommended fuels treatments in the action alternatives would reduce fine fuels to forest guidelines in 50%-98% of the project area, depending on which alternative is chosen. The analysis shows that reducing stand density and treating fine fuels would reduce the long-term risk of larger, more intense wildfires. Alternative 2 treats the least amount of residual harvest slash, and therefore includes a short-term risk of high intensity wildfires. As a result of Alternative 2 fuels treatments, approximately 50% of harvest acres would be within guidelines for fine fuel loading and about 12% of the total treated acres would be priority acres. Alternative 3 fuels treatments are more than Alternative 2 but less than Alternative 4 which presents a moderate level of risk of high intensity wildfires may be expected as a result of selecting this alternative. As a result of

Alternative 3 fuels treatments, approximately 74% of harvest acres would be within guidelines for fine fuel loading and about 15% of the total treated acres would be priority acres. Alternative 4 treatments would reduce residual slash to levels within guidelines in approximately 98% of the project area and about 44% of the total treated acres would be priority acres representing the least risk among the action alternatives of producing high intensity wildfires. Treatment costs are lowest in Alternative 2, and highest in Alternative 4. All direct, indirect, or cumulative effects associated with fuels treatments in the Hehe Project area would be mitigated with appropriate management practices.

Effects of Alternatives

Alternative 1 (No Action) - Under Alternative 1, no fuels would be generated from harvest activity and forested stands would continue on a path of natural succession. However, fire suppression policies would continue to dictate fire exclusion from the project area. A lack of disturbance would mean that stands would continue growing into an overstocked condition. Slow growing and weakened trees would die and contribute to the fuel buildup on the forest floor. Condition Class 1 stands would progress towards condition class 2 and 3. Over time, the increasing fuel loads and dense canopies could be associated with greater fire intensity, severity and rates of spread. Fire occurrence on the landscape would continue only under uncontrolled wildfire situations. The risk of large, stand destroying fires would increase and pose a future danger to the Late-Successional Reserve.

Effects Common to Alternatives 2, 3 and 4 - The proposed commercial thinning in the Hehe project area would open the stands, creating a forest canopy less susceptible to sustaining a crown fire. Ladder fuels would be reduced as harvest operations remove the vertical fuel continuity. Because heavily thinned stands would have fewer residual trees and more crown spacing, these stands would ultimately be less susceptible to crown fires than light or moderately thinned stands. The proposed treatments for all action alternatives includes varying amounts of the following treatments: skyline yarding trees with tops and limbs attached, roadside grapple piling cleanup, and pile burning on roads/landings.

The amount of harvest-related slash remaining in a unit depends primarily on the pre-existing surface fuel load and the number of trees to be harvested (thinning prescription). In the Hehe project area, a variety of thinning prescriptions and fuels treatments would be applied to the landscape, which in turn would create a diversity of post-treatment fuel loadings. The goal of the fuels treatment plan is to reduce fuel loadings (logging slash) to levels within Forest Plan guidelines.

Increased surface fuel loads (slash) affect fire behavior by temporarily increasing fire intensity and rate of spread. The increase in fuel loading is temporary because moderate to heavy winter precipitation in the western Cascade Mountains accelerates the decomposition process, especially for fine fuels. As a result, fire danger in an untreated stand would be highest 1-5 years after

thinning, and would decrease thereafter. Studies done by Fahnestock and Dieterich have shown that Douglas-fir slash decomposes to approximately 79% of its original volume after 5 years (Fahnestock 7). Field observations on the Willamette National Forest have indicated that Douglas-fir and Western hemlock slash (0-3” fuel) decomposes to approximately 50% of its original volume after 10 years; observations have found that less than 10% of residual slash remains after 20 years. This indicates that all harvest units in the Hehe Project Area would be within guidelines for 0-3” fuels after 10 years. Because fire spread is primarily influenced by 0-3” fuels, guidelines for 0-3” fuels are used to determine when slash loadings are above recommended levels.

Because the project area is currently defined as Condition Class 1, no technical change in condition class would occur as a result of thinning and fuels treatments. However, thinning the stands and removing residual fuels would result in stands that remain in Condition Class 1 for a longer period of time than would be true for un-thinned stands.

Alternative 2 -Under Alternative 2, yarding tops and limbs would occur on all skyline logged acres. However, no yarding of tops/limbs would occur on helicopter logged acres. Roadside grapple piling and burning cleanup would be done on all permanent roads that are adjacent to harvest units. As a result of these treatments, residual fuel loadings on approximately 50% of the project area would be within recommended levels for 0-3” fuels. Fuel loadings would be above guidelines for 5-10 years, depending on the pre-harvest fuel load/pre-harvest trees per acre/harvest prescription.

The following table (Table 19) displays the recommended fuels treatment by unit, predicted post treatment slash loading and percentage of project area occupied by the different fuel loadings:

Table 19 - Alternative 2 Fuels Treatment Information

Fuels Treatments	Harvest Acres	Post Treatment Acres Within Guidelines+	Priority Acres Within Guidelines++
Skyline Yarding of tops and limbs & piling and burning @ landings	1996	1339	180
Roadside grapple piling and burning (includes landings acres)	N/A	190	190
No fuel treatment	1190	60	0
Totals	3186	1589	370

+Harvest acres where post-treatment fine fuel loads are 11 tons per acre or less.

++Priority acres include acres along permanent roads and heavily thinned acres. Acres are counted in this category only if fine fuels would be reduced to levels within or below Forest Guidelines (Guidelines = 7-11 tons/acre).

As illustrated by Table 19, the recommended fuels treatments would reduce fine fuels to guidelines on 1589 acres (50% of total harvest areas); of these acres, approximately 370 priority acres would be treated (12% of total harvest acres). In helicopter and skyline units where the thinning prescription is light, fine fuels created by harvest activity would generally not exceed guidelines. In skyline units where the thinning prescription is moderate, residual fine fuel loads (slash) would generally be reduced to levels within guidelines. For Alternative 2, this means that guidelines would be exceeded on helicopter/skyline units with a heavy thin prescription, and on helicopter units with a moderate thin prescription.

As a consequence of not yarding tops/limbs on helicopter units and not doing additional fuels treatments on heavily thinned skyline units, there would be an elevated level of risk until residual slash has decayed to levels within guidelines, or up to 10 years, as noted previously. As would be seen later in this document, the fuels treatment strategies for Alternatives 3 and 4 treat more acres.

In summary, Alternative 2 fuels treatments would be limited to skyline yarding tops/limbs, and grapple piling/burning along permanent roads that are adjacent to harvest units. This alternative would create the most wildfire risk, since only about 50% of harvest acres would receive fuels treatments that reduce fine fuels to recommended levels. The remaining 50% of the area would remain above guidelines for 5-10 years.

Alternative 3 (Proposed Action) - In this alternative, yarding tops/limbs would occur on all skyline logged acres, and on helicopter logged units with moderate and heavy thinning prescription. Roadside grapple piling/burning would occur on all units next to permanent roads. In addition to these treatments, prescribed underburning would be done on approximately 281 acres. As a result of these treatments, approximately 74% of harvest acres would be reduced to guidelines. The remaining 26% of acres would remain above guidelines for 5-10 years, depending on the pre-harvest trees per acre/pre-harvest fuel load/harvest prescription. Mortality of trees in underburned units would range from 5-25%, depending on fuel loading and surface fuel moisture. The following table (Table 20) represents the fuels treatment plan for Alternative 3:

Table 20 - Alternative 3 (Proposed Action) Fuel Treatment Information

Fuels Treatments	Harvest Acres	Post Treatment Acres Within Guidelines+	Priority Acres Within Guidelines++
Skyline yarding of tops and limbs & piling and burning @ landings	1846	1310	96
Skyline & Helicopter yarding of tops & limbs & piling and burning @ landing	1253	643	46
Helicopter yarding of tops & limbs & piling and burning @	561	320	0

Fuels Treatments	Harvest Acres	Post Treatment Acres Within Guidelines+	Priority Acres Within Guidelines++
landing			
Roadside grapple piling and burning (includes landings ac	N/A	130	130
Underburn	15	281	281
No fuel treatment	85	85	0
Totals	3760	2769	553

+Harvest acres where post-treatment fine fuel loads are 11 tons per acre or less.

++Priority acres include acres along permanent roads, heavily thinned acres, or acres within ½ mile of Fall Creek Road. Acres are counted in this category only if fine fuels would be reduced to 11 tons per acre or less.

As shown in Table 20, the recommended fuels treatments would reduce fine fuels to guidelines on 2,769 acres (74% of total harvest acres); of these acres, approximately 553 priority acres would be treated (15% of total harvest acres). In helicopter and skyline units where the thinning prescription is light, fine fuels created by harvest activity would generally not exceed guidelines. In skyline and helicopter units where the thinning prescription is moderate, residual fine fuel loads (slash) would generally be reduced to levels within guidelines. For Alternative 3, this means that guidelines would be exceeded on helicopter and skyline units with a heavy thin prescription.

As a consequence of not doing additional fuels treatments on heavily thinned units, there would be a small increase in the level of risk until residual slash has decayed to levels within guidelines, or up to 10 years (as previously noted). As would be seen later in this document, the fuels treatment strategy for Alternative 4 treats even more acres.

In summary, Alternative 3 fuels treatments would include skyline yarding tops/limbs on all units, helicopter yarding tops/limbs on heavy and moderate thin units, and grapple piling/burning along permanent roads that are adjacent to harvest units. In addition to these treatments, approximately 281 acres would be treated by underburning. Because Alternative 3 would reduce fine fuels to recommended levels on approximately 74% of harvest acres, this alternative would create less wildfire risk than Alternative 2.

Alternative 4 - Under Alternative 4, yarding tops/limbs would occur on all skyline logged acres, and on all heavily and moderately thinned helicopter logged acres. Underburning would also be done on 362 acres. Roadside grapple piling/burning would occur on all units adjacent to permanent roads. In addition to these treatments, hand piling and burning would be done to achieve additional fuels reduction on most heavily thinned harvest units. As a result of these treatments, approximately 98% of harvest acres would be reduced to guidelines for fine fuels. The remaining 2% of acres would remain above guidelines for 5-10 years, depending on the pre-harvest fuel load/pre-harvest trees per acre/harvest prescription. The following table (Table 21) represents fuels treatment plans for Alternative 4.

Table 21 - Alternative 4 Fuel Treatment Information

Fuels Treatments	Harvest Acres	Post Treatment Acres Within Guidelines+	Priority Acres Within S&Gs++
Skyline yarding of tops and limbs & piling and burning @ landing	2027	1360	61
Skyline & Helicopter yarding of tops & limbs & piling and burning @ landing	1618	698	72
Helicopter yarding of tops & limbs& piling and burning @ landing	457	256	0
Roadside grapple piling and burning (includes landings ac	N/A	141	141
Underburn	15	362	362
Hand piling & burn	N/A	1196	1196
No Treatment	62	62	0
Totals	4179	4075	1832

+Harvest acres where post-treatment fine fuel loads are 11 tons per acre or less.

++Priority acres include acres along permanent roads, heavily thinned acres, or acres within ½ mile of Fall Creek Road. Acres are counted in this category only if fine fuels would be reduced to 11 tons per acre or less.

As illustrated by Table 21, the recommended fuels treatments would reduce fine fuels to guidelines on 4,075 acres (98% of total harvest acres); of these acres, approximately 1,832 priority acres would be treated (44% of total harvest acres). In helicopter and skyline units where the thinning prescription is light, fine fuels created by harvest activity would generally not exceed guidelines. In skyline and helicopter units where the thinning prescription is moderate, residual fine fuel loads (slash) would generally be reduced to levels within guidelines. Heavily thinned units would remain above guidelines after yarding tops/limbs. However, hand piling/burning would reduce most heavily thinned acres to guidelines.

In summary, Alternative 4 fuels treatments would include yarding of tops/limbs on all skyline and most helicopter units, underburning on approximately 362 acres, and hand piling treatments on approximately 1196 acres. Grapple piling/burning would also occur along all permanent roads. Alternative 4 would reduce fine fuels (slash) to recommended levels on approximately 98% of

harvest acres. Among the three action alternatives, Alternative 4 is the most comprehensive in terms of fuels treatments, and represents the least potential wildfire risk.

The only damage to residual trees would come from prescribed underburning. In these stands, mortality would range from 5-25%, depending on fuel loading and fuel moisture. Because the project area as a whole is currently best described as Condition Class 1, no technical change in condition class would be observed as a result of harvest and fuel treatments. However, thinning the stands and removing residual fuels would result in stands that would remain in Condition Class 1 for a longer period of time. If all stands were unthinned, most stands in the project area would lapse into Condition Class 2 within 20-50 years.

Table 22 (below) represents predicted mortality for stands underburned in Alternatives 3 and 4. Table 23 helps describe potential wildfire behavior in project area stands. The information in this table applies to pre-and-post treatment conditions for all alternatives. Current fuel types in the project area are Fuel Model 8, Fuel Model 5 mixed with Fuel Model 8, and Fuel Model 10. Post-harvest fuel loadings in some stands are represented by fuel models 10 and 12.

Table 22 - Prescribed Fire Scorch/Mortality Prediction (Spring Conditions)

Fuel Model	Tree Scorch Height	Mortality Predicted
10/12	10-40 feet	5-25%

Source: BEHAVE and FOFEM

Table 23 - Fire Behavior (Late Summer Conditions)

Fuel Models*	Flame Length (ft.)	Rate of Spread (ch/hr)+	1 Hour Fire Size (acres)
8/5	2.9	7.4	2.8
10	4.2	5.0	1.4
11/12	7.2	9.6	4.9

Source: BEHAVE

*Fuel model 11/12 represents forests with light to moderate amounts of untreated slash on the ground. Fuel models 8/5 and 10 represent current fuel models. Under Alternatives 2, 3, & 4, portions of the project area would remain as fuel model 11 or 12 for 5-10 years, and return to fuel model 8/5 thereafter.

See Table 1 for fuel model references.

+one chain = 66 feet

Cumulative Effects – Fuel Loading

The cumulative effects analysis area for fuel loading was the project area. Refer to Appendix B for a summary of all past, present and foreseeable actions within the Fall Creek watershed.

Alternative 1 (No Action) - Modern fire suppression practices, past wildfires, and timber management have created cumulative effects in the project area. On the Willamette National

Forest, approximately 80% of wildfires are naturally ignited by lightning. Under the no-action alternative, stands in the Hehe project area would not be thinned, but would exist in a state of continual fire exclusion. Because there has been active timber management and wildfires in the project area during the past several decades, most stands in the project area are in relatively good condition. Fire records from 1950-present indicate that approximately 44 wildfires have been ignited and/or burned into the 20,900 acre project area. Approximately 75% of these fires were contained at one-tenth of an acre or less. As earlier noted, the largest fire in known history was the 1951 Hehe fire, which burned approximately 2,800 acres within the project area. Wildfires have burned approximately 5,126 acres in the project area since 1950, or about 90 acres annually. During the pre-suppression era, natural fires in the project area would have burned about 139 acres annually or approximately 5,824 acres since 1950. This estimate is based upon a natural fire return interval of 150 years. Prescribed fires implemented in the project area since 1950 are discussed below.

The cumulative effects of fire exclusion during the modern fire suppression era are well-documented and have been observed in fire prone ecosystems throughout the American West (RMRS-GTR-42 vol. 5, p.185-203). Increasing stand density and the accumulation of fuels would inevitably lead to a wildfire that is much more difficult to control than a fire in a thinned, treated stand. Condition class would continue to worsen until future thinning/treatments are accomplished or a stand destroying wildfire occurs. A severe, large wildfire may not occur in the project area for 25 years or more, but natural combinations of weather and fuel conditions would ensure that it would happen eventually.

Cumulative Effects Common to Alternatives 2, 3, and 4 - As earlier noted, modern fire suppression practices, past wildfires, and timber management have created a cumulative effects in the project area. Wildfires—even naturally occurring ones—do the most damage when they occur in stands where previous suppression efforts have been successful in excluding fire for long periods of time. Timber management can be designed to act as a surrogate for natural fire occurrence in certain ways. Timber harvests and subsequent slash treatments reduce tree density and fuel loadings, making it easier for stands to fully mature and more difficult for stand destroying fires to occur. During the modern fire suppression era, past timber harvest in the Hehe project area has had the secondary benefit of reducing fuels. This is because broadcast burning was generally prescribed for all acres during the clearcut harvest era. Action alternatives with the higher amounts of fuels treatments would have the most impact in reducing the probability of large, stand-destroying wildfires that might occur in the near future. However, all action alternatives would have the benefit of mitigating the future, long-term effects of fire exclusion in the project area. Residual slash, even if untreated, would decompose and be reduced to background levels after approximately 10 years.

As was explained in the No Action Alternative section above, approximately 139 acres per year would have burned in the project area under the natural, pre-suppression era fire regime (150 year

fire return interval). Since 1950, wildfires have burned approximately 5126 acres in the project area. Approximately 7,306 acres in the project area have been broadcast burned to treat slash produced by timber sales during the same period of time. This means that about 12,432 total acres in the project area have been burned by wildfires and prescribed fires since 1950, or an average of 218 total acres annually. This indicates that the combined effects of wildfires and prescribed fires in the project area have (in effect) established a more frequent occurrence of fire than might naturally have occurred in the project area. However, since the implementation of the Northwest Forest Plan (1991), logging and associated prescribed burning on the Middle Fork Ranger District consist of only about 1/5 of the annual acres of the 1950-1991 logging era. The combined annual acres burned on the Middle Fork District as a result of wildfire and prescribed fire (since 1991) is less than 1/2 of the average annual acres that would have burned under the natural, pre-suppression era fire regime.

Alternative 2 - The cumulative effect of these activities has been a long-term reduction of large fire potential that is still in place. In contrast, the lack of comprehensive fuels treatments in Alternative 2 would result in higher than normal fuel concentrations in about 50% of planned harvest areas. The temporarily higher fuel loads in these areas would create short-term potential for large, intense wildfires. Such wildfires would be difficult for firefighters to safely access, control and contain with initial attack. As earlier noted, thinning stands would also have the long-term benefit of mitigating the effects of fire exclusion by reducing the future potential of large, stand destroying fires (after harvest-related fine fuels have decomposed). Stands in the area are currently categorized as Condition Class 1, and would remain in that condition for up to 50 years as a result of thinning.

Alternative 3 (Proposed Action) - Although not comprehensive, the recommended fuels treatments in Alternative 3 would result in higher than normal fuel concentrations in only about 26% of harvest acres. From a fuels perspective, the temporarily higher fuel loads in these areas would create short-term potential for intense wildfires in some areas. Because Alternative 3 would thin more acres than Alternative 2, there would be an even greater long-term benefit of mitigating the negative effects of fire exclusion and stabilizing condition class.

Alternative 4 - As was noted earlier, comprehensive fuels treatments (broadcast burning) were generally prescribed for all timber harvest areas in the pre-1991 harvest era. Although Alternative 4 fuels treatments do not include large acres of broadcast burning, the prescribed fuels treatments would reduce fine fuel loads in a fairly comprehensive way. As a result of yarding tops/limbs on nearly all acres, underburning, hand piling/burning, and roadside grapple piling/burning, post-treatment fuel loads would meet recommended levels on approximately 98% of harvest acres. Alternative 4 fuels treatments represent the most comprehensive scenario for lowering short-term wildfire risk in the project area. Because the most acres would be thinned under Alternative 4, this alternative would also create the most long-term benefit in terms of mitigating the negative effects of fire exclusion and stabilizing condition class.

Vegetation

Non Significant Issue - Stand management in Late-Successional Reserves will focus on stands that have been regenerated following timber harvest. These are stands that will acquire late-successional characteristics more rapidly with treatment, or are prone to fire, insect, disease, wind, or other disturbances that would jeopardize the reserve. Depending on stand conditions, treatments could include, but would not be limited to: 1) thinning or managing the overstory to produce large trees; releasing advanced regeneration of conifers, hardwoods, or other plants; or reducing the risk from fire, insect, diseases, or other environmental variables; 2) underplanting and limit understory vegetation control to begin development of multistory stands; 3) killing trees to make snags and coarse woody debris; 4) reforestation; and 5) limit use of prescribed fire to maintain non-forest special habitats. Thinning prescriptions will encourage development of diverse stands with large trees and variety of species in the overstory and understory (ROD, B-6).

Existing Conditions – Vegetation

The average stand is 49 years old, 13 inches in diameter, and 97 feet tall. These second growth managed stands are classified as being in the stem exclusion seral development stage (Oliver and Larson, 1990). Stands in this seral stage have dense crowns which block out the light to the forest floor, and limit additional tree regeneration in the understory. Typically, shade-tolerant understory trees that are present persist but grow very slowly. Intermediate or suppressed trees that do not tolerate shade well suffer from competition and have high mortality rate. Shade-intolerant shrubs and forbs frequently disappear at this stage.

These stands have densities that range from 177 to 510 trees per acre. The relative densities range from 36 to 95 with an average of 64. Stand vigor and growth is declining in these stands. Some trees have begun to die due to overcrowding and competition between trees for nutrient and light as evidenced by competition-induced mortality.

Appendix E provides the current (and post thin) conditions in more detail and specific to the stands being considered for treatment with this project.

There are many methods of expressing or evaluating density or stocking levels of plantations. The method used for determining the timing of commercial thinning treatments in the proposed units was Curtis's Relative Density (Curtis, 1982). This relative density method relates existing or planned density to some maximum biological potential density, hence the term "relative". The two factors used in the formula are the quadratic mean diameter and stand basal area per acre. For Douglas-fir a relative density of 50 and above has been determined to be a stand density sufficient to cause competition mortality. The recommended density for managing Douglas-fir to maximize stand vigor and growth is within the range of 35 to 50. The majority of the proposed

units have relative densities greater than 50. The growth and yield projection model - Forest Vegetation Simulator (FVS) (USDA 2002) was used to model the growth of the stands.

Due to the conditions of many of these stands, Middle Fork District requested a project-specific deviation from the Willamette Late-Successional Reserve Assessment (LSRA) 20 inch DBH cutting limit in order to accomplish density management through commercial thinning. The LSRA adopted Regional Ecosystem Office (REO) exemption criteria for commercial thinning which includes limitations on cutting trees exceeding 20 inches DBH. These stands are on productive sites and many of the stands received early precommercial thinning and fertilization under the past intensive timber management regime. The diameter distribution and growth of these stands are greater than anticipated by the REO exemption criteria for managed plantations. In order for the thinning to be effective and produce desired results (diameter growth, crown growth, understory development, species diversification) more than an incidental cutting and removal of ≥ 20 inch DBH trees needs to occur. Approximately 1,503 acres of proposed units would benefit from cutting trees exceeding 20 inches DBH to achieve the silvicultural objectives for density management. Excess 20 inches DBH trees would be used where applicable to meet snag and down wood debris requirements, but some excess 20 inches DBH trees are proposed to be removed to manage the fuel loading levels and meet tree density objectives. The Middle Fork District received a letter of consistency (USDA, 2007) from the REO which concurs with the Middle Fork District's rationale for cutting > 20 inch DBH trees and that finds the project is consistent with the objectives of the Northwest Forest Plan Guidelines for managing LSRs.

Direct and Indirect Effects – Vegetation

Summary of Effects

The stands proposed for treatment are in a condition based on stocking levels, average stand diameters, and crown ratios that would respond and benefit from commercial thinning. Commercial thinning would accelerate the development of late-successional forest characteristics, improve growth and maintain the health of the residual trees by reducing the competition between trees. It would also improve diameter growth, develop the understory and diversify the species composition by opening up the tree canopies. It would provide for an intermediate harvest of merchantable size trees from the excess trees which would normally die out from competition.

Commercial thinning proposed in the action alternatives would develop the live components of late-successional forest characteristics (5 TPA, 32" DBH Douglas fir and 6-20 TPA >9 DBH shade tolerant species) about 10-30 years faster than un-thinned stands depending on the prescription.

Commercial thinning would not change the current seral stage classifications of these stands. The treatments would move these stands along the successional pathway toward understory re-initiation and the development of late-successional forest characteristics. The treatments promote

the development of large diameter trees, multi-storied canopies, horizontal patchiness, and species diversification.

Effects of Alternatives

Alternative 1 – No Action - These over-stocked stands would continue to grow, but at slower rates as trees compete with each other for growing space. Diameter growth would be low or would decline and live crown ratios would get smaller. These trees would become less vigorous and more susceptible to insects and diseases. Competition-induced mortality would increase thus increasing both snag and down wood levels. The down material would increase fuel loadings making the stands more vulnerable to wildfire and insect infestations. The competition-induced mortality would not be available for commercial wood products. Low light levels in un-thinned stands would suppress development of shade-tolerant trees and limit understory vegetation. The diameter and product value of trees harvested in the future would be reduced without treatment.

Effects Common to Alternatives 2, 3 and 4 - The proposed stand treatments have been designed to meet the purpose and need to accelerate the development of late-successional forest characteristics and maintain or improve stand growth and health of these stands, which provides prevention and protection against insects, diseases, and fires. The commercial thinning proposals are designed to facilitate development of additional late-successional habitat from young, dense stands by:

1. Improving or maintaining growth and health of the young stands,
2. Facilitating/accelerating development of structural conditions found in late-successional forests such as large bole size and variability in tree spacing,
3. Producing long-term variability in tree size and tree spacing through variable thinning densities,
4. Enhancing or promoting canopy development for vertical diversity and complexity,
5. Diversifying species composition and structure,
6. Reducing long-term buildup of fuel and increasing crown spacing to lower risk of catastrophic wildfire.

The thinning would open up the tree canopy, allowing more sunlight and precipitation to reach the forest floor. This would result in changes in the microclimate (increased air and soil temperatures, relative humidity's, and air movement) (Chan, 1995), under the main canopy for a short-term (10-20 years) until the canopy closes back in. These changes in microclimate stimulate an increase in favorable growing conditions for most plant species.

Thinning would promote the development of diverse, multi-layered stands (Bailey and Tappeiner, 1998, Muir et all 2002), primarily by providing conditions that favored the establishment of shrubs, hardwoods, and conifers in the understory after thinning, and by releasing saplings and intermediate crown-class trees in the stand.

Thinning would maintain or enhance stand-level plant species diversity. A study found that species richness for herbaceous species and total species richness across trees, shrubs, and herbaceous vegetation (Bailey et al 1998) were greater in thinned stands than in un-thinned and old-growth stands. A portion of the increased species richness was associated with exotic species, but grasses and nitrogen-fixing species also were more abundant in thinned stands

Thinning promotes the crown differentiation by allowing overstory trees to develop deep canopies and larger diameter branches in open stand (McGuire et al 1991).

The heavier thinning would promote rapid growth of trees with characteristics normally associated with old trees in old-growth stands. Many old trees grew rapidly when they were young (30-100 years), and produced large stems and crowns. Recent evidence (Franklin et al 1981, Tappeiner et al. 1997; Poage and Tappeiner 2002) suggests that growth rates of some older forests indicate slow regeneration and at low densities over a long period with little tree-to-tree competition.

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

Some stages of forest succession may be shortened or side-stepped by commercial thinning in young stands (Andrews, et al 2005).

A short-term negative effect to understory vegetation and below ground fungi would be the mechanical damaged from logging. The removal of host trees and soil disturbance from the yarding operation impacts below ground fungi (Courtney et al 2004). This negative effect is mitigated by the rehabilitation of temporary spurs and landings and log-suspensions capabilities of skyline and helicopter yarding systems.

Thinning may help these stands to develop resistance to environmental variables. Studies have compared live-crown ratio and height: diameter (H:D) ratios of trees in young stand managed for timber production to those of trees in old-growth stands (Poage 2001). Live –crown ratios averaged about 50 percent or higher in the old trees, and 30 percent or less in trees in young stands, depending on stand density and whether or not the trees had been thinned. Old trees also had low H:D ratio (often <40-50), which suggests that they are resistant to disturbances by agents such as wind, fire, and ice (Wilson and Oliver 2000, Wonn and O’Hara 2001). In young stand, these ratios were often closer to 70, which suggest that these trees are relatively, unstable, and have relatively low resistance to wind, fire, and ice. Thinning reduces the densities and promotes greater diameter growth of residual trees that increases the stability of these stand over time by making them more resistant to windthrow. However, the heavier thinning could possibly make the residual trees more susceptible to windthrow initially (Garmen, et al. 2003). Following

thinning, some trees may blow down as a result of increased exposure to wind. Windthrow creates canopy gaps and supplies coarse woody material as a fine-scale distance (Hayes et al 1997).

Appendix E compares stand conditions for pre and post treatments scheduled for year 2009 in thinned units for the proposed action.

Stand Modeling

The stand exam data for three stands (Unit #606, #12, and #780) which represent the three thinning prescriptions, light, moderate, and heavy, respectively, were modeled in the Forest Vegetation Stimulator (FVS) (USDA, 2002) to evaluate the progression of the stands toward the criteria of late-successional forest structure minimum thresholds (see Silvicultural Prescription in Project File).

Table 24 - Unit 606 - Light Thin - Modeled Stand Conditions at 150 years

	No Thinning	Light Thinning
Large Diameter Douglas fir TPA >32" DBH @ 150 years	1	14
Shade Tolerant Species TPA >9" DBH @ 150 years	28	25

Table 25 - Unit 12 -Moderate Thin - Modeled Stand Conditions at 150 years

	No Thinning	Light Thinning
Large Diameter Douglas fir TPA >32" DBH @ 150 years	2	6
Shade Tolerant Species TPA >9" DBH @ 150 years	32	53

Table 26 - Unit 780 - Heavy Thin - Modeled Stand Conditions at 150 years

	No Thinning	Heavy Thinning
Large Diameter Douglas fir TPA >32" DBH @ 150 years	2	7
Shade Tolerant Species TPA >9" DBH @ 150 years	0	21

The density of Douglas-fir > 32"DBH projected in the 100 years model analysis period (stand age about 150 years old) is increase by about 4-13 TPA with the different thinning intensities. The scenario where no thinning would take place shows that the minimum threshold 5 trees per acre for Douglas-fir would not be produced within the next 100 years. Each of the three thinning

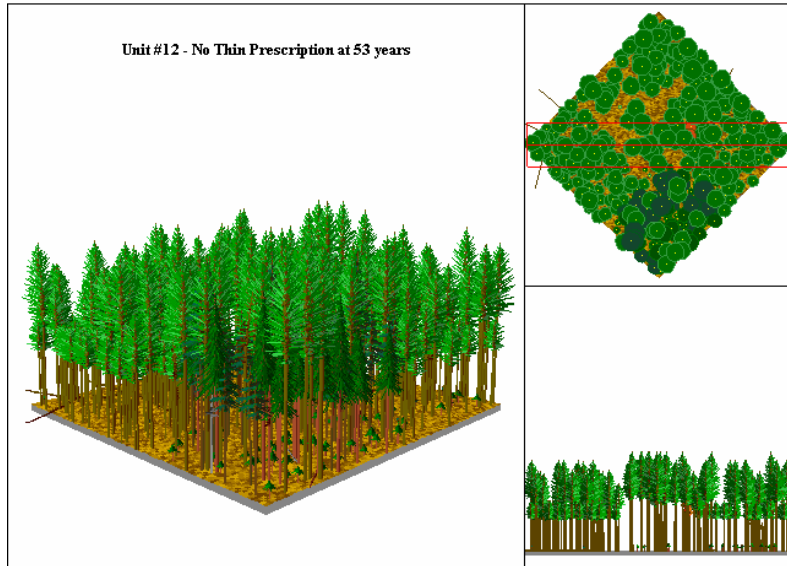


Figure 6 - No Thin Prescription

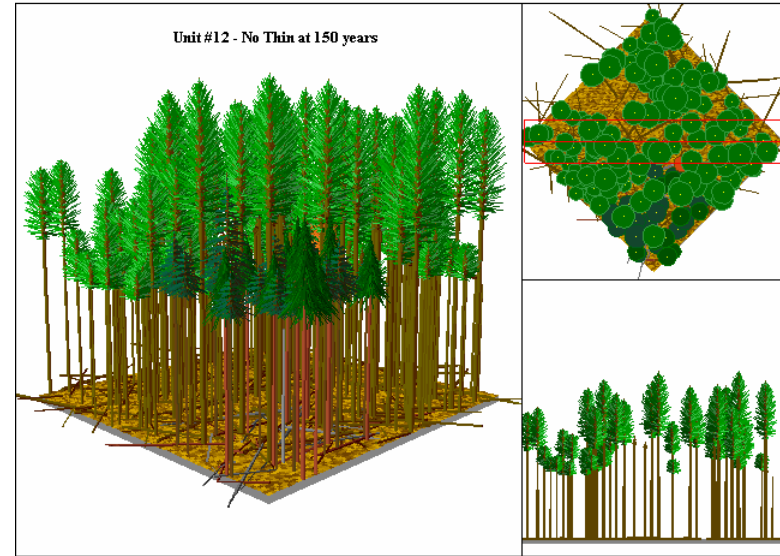


Figure 8 - No Thin Prescription at 150 years

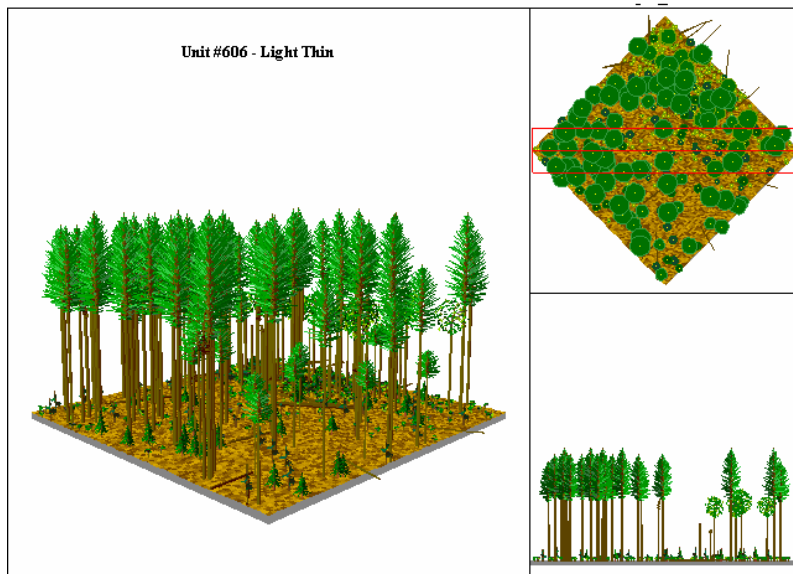


Figure 7 - Light Thin Prescription

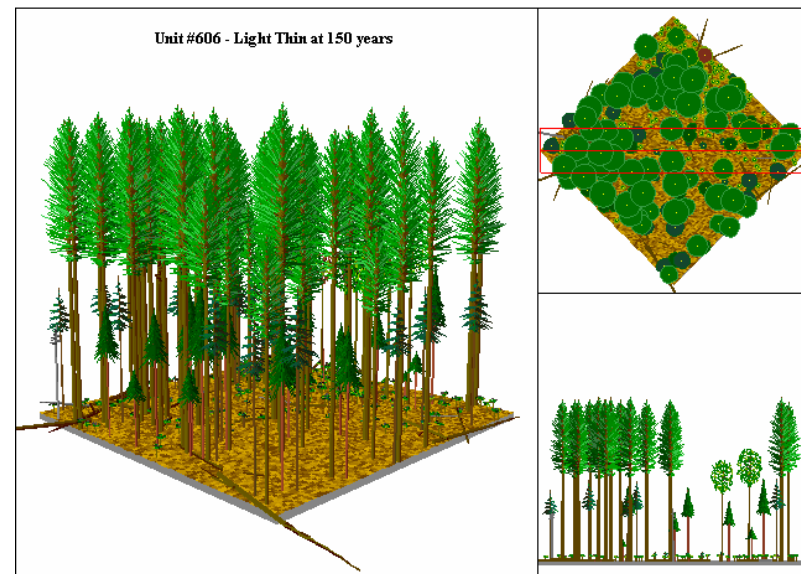


Figure 9 - Light Thin Prescription at 150 years

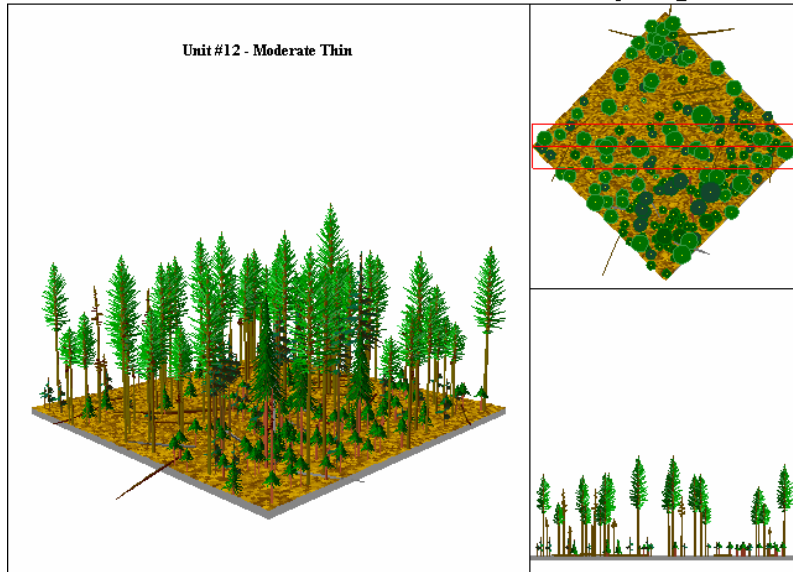


Figure 10 - Moderate Thin Prescription

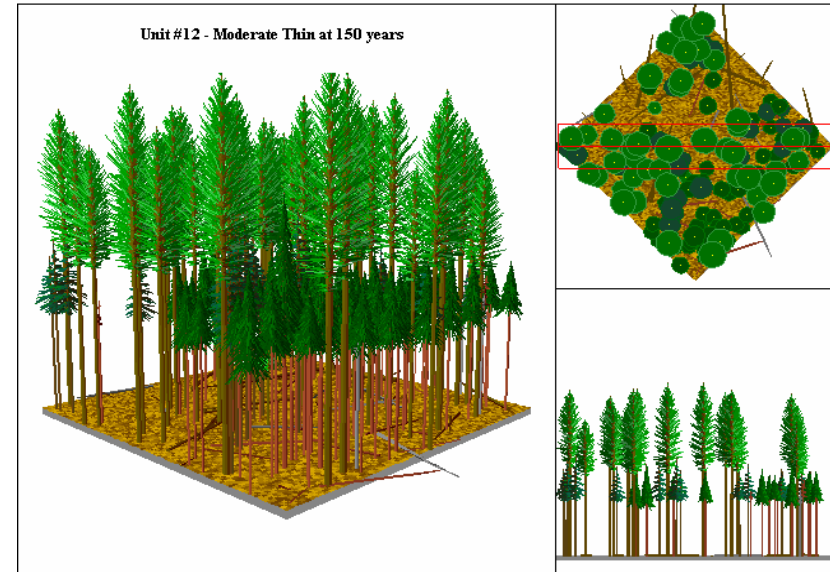


Figure 12 - Moderate Thin Prescription at 150 years

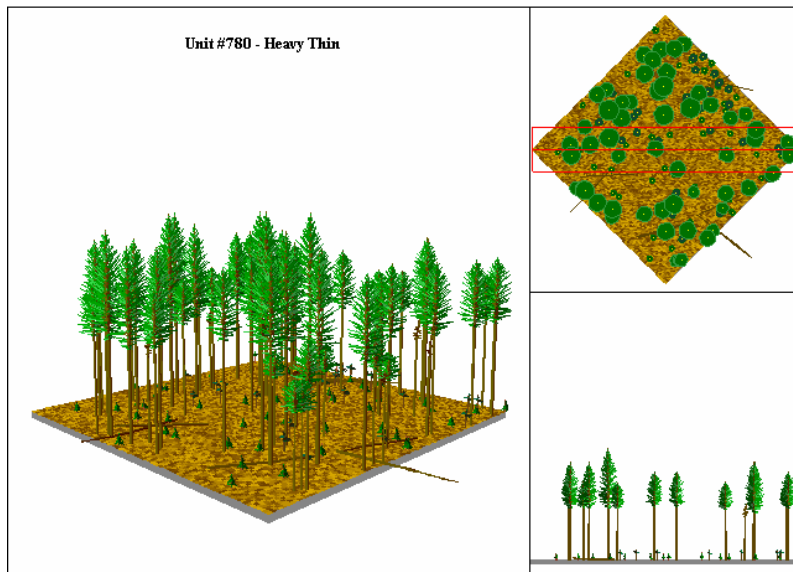


Figure 11 - Heavy Thin Prescription

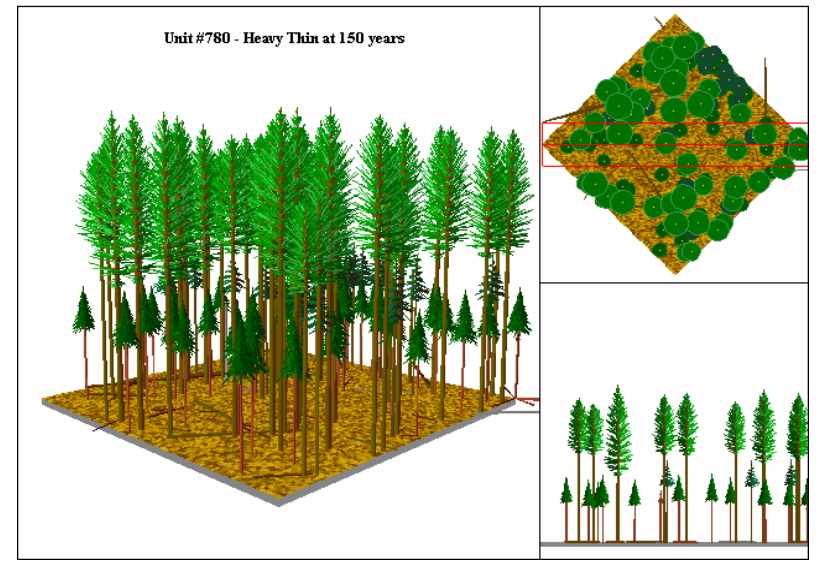


Figure 13 - Heavy Thin Prescription at 150 years

intensities, light, moderate, and heavy would exceed the threshold number of 5 Douglas-fir >32" DBH trees per acre at 143 years, 131 years, and 122 years, respectively.

The shade tolerant understory criterion at 150 years is met for both the light and moderate thins and with the no thinning prescription in each of the sample Units #606 and #12. The shade tolerant trees per acre would not be met in Unit #780 with the no thinning prescription but would exceed the threshold levels with the heavy thin (21 TPA). Each of the three thinning intensities, light, moderate, and heavy would exceed the threshold number of 16 shade tolerant species >9" DBH trees per acre at 143 years, 107 years, and 122 years, respectively. It should be noted that Unit #12 with no thinning prescriptions would meet the shade tolerant criteria at age 53 years old given the current species composition dominated by big leaf maple clumps.

Figures 6-13 displays representative illustrations of the stand conditions of the four different thinning prescriptions (no thin, light, moderate, and heavy) at about 10 years after the thinning and at 150 years.

Alternative 1 (No Action) does not propose any thinning and these stands would take over 150 years to develop the live components of late-successional forest conditions. Alternative 2 would promote the development of 3,186 acres of late-successional forest conditions in less than 150 years, Alternative 3 would promote the development of 3,762 acres, and Alternative 4 would promote the development of 4,179 acres.

Cumulative Effects – Vegetation

The area analyzed for cumulative effects on vegetation was the project area. The project area is delineated by the Hehe Creek sixth sub-watershed Jones, Alder, Sunshine, Pernot, Hehe, Tiller, Puma, and Marine Creek drainages. This area provides a logical analysis area to assess stand conditions based on the plant association series and the approximate size (5,000 to 10,000 acre) of the typical natural wildfire disturbance event.

Existing conditions are a direct result of the harvest history of the area. Past timber harvest and road construction have been the dominant management activities which has had a cumulative effect on the vegetation. Appendix B in the EA provides a summary of the history of past timber harvest and road management.

As a result of past management actions, the current development stage distribution in the project area is 4,709 acres of stand initiation, 5,255 acres of stem exclusion, 2,599 acres of understory reinitiation, 8,178 acres of late-successional old growth and 160 acres of non-forest. There are no present actions that would affect the seral stage distribution in the analysis area. The only reasonably foreseeable future action affecting vegetation is timber stand improvement treatments such as pre-commercial thinning. This young stand thinning would not change the seral class condition in these stands.

The cumulative effects on development stage distribution in the analysis area that would be caused by the alternatives being considered are displayed in Table 27 below.

The following table displays the acres and percent of each development stage in the project area.

Table 27 -Project Area Development Stages and Effects by Alternative

Development Stage	Alternative 1	Alternative 2	Alternative 3	Alternative 4
	(No Action) (Current Conditions)		(Proposed Action)	
Stand Initiation	4,709 ac.	4,709 ac.	4,709 ac.	4,709 ac.
Stem Exclusion	5,255 ac.	5,255 ac.	5,255 ac.	5,255 ac.
Understory Re-Initiation	2,599 ac.	2,599 ac.	2,599 ac.	2,599 ac.
Old Growth	8,178 ac.	8,178 ac.	8,178 ac.	8,178 ac.
Non Forest	160 ac.	160 ac.	160 ac.	160 ac.

The Alternatives would have no cumulative effects on development seral stages. Proposed thinning in Alternative 2, 3 and 4 would not alter the development stage but would change the number of trees per acre and the canopy density, in treated stands. The treatments would move these stands along the successional pathway toward the understory re-initiation stage.

Cumulative effects on growth rates would be the same as described in direct effects. This cumulative effect would be the same for thinning in all action alternatives.

Consistency with Direction and Regulations – Vegetation

The commercial thinning treatments are consistent with standards and guidelines in the Forest Plan as they relate to commercial thinning (MA-14a-13) and the land allocations (Late-Successional Reserves and Riparian Reserves). All thinning treatments would take place on land classified as suitable for forest management. Areas determined to be unsuitable have been avoided and dropped for the units. Thinning maintains or enhances species diversity through the development of understory vegetation. The stands have not reach culmination of mean annual increment, therefore no regeneration harvest is planned.

The project is consistent with the competing vegetation direction. In the thinning units, competing and unwanted vegetation is not a concern due the age of the stands, seral stage condition of the stands, and the proposed treatment type. These stands are 35-60 years old and are dominant in size and height over any competing vegetation. Over the long-term, the canopy cover would expand back to where the shading would control the levels of any potential competing vegetation.

Invasive Plants

Non Significant Issue - Timber sale activities may contribute to the spread of invasive plants. The spread of invasive plants displaces native plants, which may have an affect on biotic communities.

Existing Conditions – Invasive Plants

Plants in the project area that pose the most serious threat to native vegetation are: Slender false brome (*Brachypodium sylvaticum*), Scot's broom (*Cytisus scoparius*), Himalayan blackberry (*Rubus discolor*), evergreen blackberry (*Rubus laciniatus*), meadow knapweed (*Centaurea debeauxii*), and everlasting peavine (*Lathyrus polyphyllus*). Reed canarygrass (*Phalaris arundinacea*), tansy ragwort (*Senecio vulgaris*), oxeye daisy (*Leucanthmum vulgare*), St. John'-wort (*Hypericum perforatum*), foxglove (*Digitalis purpurea*), Canada and Bull thistle (*Cirsium arvense* and *C. vulgare*), white sweet clover (*Melilotus alba*) and common mullein (*Verbascum thapsus*) are also present in the analysis area.

The following species are most commonly associated with forest openings such as road corridors, clearcuts and young plantations.

Slender false brome is a highly invasive perennial grass that has the capability to dominate the forest floor to the exclusion of native species. It has been reported to competitively exclude other species in the understory of coniferous forests it invades, even inhibiting establishment of tree seedlings by sequestering much-needed soil moisture (Kaye, T.N. 2001). This highly invasive grass is a high priority for eradication and control on the Forest. It has been documented in dispersed locations throughout the project area. It is mainly found along road ditches and shoulders. Small patches have been found along the banks of Fall Creek and along Road 1800. Other populations exist throughout the Fall Creek watershed. The species has been documented on adjacent Army Corps of Engineers and Lane County lands surrounding Fall Creek Reservoir.

Scot's broom is a well-established, widespread woody shrub in the legume family up to ten feet tall that favors roadsides and early seral plantations. Himalayan and evergreen blackberries are robust evergreen shrubs that prefer open areas and roadsides but can also persist and spread under the forest canopy. Both species are spread by birds and other animals that eat the berries and both species spread vegetatively by root tipping. These species are commonly found along the project area roads, and in, or adjacent to many proposed stands.

For a complete description of the rest of the invasive plants in the project area refer to the Botanical Report (McMahan, 2007) in the Project File. The Botany Report includes a table which summarizes known weed species locations relative to roads, quarries and stands that were botanically surveyed. The list includes potential control measures and associated costs per treatment acre of for three years of treatment. This list is not a complete inventory of the entire subwatershed, as not all areas were surveyed for invasive weeds, only those in proximity to proposed units and along haul routes.

Direct and Indirect Effects – Invasive Plants

Summary of Effects

All alternatives, including No Action, would result in new and continued disturbances that promote introduction and colonization of new weed species and expansion of existing species in the project area. The risk of future weed infestation can be reduced by implementation of Best Management Practices (BMPs) that are incorporated into project design. Mitigating measures to be applied would cumulatively lower the risk of increasing invasive plants populations within the watershed. Some false brome populations in the watershed have been treated with herbicides in the past using weed treatment funds and regardless of alternative design, spot spraying would continue when monitoring documents new localized populations.

Effects of Alternatives

Alternative 1 (No Action) - The no action alternative would not mitigate for any invasive plant populations that persist in the project area. It is unknown whether invasive species are increasing, decreasing or stable because there is no available data on rates of weed spread on federal or non-federal lands in the watershed. Long-term data collection and monitoring of weed populations has not been done on road systems in the project area. Some populations of false brome has been treated with herbicides the past several years, and it appears that patches have diminished. Because no logging or road maintenance machinery would be dispatched to the site, there should be no risk of additional introduction from contaminated off-road equipment. Alternative 1 does not provide any soils or fuels treatment scenarios that could promote short-term weed flushes; no ground would be opened to provide a seed bed for invasive species, therefore this alternative has the least direct risk of spreading weeds. No forest would be thinned; many shade intolerant weed species cannot survive the deeper darker conditions that would result from foregoing thinning in these stands; thus there is less risk that weeds would spread into the closed canopy stands, not only due to light limitations but also because there would be no equipment in the stands that could potentially spread weed seeds. Weed populations already present in perpetually open areas in the project area would remain growing unchecked unless treated.

Effects Common to Action Alternatives 2, 3 and 4

Thinning activities, spur road construction and system road maintenance increase risk of invasive plant seed dispersal and establishment by creating conditions that allow invasive plants to pioneer disturbed sites and eventually out-compete native plants. Soil disturbance and transport of seed are direct effects of timber harvest on weed introduction and persistence. In the action alternatives, the areas that would be permanently opened up to light and disturbance, e.g., roads and landings would be most at risk. These areas are disproportionately subject to ground disturbance and exposure to vehicles and equipment that may bring seed in.

The alternative with the greatest number of disturbed acres and miles of road for hauling logs would create the most habitats for invasive weed introduction. Harvest creates habitat by opening of the canopy and by yarding logs using ground-based equipment that disturbs soils. Limiting mechanical disturbance helps to limit spread of the existing weed seed bank into the stands. Weed invasion into adjacent thinned stands could lead to competition, affecting tree and shrub seedling establishment and growth, which in turn could affect sensitive botanical species. Weeds directly compete with sensitive species like tall bugbane when they invade their habitat.

Alternative 4 has the highest risk of promoting invasive weeds because it has the higher disturbance and habitat modification. This alternative has a higher risk of increasing weed sites because it proposes 350 more acres of skyline yarding than in Alternative 3, and 930 more acres than Alternative 2 where soil disturbance could provide seed beds

Roads would have to be maintained and, in some cases, upgraded for harvest. Of particular concern are road systems that would be used for transport that contain false brome, as vehicular traffic may facilitate movement of weed seed up and down road systems when seed is caught in the mud on vehicle undercarriages. New temporary spur construction and road upgrade could potentially bring in weed seed from contaminated gravel. Hehe Creek and Alder Creek bridge abutment work would involve in-stream excavation and placement of new footings. Numerous road culverts would have to be installed or replaced. All these activities increase the risk of invasive weed introduction through potential contamination from off-road equipment that is not cleaned, as well as by opening up a seed bed. There are at least 41 documented new invader sites located near or at proposed landing areas, most contain blackberries and scattered, linear false brome sites. Two sites are meadow knapweed.

Roads are well documented as vectors for weeds and sites where new populations could easily establish. There are at least 83 new invader sites along haul routes. Because weeds most often travel along road systems, risk of weed infestation decreases in areas where roads and landings are closed, rehabilitated, and seeded with desirable species.

Porcupine rock pit is located on FS Road 1824-163 to the south and outside of the project area. This is a preferred source site for road material which contains abundant Scot's broom (upper north corner), lesser amounts of both Himalayan and evergreen blackberries, tansy ragwort and

common mullein. Pre-treatment for invasive weeds of this area is necessary before material can be loaded for project use.

No-cut buffers in Riparian Reserves lessen the risk of slender false brome invading and spreading along waterways by protecting these areas from disturbance.. The action alternatives 2, 3, and 4 have approximately 2,048 acres, 2,368 acres, and 2,582 acres no thin buffer areas, respectively.

Alternative 2 would reduce the miles of roads in the project area by about 4 percent. No recorded new invader weed sites are associated with decommissioned roads in this alternative. Alternative 3 (Proposed Action) and Alternative 4 reduce the miles of roads in the project area by about 31 percent. Nine recorded new invader weed sites are associated with decommissioned roads in Alternative 3 and thirty recorded new invader weed sites are associated with decommissioned roads in Alternative 4. All action alternatives would eventually decrease the risk of permanent weed establishment when native vegetation re-grows in the long term, with the provision that any current populations of invasive plants are treated effectively prior to closing.

Table 28 - Comparison of Invasive Plants Introduction and Established Potential by Alternative

Activity	Alt.1 (No Action)	Alt. 2	Alt. 3 (Proposed Action)	Alt. 4 acres
Total area treated through thinning	0 ac	3, 186* ac	3, 762*ac	4, 179* ac
Yarding systems				
Skyline	0 ac	1,996 ac	2, 576 ac	2, 926 ac
Helicopter	0 ac	1, 189 ac	1, 186 ac	1, 253 ac
New landings	0 ac	6.5 ac*	7.6 ac*	9.3 ac*
Road Management				
New Temporary roads	0 ac (0 mi)	5.6 ac (3.9 mi)*	5.5 ac (3.8 mi)*	7.0 ac (4.8 mi)*
Maintenance and reconstruction of haul routes	0 ac.	309.4 ac (102.1 mi)*	349.4 ac (115.3 mi)*	386.4 ac (127.5 mi)*
Road closed to passenger cars	0 ac.(0 mi)	13.3 ac (4.4 mi)	115.2 ac (38.1 mi)	115.2 ac (38.1 mi)
Subsoiling of decommissioned roads	0 mi	3.7 ac	7.6 ac	8.7 ac
Fuel treatments				
Fine fuel mitigation, yarding tops and machine piling at landings	0 ac	1,996 ac	3,660 ac	4,101 ac
Prescribed under-burning	0 ac	0 ac*	281 ac*	362 ac*
Machine grapple piling and burned within 40' of open roads and landings	0 ac	190 ac*	130 ac*	141 ac*
Supplemental hand piling and burning	0 ac	0 ac*	0 ac*	1, 196 ac*

*Treatment acres used in cumulative effects analysis

Alternative 2 includes 190 acres of grapple piling adjacent to roads, representing 26 % more than Alternative 4 and a 32 % increase from Alternative 3 in acres disturbed that would create invasive weed habitat by the soil disturbance. Alternative 3 and 4 include 281 and 362 acres, respectively, of prescribed underburning that could promote additional weed seed germination in the short-term. Alternative 4 also includes an additional 1,196 acres of supplemental hand piling and burning of which creates scattered burned spots of bare soil. These burned spots increase the risk of weeds spread by creating sites favorable for invasive plants.

Cumulative Effects – Invasive Plants

Cumulative effects for weeds are analyzed on a watershed scale since the entire Fall Creek basin contains habitat and weed species similar to those in the project area. Modes and patterns of dispersal and rate of spread of species are similar to those found elsewhere in the watershed. We considered the cumulative effects to all species found in the project area collectively with the other sites in the watershed.

The Fall Creek watershed contains approximately 76,704 acres. Past actions that created habitat for weeds within the watershed include clear-cut and shelterwood harvesting by the Forest Service. Clear-cut harvesting stands less than 20 years old are assumed to be un-recovered and activities such as tractor yarding, temporary road construction, road maintenance and upgrade, soil restoration treatments, hand-piling, grapple piling and burning, and under burning contribute to an overall increase in early seral (potential weed) habitat in the watershed. Several roadside projects in the recent past that included activities such as hazard tree removal, fire salvage, and restoration of fire damaged recreation areas that also included native and non-native grass seeding.

The FS Road 18 system in the watershed is the main travel route along which infestations are moving. Road maintenance activities occur in this watershed on an as needed basis depending upon level of use. There are 483 miles (approximately 1,463 acres) of open roads in the watershed. Refer to Appendix B for the history of the development of the road system in the Fall Creek watershed and past, present and foreseeable future activities. No new roads are proposed for Forest Service currently or in the foreseeable future.

Alternative 1 (No Action) - This alternative would not reduce the open road system and would not create any additional habitat (zero percent), so this alternative would contribute no additional cumulative effects. Weeds are spread through a combination of human and wildlife activities, and natural events including wind and rain. Foreseeable activities within the project area are expected to be similar to past and current activities. Human activities that would vector weeds onto and within federal and non-federal lands in the watershed such as recreational use (such as off road vehicle traffic, etc.), road travel, road construction and maintenance, and special forest product collection would all continue to occur regardless of whether or not any of the action alternatives

occur. Incremental increases in weed infestation, whether by human or natural disturbances, cannot be accurately predicted because of all the variables involved in vectoring weeds.

The cumulative effect on weeds by alternatives that include ground disturbing activities would be to increase the overall amount of area infested because more area would be disturbed.

Alternative 2 - Activities that would perpetuate or increase habitat for weeds include approximately 102.1 miles of road that would be maintained, representing about 309.3 acres of open weed corridor, or 0.4 percent of the watershed. Stand treatment activities associated with this alternative would create approximately 3,383 acres of additional habitat (4 percent of the watershed).

Alternative 3 (Proposed Action) - Approximately 115.3 miles of road would be maintained, representing about 349.43 acres of open weed corridor, or 0.5 percent of the watershed. Stand treatment activities associated with this alternative would create approximately 4,181 acres of additional habitat (5 percent of the watershed).

Alternative 4 - Approximately 127 miles of road would be maintained, representing about 386.4 acres of open weed corridor, or 0.5 percent of the watershed. Stand treatment activities associated with this alternative would create approximately 5,888 acres of additional habitat (8 percent of the watershed).

Botanical Threatened, Endangered and Sensitive (TE&S) Species and Survey and Manage (S&M)

Non Significant Issue - Known sites for certain botanical TE&S species do occur within the project area and potential habitat exists for other species that are suspected to occur. Harvest associated activities could affect TE&S species and their habitats within, adjacent to and downstream of the project area.

Management Direction - Botanical TE&S Species and Survey and Manage and protection Buffer Species

Forest Service Manual (FSM) 2670 direction is to ensure the viability of sensitive botanical species and to preclude actions that would contribute to the federal listing of a species. To ensure compliance with this direction, a biological evaluation is required for forest management activities that may alter habitat for proposed, endangered, threatened or sensitive species (*FSM 2671.44*) in order to determine the possible effects of the proposed activities on these species.

Northwest Forest Plan (USDA, 1994) established survey and manage guidelines that provided an adaptive-management process for acquiring information and managing rare and uncommon and poorly understood old-growth forest related species. In January 2001, the Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines (USDA, USDI, 2001) adopted new

standards and guidelines for survey and manage and protection buffer species, and other mitigating measures. Species in Categories A and C are required to have pre-disturbance surveys conducted for them. Some Category B species are also required to have pre-disturbance surveys conducted because strategic surveys have not been completed as of fiscal year 2006 (USDA, USDI, 2001).

Existing Conditions – Botanical T,E,&S Species and Survey and Manage and protection Buffer Species

Habitat exists for 47 of the 72 botanical species listed as sensitive on the Willamette National Forest. Documented sensitive and survey and manage species sites in the Fall Creek watershed but not within proposed thinning areas include: *Cimicifuga elata*, *Romanzoffia thompsonii*, *Nephroma occultum*, *Pseudocyphellaria rainierensis*, and *Usnea longissima*. Surveys were conducted in June, July, and August and September of 2003, 2004, and 2006 for vascular, bryophytes and lichens. No sensitive vascular plants were found. Three survey and manage lichen species requiring management of sites were discovered within proposed thinning stands during the course of surveys, two of which are also listed as sensitive.

Surveys identified three sensitive lichens species. *Peltigera pacifica* (Category E species) was located in Unit #3557 on boulder substrate on August 17, 2003, and Unit #164 on conifer trunk and rotten wood on August 19, 2003. *Usnea longissima* (Category F species) was found in Unit# 212 on a cherry branch on September 23, 2003. *Nephroma occultum* (Category B) was recorded at the northeast corner tip of Unit #3556 adjacent to 1831-386 past 1831-390 in 1996.

No surveys were conducted for the 17 fungi species because single pre-disturbance surveys for these species have been deemed impractical (USDA 1998, USDA 2000, USDA 2004) because fungi fruit inconsistently and would require multiple year surveys to determine their presence.

Direct and Indirect Effects – Botanical TE,&S and Survey and Manage Species

Summary of Effects

In summary, because no surveys were completed to determine effects on fungi, all action alternatives were given a May Impact Individuals or Habitat (MIIH), But Will Not Likely Contribute to a Trend Towards Federal Listing or Loss of Viability for the Population or Species rating.

For the rest of the species, all action alternatives were given a No Impact (NI) conclusion because either no populations were found, or the documented populations and associated habitat is sufficiently buffered or located away from the impacts of project activities.

Table 29 - Sensitive Plants Summary of Effects Determination by Alternative

Species	Alternative 1 – No Action	Alternative 2	Alternative 3 (Proposed Action)- Proposed Action	Alternative 4
<i>Botrychium minganense</i>	NI	NI	NI	NI
<i>Botrychium montanum</i>	NI	NI	NI	NI
<i>Bridgeporus nobilissimus</i>	NI	NI	NI	NI
<i>Carex livida</i>	NI	NI	NI	NI
<i>Cimicifuga elata</i>	NI	NI	NI	NI
<i>Corydalis aqua-gelidae</i>	NI	NI	NI	NI
<i>Dermatocarpon luridum</i>	NI	NI	NI	NI
<i>Eucephalis(Aster) vialis</i>	NI	NI	NI	NI
<i>Hypogymnia duplicata</i>	NI	NI	NI	NI
<i>Iliamna latibracteata</i>	NI	NI	NI	NI
<i>Leptogium burnetiae</i> var. <i>hirsutum</i>	NI	NI	NI	NI
<i>Lycopodium complanatum</i>	NI	NI	NI	NI
<i>Montia howellii</i>	NI	NI	NI	NI
Mycorrhizal Fungi	NI	MIH	MIH	MIH
<i>Nephroma occultum</i>	NI	NI	NI	NI
<i>Pannaria rubiginosa</i>	NI	NI	NI	NI
<i>Peltigera neckeri</i>	NI	NI	NI	NI
<i>Peltigera pacifica</i>	NI	NI	NI	NI
<i>Pseudocypbellaria rainierensis</i>	NI	NI	NI	NI
<i>Ramalina pollinaria</i>	NI	NI	NI	NI
Saprophytic on Litter fungi	NI	MIH	MIH	MIH
<i>Romanzoffia thompsonii</i>	NI	NI	NI	NI
Saprophytic on wood fungi	NI	MIH	MIH	MIH
<i>Scouleria marginata</i>	NI	NI	NI	NI
<i>Tetraphis geniculata</i>	NI	NI	NI	NI
<i>Usnea longissima</i>	NI	NI	NI	NI

NI=No Impact

MIH=May Impact Individuals or Habitat, But Will Not Likely Contribute to a Trend Towards Federal Listing or Loss of Viability for the Population or Species

Effect of Alternatives

Vascular Plants

No direct or indirect impacts to sensitive vascular species are anticipated in any of the Alternatives because no TE&S or S&M species were found.

Lichens and Bryophytes

Alternative 1 (No Action) – No direct or indirect effects are anticipated because no actions would take place.

Effects Common to Action Alternatives 2, 3 and 4

Changes in hydrology, including water temperature and sediment may affect aquatic lichens found on submerged rocks in clear, cold streams (USDA, USDI 2003). Persistence of the other lichen species may be threatened by host tree removal, wind throw, changes in microsite conditions, changes in epiphyte ecology and competition in more open stands, and by dispersal limitations in more widely spaced stands (USDA, USDI 2003). The variable thinning prescriptions would, in the long-term, enhance habitat for most survey and manage species. In some cases, thinning may be beneficial to these epiphytes by enhancing tree species diversity, including Pacific yew and hardwoods such as bigleaf maple, two tree species known for their abundant lichen communities. Larger diameter trees, retention areas, dominant tree release, and the retention of minor tree species would add complexity to the forest. Late-successional forest provides better habitat for sensitive lichens through retention of mature and old-growth trees providing long-term substrate and microclimates. All alternatives propose riparian thinning which increases potential impacts to many species more typically associated with riparian habitat.

Prescribed burning could cause direct loss of individuals from radiant heat and smoke, especially when plants are moist and physically active (USDA, USDI 2002).

Fungi

Effects Common to Action Alternatives 2, 3 and 4

There would be direct effects to fungi under all action alternatives, but severity and amount of habitat disturbance differs by prescription. Most fungi form mycorrhizal relationships with conifers, and thinning has been shown to have negative short-term (5-7 years) impacts to fungi (Pilz et al 2003). Stand treatments would result in the disruption of mycelial networks (Kranabetter and Wylie, 1998; Amaranthus and Perry, 1994). It is likely that individual sites of fungi may be negatively affected in the short-term by host tree removal, physical disturbance, soil compaction, and disruption of mycelial networks if the fungi are present (Kranabetter and Wylie 1998, Amaranthus and Perry 1994). Reductions in the number of fruiting bodies of chanterelles, a common mycorrhizal species, were noted after initial thinning in similar second growth stands but appear to rebound after several years (Pilz et al 2003).

Indirect effects to survey and manage and sensitive species and their habitats vary. Two studies have shown that fungal species richness declines in forest openings (Durall, et al, 1999, Kranabetter and Wylie 1998). Therefore, in the short-term, thinning prescriptions may reduce habitat for sensitive mycorrhizal fungi. The prescriptions in all action alternatives would take place in such a way to enhance late-successional characteristics over the long-term. This includes greater diversity in stand structure and stand species. The addition of understory trees and shrubs may benefit the sensitive mycorrhizal species. Duff retention and coarse woody debris creation would benefit the sensitive saprophytic species and would lead to an increase in habitat complexity over the long-term (20-100 years).

Reducing heavy equipment yarding through forested stands is assumed to be beneficial to forest vegetation. Skyline yarding causes fewer disturbances to the top soil horizons than tractor yarding; soils are less likely to become compacted with partial (or full suspension) skyline yarding than ground based systems. Cable yarding of trees causes localized soil compaction and disturbance along yarding corridors. This causes a loss of ectomycorrhizal root tips (Amaranthus et al, 1996) and can disturb litter-dwelling and saprophytic fungi within the logging corridors. All action alternatives propose skyline yarding, helicopter yarding to landing areas, and grapple piling. These activities would potentially create soil compaction and disturbance that would affect fungi habitat.

Culvert replacement may cause some disturbance to soil-dwelling fungi through direct disturbance and potential removal of habitat, but in small localized area. Development of temporary access roads and helicopter landing areas would have a similar localized direct effect on fungi in the soil.

Effects of burning on fungi have been the subject of many scientific investigations. Loss of large downed woody debris that can act as moisture reservoirs and refugia is a concern (Penttila and Kotiranta, 1997). Prescribed burning in the analysis area would cause loss of litter, so it could reduce substrates for litter-dwelling fungi. Bruns (2002) studying short-term effects of ground fire in the Sierra Nevada found a short-term reduction in the biomass of ectomycorrhizal fungi correlated with incineration of the litter layer, but that lower layers, where the greatest species richness occurs, were preserved. Stendell et al.(1999) found a similar pattern in a Sierra Nevada ponderosa pine forest after prescribed fire where litter/organic species biomass decreased eightfold but no difference was detected in mineral layers.

Alternative 1 – No Action - Under this alternative, no acres would be thinned and the stands would undergo a slow decline before opening up enough to provide an understory. An indirect effect of no action would be natural succession which may change the underground species composition. Windthrow, snowdown (which are both prevalent in the watershed), and insect and disease pockets would create openings. Coarse woody debris would be abundant as trees die due to overcrowding. Indirect effects to sensitive fungi would likely be minimal. As stands get older,

the underground species composition also gets more diverse (Visser, 1995; Bradbury et al, 1998; Smith et al, 2002).

The stands do provide potential habitat for many sensitive botanical species. Potential habitat for some of these plants would deteriorate as the dense canopies of Douglas-fir close in and darken the forest floor. Some species may be negatively affected by development of a dense closed canopy. These species must have adequate light to photosynthesize; also, a deep dark canopy tends to favor greater moss cover, which can out compete the lichens. Species associated with shrubs and hardwoods such as bigleaf maple would likely drop out of the stand unless thinning takes place.

Alternative 1 would result in no soil disturbance and compaction from harvesting methods, new road construction or any fuels treatments that would affect fungi or other species habitat.

Conversely, because no fuels treatments would occur, potential sensitive plant habitat could be indirectly affected by risk of stand replacing fire disturbance due to heavier unmanaged fuel loads.

Alternative 2 - This Alternative has the least amount of acres potentially containing fungi that would be subject to short-term impacts through thinning.

This alternative also would result in the least amount of acres subject to short-term impacts on lichens through removal of current substrate. The *P. pacifica* site in Unit #164 lies within a no cut riparian buffer and no burn protection area. The *P. pacifica* site in Unit #3557 has been protected with a 50 foot no cut and no burn protection buffer to protect it from mechanical damage and yarding would be directed away from the no cut area. Buffer prescriptions would help to protect species and substrate from damage and help maintain microclimatic conditions of each site. The *U. longissima* site adjacent to Unit # 212 is associated with a mapped special habitat which would be avoided during yarding activities; the site is outside any alternative thinning prescriptions and would not require a protection buffer. The *N. occultum* found in litterfall near Unit # 3556 does not appear to require buffering in any alternative to mitigate for potential adverse effects

Post-thinning fuels would be mitigated by yarding tops and machine piling at landings on about 1,996 acres. About 141 acres would be machine piled and burned within 40 feet of open roads and landings in or adjacent to thinning areas. This represents a 35 % to 43 % increase in the amount of acres included in higher intensity pile burning and additional machinery disturbance than alternative 3 and 4.

Alternative 3 (Proposed Action) -This alternative proposes 576 additional thinning acres and 580 additional acres of skyline yarding that would likely have direct short-term impacts on fungi if they occur in these stands.

Post-thinning fuels would be mitigated by yarding tops and machine piling at landings on about 3,660 acres, potentially creating 45% additional acreage subject to potential mycelium disturbance from fine fuels mitigation. About 81 acres would be machine piled and burned within 40 feet of open roads and landings in or adjacent to thinning areas. This alternative also includes 281 acres of prescribed underburning. Broadcast burning in occupied sites may cause mortality to lichen individuals from radiant heat and smoke. Buffers for the sensitive lichens would be as described in Alternative 2, thus no impacts are anticipated.

Alternative 4 - Log removal would be accomplished by yarding 2,926 acres (70 %) with skyline and 1,253 acres with helicopters. Given this, Alternative 4 would have more total thinning acres directly affected by ground compaction from the additional skyline yarding, which would increase the amount of compaction on mycelial networks. This alternative has the highest amount of acreage subject to short-term impacts through thinning, 10% more than Alternative 2, and 24% more than Alternative 3.

Post-thinning fuels would be mitigated by yarding tops and machine piling at landings on about 4,101 acres, which represents the highest amount of potential mycelium disturbance through fine fuels mitigation. About 92 acres would be machine piled and burned within 40 feet of open roads and landings in or adjacent to thinning areas. This Alternative also includes about 362 acres of prescribed under-burning, and about 1, 196 acres of supplemental hand piling and burning to mitigate for fuel loading, increasing localized litter loss under higher intensity burn piles. Broadcast burning in occupied sites may cause mortality to lichen individuals from radiant heat and smoke. Buffers for the sensitive lichens would be as described in Alternative 2, thus no impacts are anticipated.

Cumulative Effects – Botanical TE&S and Survey and Manage Species

The area analyzed for cumulative effects to botanical T,E&S and Survey and Manage resources is the Fall Creek watershed, which contains additional sensitive and survey and manage species and sites similar to those suspected to be in the Hehe project. This increases the likelihood of such species existing in project area stream drainages. For known sites in the project area, information about species elsewhere in the watershed helps further define the local relative degree of rarity of species. The Fall Creek Watershed Analysis (USDA, 1995) and Fall Creek LSR Assessment (USDA 1996) contain background information regarding known species sites, though new sites have been identified through other projects that have since been surveyed for botanical species including those associated with the Hehe project, the Clark fire, Survey and Manage Regional Random Grid surveys, and various stream, trail and campground projects. Some of these survey efforts have resulted in identification of new sites in the watershed for vascular and non-vascular species.

The project area is designated as Late-Successional Reserve (LSR) under the Northwest Forest Plan and approximately 38 percent of native stands are in old-growth forest conditions. These

stands serve as refugia for many survey and manage and sensitive species that would be able to re-colonize the younger stands as they mature and become more complex in structure and diversity. The watershed has abundant lichen and bryophyte populations, especially evident in the lower elevation mixed hardwood/conifer stands. Nearly half of the project area has been previously harvested. Those previous native old growth forests likely contained multiple populations of survey and manage and sensitive botanical species prior to the creation of younger managed stands through multiple human caused fires, wildfires and intense harvest activity. Fungal diversity declines with clear-cutting and fire (Byrd, et al 2000, Bruns, et al 2002) and stands were typically burned after harvest. It is probable that there has been some recovery of mycorrhizal diversity in stands over 20 years of age following clearcut activity which has the most severe effects on mycorrhizal diversity within the project area by harvesting the host species they depend upon. In the long-term (20-100 years), habitat for survey and manage and sensitive botanical species would be enhanced in the action alternatives.

Wildlife

Big Game Habitat

Non-Significant Issue - All or portions of 4 big game emphasis areas occur within the project planning area. NW Forest Plan Standards and Guidelines for large LSR conflict with Willamette S&Gs for big game management LSR objective is to protect and enhance conditions of late-successional and old-growth forest ecosystems. Management of these elk emphasis areas are based on a set of habitat effectiveness indices as identified in the Willamette Forest Plan, which encourages clearcutting and broadcast burning approach to providing optimal habitat conditions for big game.

Existing Conditions – Big Game Habitat

The Fall Creek LSR Thinning project area has portions of four Big Game Emphasis Areas (BGEAs) namely Alder (Mod), Sunshine-Pernot (Mod), Platt (Low) and Logan (Low). All are either low or moderate emphasis areas under the Forest Plan. The majority of big game usage occurs in the lower portions of the project area, in the lower Hehe Creek area and along the divide between Little Cowhorn Mtn. and Symbol Rock.

Management activities proposed by the Hehe LSR Thin Project have been evaluated for effects to habitat in these four BGEAs according to Forest Plan Standards and Guidelines (S&G) (FW-137). Recent analysis of the Habitat Effectiveness Index (HEI) (Wisdom et al. 1986) on Alder, Sunshine/Pernot, and Logan BGEA's all indicate that current individual values for forage quality (HEf) and open road density (HEr) are below Forest Plan S&Gs (Table 32, and Table 33). Individual effectiveness values for habitat patch size and spacing (HEs) and cover quality (HEc) are currently above Forest Plan S&Gs. Because of the low HEf and HEr values in the Alder and

Sunshine/Pernot BGEAs the overall HEI value also falls below current S&Gs for a moderate level BGEA. Recent analysis for Platt BGEA shows that current habitat quality for all individual indices, and overall HEI, exceeds S&Gs for a low level BGEA.

The Forest acknowledges that the HEI model cited in the Forest Plan standards and guidelines is not the most recent science concerning big game habitat. Holthausen et al. (1994) concluded that expert opinion may exceed accuracy of model output when cover:forage ratios exceed 80:20. Current cover forage ratio for the moderate BGEAs, such as Alder (69/16) and Sunshine/Pernot (71/15) clearly show that the most limiting factor is forage at this point time. Model output is insensitive to small differences between alternatives in how they affect the overall amount of forage habitat in the BGEA. The model is also considered insensitive to the potential quantity and quality of native forage habitat restored under all Action Alternatives relative to the proposed silvicultural prescription and subsequent sale area improvement plans.

District Watershed Analysis (USDA 1995) and other documents (ODFW 2003, Cook 2002) have included discussion that identified a projected downward trend in local HEI due to the loss of forage habitat as it develops into cover habitat based on effects from shifts in management practices under the Northwest Forest Plan.

Current ODFW biological data are not sufficient to provide an accurate estimate of the black-tailed deer population in western Oregon (ODFW 2002). Despite a perceived overall decline, ODFW has identified areas such as those in the vicinity of the project area as being more productive and achieving higher population densities than elsewhere in northwestern Oregon.

Because of a declining forage base, ODFW (2005) has proposed a 4% reduction in the target population management objective for elk in the McKenzie Wildlife Management Unit (WMU) surrounding the Hehe LSR Thin Project area. Nevertheless, recent ODFW population estimates indicate elk are at 96% of their current management objectives for the McKenzie WMU (Bill Castillo pers com; ODFW 2003; ODFW 2005).

No specific data are available for the local deer/elk population within any of the project area BGEAs. Sightings of individuals, and particularly their sign, are common throughout the area.

Direct and Indirect Effects – Big Game Habitat

Summary of Effects

Habitat modification associated with the Hehe LSR Thin Project as described previously can be summarized as having the following direct and indirect effects on deer/elk:

- Approximately 4.5 -39.00 miles of currently open roads would be closed throughout the planning area, predominantly in the Sunshine –Pernot and Alder BGEAs.
- Proposed action activities of thinning in dense, managed units, while maintain legacy structure (J. Hagar Pers. Comm.. 2007) would elevate all aspects of habitat quality for numerous early seral species, especially black-tailed deer and elk in within all BGEAs. It would have the greatest effect in the Sunshine/Pernot BGEA because this is the largest

BGEA, would have most of the thinned units and has the highest number of miles of road closures.

- Alternative 4 has a slight qualitative advantage over Alternative 3 by creating and enhancing an additional 81 acres (281ac. proposed for under burning in Alt 3 –vs-362 ac.in Alt 4) of forage habitat created by prescribed under burning. Otherwise overall effects are considered similar between all Action Alternatives.

Given what is currently known about local deer and elk populations, the future viability of these species in this area should be assured as long as habitat management opportunities continue to be implemented, and adequate protection measures such as Standards and Guidelines governing activities proposed by the Hehe LSR Thin Project continue to be implemented.

Effects of Alternatives

Table 30 -Table 33 displays projected effects of the Hehe LSR Thin Project alternatives against the current habitat effectiveness baseline (No Action - Alternative 1) resulting from model output (Wisdom et al. 1986) for each affected BGEA. The tables also displays HEI conditions over the past decade, and reveals the downward trend in forage habitat and subsequent decline in overall big game habitat quality in these areas. This trend has been validated elsewhere in the Middle Fork Ranger District in other recent project analyses, and across the Forest. Values from 2003 are based on model output presented in the preliminary Hehe Density Management Project wildlife current conditions (Lunstrum 2003).

Table 30 - HEI for Alder BGEA

HEI Modeling Outputs	Alder – Moderate BGEA				
	Individual Indices				Overall Index
	HEs	HEr	HEc	HEf	HEI
Alternative 1 (No Action)	0.76	0.40	0.69	0.18	0.43
Alternative 2	0.78	0.45	0.69	0.16	0.44
Alternative 3 (Proposed Action)	0.78	0.48	0.66	0.19	0.48
Alternative 4	0.78	0.51	0.69	0.16	0.46

Table 31 - HEI for Platt BGEA

HEI Modeling Outputs	Platt Low BGEA				
	Individual Indices				Overall Index
	HEs	HEr	HEc	HEf	HEI
Alternative 1 (No Action)	0.87	0.25	0.72	0.21	0.42
Alternative 2	0.87	0.28	0.73	0.20	0.43
Alternative 3 (Proposed Action)	0.88	0.32	0.73	0.20	0.45
Alternative 4	0.88	0.32	0.73	0.20	0.45

Table 32 - HEI for Sunshine-Pernot BGEA

HEI Modeling Outputs	Sunshine-Pernot- Moderate BGEA				
	Individual Indices				Overall Index
	HEs	HEr	HEc	HEf	HEI
Alternative 1 (No Action)	0.87	0.27	0.64	0.20	0.41
Alternative 2	0.92	0.48	0.69	0.15	0.46
Alternative 3 (Proposed Action)	0.92	0.55	0.71	0.15	0.48
Alternative 4	0.92	0.55	0.71	0.15	0.48

Table 33 - HEI for Logan BGEA

HEI Modeling Outputs	Logan – Low BGEA				
	Individual Indices				Overall Index
	HEs	HEr	HEc	HEf	HEI
Alternative 1 (No Action)	0.84	0.39	0.66	0.19	0.45
Alternative 2	0.84	0.44	0.66	0.19	0.47
Alternative 3 (Proposed Action)	0.84	0.48	0.66	0.19	0.48
Alternative 4	0.84	0.48	0.66	0.19	0.48

The overall effects of commercial thinning and associated activities proposed by Hehe LSR Thin Project such as road closure and seeding of closed roads would result in overall positive changes to habitat effectiveness values. However current modeling methods may not be sensitive enough to accurately reflect changes to big game habitat in the area resulting from proposed activities.

The Wisdom model was developed to evaluate landscape areas where quality forage areas were provided primarily by clearcutting and associated post-harvest burning and fertilization. With the decline in regeneration timber harvest under the Northwest Forest Plan, there has been a corresponding decline in high-quality elk forage habitat. This trend, coupled with recent studies, has increased the importance of providing forage habitat for elk on the Forest. A drawback of the Wisdom model is that forage is evaluated based on the average value of defined forage areas and

does not consider the amount of forage provided. Areas that do not provide meaningful forage are not considered in the forage effectiveness calculations. Consequently, providing substantial acres of temporarily improved elk and deer forage conditions by commercial thinning may result in a lower forage score in the Wisdom model if these acres lower the average value for forage areas in the landscape. Published research support the idea that increasing the amount of available forage by commercial thinning should improve the overall habitat conditions for elk and deer within the analysis area regardless of the average forage value derived from the Wisdom model.

In similar habitat, thinning has been shown to immediately stimulate the development of understory vegetation – much of which contributes to foraging habitat for deer and elk (Hagar et al. 2004, Suzuki and Hayes 2003). Understory vegetation data associated with a study of thinning effects on habitat similar to Hehe LSR Thin Project showed an average 46% increase in grass, forbs, and shrub coverage between thinned and unthinned stands (Artman 2003). Increases such as this can be expected to occur within thinned stands throughout much of the planning area.

As evidenced by the positive growth response of native forage species to reduction in forest overstory cover associated with previous commercial thinning activity in portions of the project area, an increase in forage quantity would occur in areas associated with thinning proposed by Hehe LSR Thin Project. Declines in forage quality (digestibility) are known to occur in conjunction with increases in forage quantity responding to growth stimulated by overstory removal (Cook 2002). However this relationship appears to be variable between study sites and across regions. Dynamic shade patterns resulting from buffered Riparian Reserves and variable density thinning should mitigate potential negative responses discussed by Cook (2002) in forage quality against positive responses in forage quantity. Evidence suggests the diversity of tree, shrub, grass, and forbs species throughout the project area would increase from restoration activities thereby adding to overall quality of habitat for big game.

The effectiveness of increasing big game forage habitat under all action alternatives would be further enhanced by implementing proposed road closures. Open road density would be reduced under all of the Action Alternatives by implementing the road closures. Road closures proposed by Action Alternatives are about 4.5 miles under Alternative 2 and about 39 miles in both Alternatives 3 and 4. All or portions of roads scheduled for closure would be treated for soil compaction, seeded, and fertilized.

Any increase in the amount and extent of forage habitat would benefit deer and elk within any of the above listed BGEAs affected by proposed thinning treatments. The potential to increase forage habitat is considered slightly higher under Alternative 4, than Alternative 3 due to a slight increase in the numbers of acres treated. High quality forage habitat would exist in these areas until seedlings grow to height that would out compete other forage vegetation.

The effects of the proposed activities are considered in the context of disturbance and habitat modification. Individuals that are within close proximity to proposed activities are likely to leave the area while the disturbance is underway. Disturbance may include falling, yarding, hauling, fuels treatment, and other prescribed activities. However those activities are expected to occur at a spatial and temporal extent such that they should not result in negative direct or indirect effects to individuals or the local population.

Cumulative Effects – Big Game Habitat

The cumulative effects analysis areas for big game are the BGEAs. In a general context, cumulative effects of the Hehe LSR Thin Project on deer/elk would be positive in the short-term (<7-10 years) yet inconsequential in the long-term and relative to overall cumulative effects from past actions. No other foreseeable future actions are currently planned that would additionally modify habitat in these BGEAs.

Terrestrial Fauna Threatened, Endangered and Sensitive (TE&S) Species

Non Significant Issue - Known sites for certain TE&S species do occur within the project area and potential habitat exists for other species that are suspected to occur. Harvest associated activities could affect TE&S species and their habitats within, adjacent to and downstream of the project area.

Summary of Effects - Terrestrial Fauna Threatened, Endangered and Sensitive (TE&S) Species

Table 34 – Summary of Biological Evaluation Process with Effects Determinations

	STEP 1	STEP 2	STEP 3	STEP 4	STEP 6
	<i>Prefield Review</i>	<i>Field Recon.</i>	<i>Risk Assessment</i>	<i>Analysis of Significance</i>	<i>USFWS Review</i>
SPECIES	Habitat Present (B,R,F,D) *	Occupancy Status	Conflicts? Action Alts	Effects / Impacts Action Alts	Consul-tation? BA ¹ /BO ²
Northern Spotted Owl <i>Strix occidentalis caurina</i>	B,R,F,D	Occupied	Potential Conflict	NLAA	1-7-06-F-0179 09/22/06
Northern Bald Eagle <i>Haliaeetus leucocephalus</i>	B,R,F	Unoccupied	No Conflict	NE	NA
Least Bittern <i>Ixobrychus exilis</i>	No				
Bufflehead <i>Bucephala albeola</i>	No				
Harlequin Duck <i>Histrionicus histrionicus</i>	B,R,F,D	Unknown	No Conflict	NI	NA
American Peregrine Falcon <i>Falcon peregrinus anatum</i>	F,D	Unknown	No Conflict	NI	NA
Yellow Rail <i>Coturnicops noveboracensis</i>	No				

	STEP 1	STEP 2	STEP 3	STEP 4	STEP 6
	<i>Prefield Review</i>	<i>Field Recon.</i>	<i>Risk Assessment</i>	<i>Analysis of Significance</i>	<i>USFWS Review</i>
SPECIES	Habitat Present (B,R,F,D) *	Occupancy Status	Conflicts? Action Alts	Effects / Impacts Action Alts	Consul-tation? BA ¹ /BO ²
ack Swift <i>Cypseloides niger</i>	No				
Baird's Shrew <i>Sorex bairdii permiliensis</i>	B,R,F,D	Unknown	Potential Conflict	NLCT	NA
Pacific Shrew <i>Sorex pacificus cascadenis</i>	B,R,F,D	Unknown	Potential Conflict	NLCT	NA
Wolverine <i>Gulo gulo</i>	No				
Fisher <i>Martes pennanti</i>	B,R,F,D	Unknown	No Conflict	NI	NA
Pacific Fringe-tailed Bat <i>M. thyanodes vespertinus</i>	R,F	Unknown	Potential Conflict	NLCT	NA
OR Slender Salamander <i>Batrachoseps wrighti</i>	B,R,F,D	Unknown	Potential Conflict	NLCT	NA
Cascade Torrent Salamander <i>Rhyacotriton cascadae</i>	B,R,F,D	Unknown	No Conflict	NI	NA
Foothill Yellow-legged Frog <i>Rana boylei</i>	No				
Oregon Spotted Frog <i>Rana pretiosa</i>	No				
Northwestern Pond Turtle <i>C. marmorata marmorata</i>	No				
Mardon Skipper <i>Polites mardon</i>	No				
Crater Lake Tightcoil <i>Pristiloma arcticum crateris</i>	B,R,F,D	Unknown	No Conflict avoid riparian	NI	NA

* B = breeding (nesting/denning) habitat R = roosting/cover habitat F = foraging habitat

D = dispersal habitat

¹ Date of Biological Assessment (BA) Consultation initiated with USFWS

² Date Biological Opinion (BO) or Concurrence issued from USFWS

NA = not applicable

NE = No Effect

BE = Beneficial Effect

NLAA^a = May Affect, Not Likely to Adversely Affect

LAA^b = May Affect, Likely to Adversely Affect

NI = No Impact.

NLCT = May impact individuals or their habitat, but the action will Not Likely Contribute to a Trend towards Federal Listing or loss of viability to the population or species.

MCT^c = May impact individuals or their habitat, with a consequence that the action May Contribute to a Trend towards Federal Listing or a loss of viability to the population or species.

BI = Beneficial Impact

- a. A NLAA determination requires informal consultation with the U.S. Fish and Wildlife Service.

- b. For listed species, a LAA determination requires formal consultation with the U.S. Fish and Wildlife Service. For proposed species, a LAA determination requires conferencing with the U.S. Fish and Wildlife Service (WO Amendment 2600-91-3, Forest Service Manual 2671.45, March 31, 1991).
- c. A MCT determination may require that an Environmental Impact Statement be written.

Alternative 1 (No Action) – This Alternative would have no effect on federally listed threatened, endangered, or proposed species, and is also expected to have no impact on sensitive species identified by the Regional Forester.

The No Action proposal would have no effect/impact on TES terrestrial wildlife species based on the following assumption – that habitat within and adjacent to the project area would continue to provide existing habitat for wildlife species that may be present as it evolves without human management. The evolution of habitat and associated dynamic nature of habitat suitability that may be subject to an unknown frequency and variety of stochastic events is considered beyond the scope of this evaluation. References used to support discussion, determinations, and recommendations are provided in Biological Evaluation (Quintana, 2007) located in the Project File.

Northern Spotted Owl – Refer to section on Spotted Owls.

Northern Bald Eagle

Although the Fall Creek river corridor offers potential food sources such as fish and waterfowl, concentrated northern bald eagle activity during the nesting season has not been observed within the action area. Occasional sightings of one or two bald eagles roosting or foraging within this corridor have been reported by District employees and the general public. Most eagle observations are associated with areas along the Middle Fork of the Willamette River west of the project area and around Dexter and Lookout reservoirs (west of the project area). The nearest known bald eagle nest site is located approximately 8 miles from the southwest edge of the planning area. No nesting activity is known to occur within the project area boundary.

Direct, Indirect and Cumulative Effects – Northern Bald Eagles

No management activities are proposed that would affect nesting, roosting, or perch habitat in the action area. No direct effects to bald eagles are anticipated as a result of activities proposed under any action alternative associated with the Hehe Project.

Nesting, roosting, or perch habitat would improve as a result of this project's activities as maturing second growth stands respond to commercial thinning and silvicultural objectives such as increasing growth, vigor, and structural diversity are realized. Indirect effects are considered equal between all action alternatives

The analysis area considered during review of cumulative effects to bald eagles was defined as the area within the project area boundary plus an area within 0.5 mile on either side of Road

#1800. There are no future State or private activities that are reasonably certain to occur within the analysis area that would result in cumulative effects to bald eagle habitat.

Because the Hehe LSR Thin Project does not propose potential disturbance activities within a known nest area or key wintering area for bald eagles, or propose activities under any action alternative that would affect the integrity of potential nesting, roosting, or perch habitat, it is determined this project would have no effect on bald eagles.

Harlequin Ducks

Harlequin duck sightings have been reported during the breeding season on all the Districts of the Willamette National Forest, including the previously mentioned reports around Puma Campground on the southwest portion of the planning area. Other records of sightings include pairs, singles, and females with young in adjacent or nearby watersheds such as Salmon Creek, Salt Creek, Hills Creek, Lower Middle Fork, Winberry Creek, and Fall Creek on the Middle Fork District.

No formal harlequin duck surveys have been conducted on the Middle Fork Ranger District, and no harlequin observations have been reported by project personnel anywhere along the Fall Creek River corridor during field reconnaissance in support of the Hehe Project. In previous documents such as the Clark Fire analysis, the biological analysis made reference to several sighting of harlequin ducks in the Fall Creek drainage.

Direct, Indirect and Cumulative Effects – Harlequin Ducks

No management activities are proposed that would modify or otherwise disturb breeding, loafing, foraging, or dispersal, habitat located in a limited portion of the project area for harlequin ducks. No direct effects to this species are anticipated as a result of activities proposed under either action alternative associated with the Hehe Project.

The quality of suitable foraging habitat in Fall Creek drainage for harlequin ducks may improve as a result of this project's influence on upslope riparian habitat responding to silvicultural objectives such as increasing growth, structure, and overall diversity.

The Hehe Project may generate funds to support in-stream placement of large woody debris in the upper portions of Hehe Creek, Alder Creek and Tiller Creeks to improve fish habitat. These activities would not occur in or near suitable harlequin duck nesting habitat where it has the potential to disturb the species. If any change in location for instream placement should occur the seasonal restriction to avoid disturbance would be implemented with a restriction period from March 15 through July 15.

Potential effects to habitat for harlequin ducks from activities proposed under any action alternative are considered limited to a portion of the project area which is adjacent to the Fall Creek River. Numerous sighting have occurred on Fall Creek between the Puma and west to the

Forest boundary (southwest corner of the planning area). All of this area is located in riparian reserve and some thinning is planned along this area, but well outside the zone of influence for this species. Suitable breeding habitat for harlequin ducks exists within riparian reserve habitat along portions of the Fall Creek River in the project area, as previously described. However, no known nests are located in the project area. Along with aquatic habitat, this area provides nesting, loafing, foraging, and dispersal opportunities for harlequins.

There are no activities that are reasonably certain to occur within the project area that would result in cumulative effects to habitat for harlequin ducks.

Cumulative effects from the Hehe LSR Thin Project would be positive on the limited amount of habitat in the project area as overall biodiversity increases in and near areas responding to the silvicultural treatments proposed. These treatments would encourage a long-term increasing trend in the quality of riparian and/or aquatic habitat that may support harlequin ducks in the Fall Creek drainage.

Because suitable habitat for harlequin ducks exists in only a very small portion of the project area and would not be modified or disturbed by activities associated with proposed thinning under any action alternative, it is determined this project would have no impact on harlequin ducks or their habitat.

American peregrine Falcon

Suitable peregrine nesting habitat is extremely limited in the Hehe planning area. Gibraltar Rock and Symbol Rock occur within the area; however, after conferring with District Wildlife Biologist Dick Davis, (Pers. Comm. 2006) these areas have low probability of providing sufficient nesting for Peregrine Falcons. The southwest corner of the project area is however adjacent to the outer edge of tertiary management zone for one known nearby peregrine nest site.

Effects from proposed activities are normally considered in relation to a management area delineated around each of these nest sites. This area encompasses approximately 18,500 acres within roughly a 3-mile radius around each site. Each management area consists of three concentric zones (primary, secondary, tertiary) extending outward from a nest site. Effects from the Hehe LSR Thin Project proposal are considered relative to the nearby nest site, but address how habitat within the project area may be used by peregrines.

Although the Hehe LSR Thin Project area is not within the management area considered for nest site, peregrines regularly forage beyond three miles from a nest site, so it is likely that on occasion areas within the project area are used as foraging habitat by this species. It is also possible that young dispersing from the nearby nest site may utilize habitat within the planning area.

Proposed thinning activities under all action alternatives would not affect peregrines at a nest ledge. In some situations activity such as the operation of medium or heavy rotary wing aircraft

(helicopters) conducted in a tertiary zone could result in indirect disturbance to peregrines by influencing prey behavior and foraging success (USDA 2002). This disturbance is considered detrimental to peregrines if it occurs during the breeding season, which is identified as between January 15 and July 31 for the nearby nest site (Pagel 1992, USDA 2002). However, the likelihood of this occurring is relatively low due to geographic proximity of the OE-48 site and topographic breaks between potential helicopter flightpaths and the project area (Davis, Pers. Comm. 2007).

Direct, Indirect and Cumulative Effects – American peregrine Falcon

No management activities are proposed that would affect nesting habitat, nor influence foraging success or dispersal behavior in the planning area. No direct effects to peregrine falcons are anticipated as a result of activities proposed under any action alternative associated with the Hehe LSR Thin Project.

Foraging habitat would improve as habitat responds to silvicultural treatments by increasing growth, structure, and overall diversity, which would benefit a variety of birds known to be preyed upon by peregrines.

There are no activities that are reasonably certain to occur within the project area that would result in cumulative effects to peregrine habitat.

The changing trend in timber and habitat management that has occurred within the past decade, and is projected for the future, would positively influence utilization of foraging habitat for peregrines. More emphasis is placed on recruitment of key structural components missing from previously harvested stands and retention of key structural components present in unharvested stands. Also treatment in riparian systems to promote structure, and the restoration and maintenance of special habitats are key components of improving biodiversity at a landscape level.

Cumulative effects from the Hehe Project would be positive as overall biodiversity increases in response to silvicultural treatments. These treatments would encourage a long-term increasing trend in the quality of foraging and dispersal habitat for peregrine falcons that may utilize this area in association with the nearby nest site or potential nest site at Gibraltar Rock.

Because the Hehe LSR Thin Project does not propose potential disturbance activities within a management area established for a known nest site, or activities that would otherwise affect the integrity of potential nesting habitat, it is determined this project would have no impact on peregrine falcons

Baird's and Pacific Shrew

Both these *Sorex* species have documented occurrences on the Willamette National Forest in habitat similar to that associated with natural and older managed stands found throughout the

Hehe Project planning area. At least 38 specimens of *S. bairdi* are known to have been collected from sites in Lane County, most from locations on or near the Willamette National Forest (Verts and Carraway 1998). At least 65 specimens of *S. pacificus* are known to have been collected from sites in Lane County, most from locations on or near the Willamette National Forest including one location on the Middle Fork Ranger District (Verts and Carraway 1998). Based on life histories, documented occurrences and habitat associations, and locations of proposed thinning units, effects to these species from proposed activities are considered limited to within the project planning area.

Studies have shown that leaving small no-harvest streamside buffers (9-67m) is beneficial in maintaining riparian communities of small mammals at levels comparable to nearby undisturbed areas (Cross 1985, Anthony et al. 2003). The variable density thinning prescription proposed under all action alternatives includes a no-harvest buffer in riparian habitat averaging 15-30m on either side of all streams, seeps, and springs. In addition, the prescription incorporates a strategy designed to promote down wood plus herbaceous and shrub cover, as well as provide patches of closed-canopy conditions. Such a prescription positively addresses finer-scale habitat features important to these shrew species, and has been considered to have the highest probability of maintaining the diversity of indigenous ground-dwelling vertebrates within a stand (Garman 2000).

Proposed thinning activities would be limited to about 18 % of the planning area, and would be spread out over an estimated 2-7 year timeframe. Fire associated with fuels reduction (pile burning) and prescribed underburning would not occur within buffers established in Riparian Reserves, and combined would affect only about 1% of the planning area.

Specific field surveys for *S. bairdi* and *S. pacificus* have not been conducted within the Hehe LSR Thin Project project area. Garman (2000) analyzed survey data that documented the presence of these *Sorex* species during an intensive young stand study (YSS) on the Willamette National Forest that included conifer dominated managed stands adjacent to the northern portion of the Hehe LSR Project planning area.

It is assumed that *S. bairdi* and *S. pacificus* each have the potential to occur in natural and older managed stands throughout the planning area.

Given current knowledge on the locations, ecological associations, and needs of these species it appears that maintaining or promoting biological diversity as proposed under the silvicultural prescription would assure the short-term and long-term availability of habitat suitable for use by *S. bairdi* and *S. pacificus* throughout the Hehe LSR Thin

Direct, Indirect and Cumulative Effects - Baird's and Pacific Shrew

S. bairdi and *S. pacificus* can be affected under the action alternatives, by habitat modification activities such as falling and yarding – particularly when they occurs adjacent to or within portions of Riparian Reserves. Prescribed underburning and the associated potential disturbance can result in loss or displacement of individuals that may be occupying affected habitat during these activities.

Direct effects on these species are judged by the relative amount of habitat modified or disturbed against the amount available throughout the project area. All natural stands, 52% of the project area would be unaffected by proposed thinning. Thinning activities are proposed in about 48 % of the previously harvested stands and would affect about 18% of the planning area. Prescribed underburning would occur in three of 39 harvest units and affect about 3% of all acres thinned. A variable density component to the silvicultural prescription, along with a riparian no-harvest buffer and a variety of seasonal restrictions would apply to any action alternative. The anticipated scheduling of harvest activities over a period of about 2-8 years would further stagger modification or disturbance of habitat spatially and temporally across the planning area.

These measures would provide a level of spatial and temporal refugia for individuals that may be exposed to direct effects from proposed activities. Nevertheless this project would result in disturbance or modification of some habitat features known to be associated with use by *S. bairdi* and *S. pacificus*. Direct effects associated with thinning activities may result in a short-term adverse effect to an undeterminable number of individuals.

Indirect effects associated with habitat modification activities are considered beneficial to *S. bairdi* and *S. pacificus* for the following reasons. Implementing the silvicultural prescription as proposed would result in accelerating the transition from managed stands in a structurally simplified mid-seral condition, to habitat having late-successional characteristics as released trees respond by increasing size and structural diversity, understory vegetation growth is stimulated, and as additional levels of larger down wood continue to accumulate. The developmental effects in riparian/upland ecotone habitat would be particularly beneficial to *S. bairdi* and *S. pacificus*.

There are no recognized indirect effects to these *Sorex* species related to disturbance associated with this thinning project as currently proposed.

There are no activities that are reasonably certain to occur within the project area that would result in cumulative effects to *S. bairdi* or *S. pacificus* from modification or consequential disturbance of habitat.

Management of the project area under the Forest Plan as amended, and the Willamette Late-Successional Reserve Assessment (USDA, 1998) would provide a long-term increasing trend in amount and distribution of habitat capable of providing for the ecological requirements of these *Sorex* species. Cumulative effects from the Hehe LSR Thin Project in conjunction with past

actions would be positive as overall biodiversity increases in response to the silvicultural treatments proposed. Any effect to these two species is considered the same under any of the action alternatives.

Habitat in natural stands throughout the project area with highest potential to be occupied by *S. bairdi* or *S. pacificus* would not be modified or disturbed by Hehe LSR Thin Project activities. However the potential for activities to modify or disturb individuals that may be utilizing less than desirable habitat exists in about 25% of the planning area. Therefore it is determined that activities as proposed under any action alternative would result in a situation that may impact individuals or their habitat, but the action will not likely contribute to a trend towards Federal listing or loss of viability to the population or species (Baird's Shrew (*Sorex bairdi permiliensis*) and Pacific Shrew (*Sorex pacificus cascadenis*)). This potential impact to these two species is considered the same under any of the action alternatives.

Fisher

It has been proposed, and generally accepted that any fishers that may occur in this area are members of one of two genetically isolated populations remaining in Oregon; and also that any individuals in the southern Cascade Range population are descendants from a reintroduction effort that occurred between 1977 and 1981 (Aubry and Lewis 2003). Based on historic and current information, this analysis assumes the potential for fisher to utilize habitat associated with this project for one or more of its biological requirements.

Specific field surveys for fisher have not been conducted within the planning area. Nor has any evidence of the presence of this species been detected as a result of any field reconnaissance or surveys associated with this project throughout the planning process to date. Literature suggests fisher are more likely to associate with late seral and old-growth habitat, but may also be expected to occur within younger stands if they contain structural components more commonly associated with older stands. Mature stands and/or stands with 70% canopy closure are located throughout at least two-thirds of the planning area, and possess sufficient structural diversity such that they are assumed to serve as suitable fisher resting and denning habitat (Yaeger 2005). Potential forage and dispersal habitat is more extensive, and includes much of the remaining forested habitat across the planning area.

Wherever they occur, fishers are considered a riparian associate species (Anthony et al. 2003, Jones and Gorton 1994) and are likely to conduct more of their activities in corresponding habitat. Under a more natural condition for this area, habitat associated with riparian areas along the Fall (class 1), Hehe (class 1,2) and Alder Creek (Class 2), Tiller (class 2, 3) and Pernot Creek (class 2) drainages, and all other Class II and III streams would have functioned as having highest potential use by fisher. However, results of a recent study of habitat at fisher resting sites (Yaeger 2005) suggests that fisher may utilize upland locations across the project area as resting and foraging habitat also.

The current spatial and temporal extent of human presence throughout the project area has changed greatly since the reference era when Native Americans used the area for a variety of activities on a seasonal basis. Since that time trapping pressure by European settlers and the subsequent establishment of roads, trails, developed and dispersed campsites (particularly within riparian habitat), and residential areas have resulted in year-round human disturbance throughout most of this area. With the increasing trend in forest visitor days, particularly associated with the Fall Creek River corridor and adjacent areas trails in the area, this presence will likely continue to grow.

Habitat associated with the Hehe Project currently considered being most capable of serving as breeding/denning, resting, foraging and dispersal habitat for fisher falls outside areas proposed for thinning activities. This particularly applies to habitat capable of providing denning and resting sites.

Direct, Indirect and Cumulative Effects - Fisher

Fisher are more likely to associate denning or resting activity in late-successional or old-growth habitat found throughout about 51% of the project area than in previously harvested stands proposed for thinning activities. The silvicultural prescription provides measures for protecting key features of potential denning or resting habitat such as existing snags and large down logs. Hehe LSR Thin Project proposes no activity within old growth areas, which represent about 51% of the project area, that are considered to result in a situation that would directly affect the ability of fisher to utilize habitat throughout the project area for denning, resting, foraging, or dispersal.

Noise generating activities are considered to have some potential for disturbance to this species would it occur in close enough proximity. However because of the wide-ranging daily movements of fisher, the low density of any potential population, plus the spatially and temporally dispersed aspect associated with activities across the project area, disturbance potential is considered low. Any direct effects in this regard would not compromise the suitability of overall habitat throughout the project area for use by fisher to any estimable extent.

Indirect effects associated with habitat modification activities are considered beneficial to fisher for the following reasons. Implementing the silvicultural prescription as proposed would result in accelerating the transition from managed stands in a structurally simplified early to mid-seral condition, to habitat having late-successional characteristics as released trees respond by increasing size and structural diversity, and as additional levels of larger down wood continue to accumulate. The developmental effects in riparian habitat would be particularly beneficial to fisher.

There are no recognized indirect effects to fisher related to disturbance associated with this thinning project as currently proposed.

For this evaluation, effects from proposed activities on this wide-ranging species are considered in relation to the Hehe project area. Habitat conditions in this area during the reference era favored the likelihood of occupancy by fisher, as it is located well within the historic range for this species and would have been relatively free from human disturbance – especially during the breeding season. Then, as now, population densities would be expected to have been low given our current understanding of fisher ecology.

There are no activities that are reasonably certain to occur within the project area that would result in cumulative effects on fisher from modification of habitat.

Management of the project area under the Forest Plan as amended, and the Willamette LSR Assessment would provide a long-term increasing trend in amount and distribution of habitat capable of providing for the ecological requirements of fisher. Cumulative effects from the Hehe LSR Thin Project in conjunction with past actions would be positive as overall biodiversity increases in response to the silvicultural treatments proposed within the project area.

Fishers have a well documented sensitivity to disturbance connected with human activity. Effects of past, present, and expected human use and management activities combine to influence the potential for fishers to occupy habitat in or near the project area. Recreational activities associated with roads, trails, and campsites; along with habitat management associated with extensive timber harvest activity can be considered to have contributed to the potential extirpation of fishers from this area or to be compromising the ability of this species to thrive in formerly occupied habitat. The increasing trend in recreational use throughout this area may negatively influence occupancy of otherwise suitable habitat for the fisher.

There are no recognized cumulative effects to fisher associated with disturbance from Hehe LSR Thin Project activities.

It is recognized that because of the history of human use and management activities, the likelihood that habitat associated with this project area is currently occupied by fishers is low. There is no known threat to any local fisher population from activities proposed under the Hehe LSR Thin Project. This project does not propose any activity that would modify or otherwise disturb potential fisher denning or resting habitat. Considering the spatial and temporal extent of proposed activities across the project area, the wide-ranging nature of daily movements associated with fisher foraging and/or dispersal behavior, along with the low likelihood of occurrence, this project would not result in disturbance to the species. It is therefore determined this project would have no impact on fishers whether implemented under any of the action alternatives.

Pacific Fringe-tailed Bats

Despite an overall lack of survey data and poorly documented habitat requirements and life-history accounts for this species, this species presence has been documented on the Middle Fork Ranger District (Ormsbee pers com., Verts and Carraway 1998). A review of recent documented location data for this species includes a record from a location in the North Fork of the Middle Fork watershed within five miles of the Hehe Project planning area. The potential exists that at least single individuals may utilize available forage and roost habitat throughout the summer and early fall in or adjacent to areas where activities associated with proposed thinning would occur.

Formal bat surveys within the project area have been conducted along Fall Creek and the bridges associated with the FS road 18 (Ormsbee 2006). There are no caves, mines, or abandoned wooden bridges and buildings that would serve as suitable hibernacula nor are there known roost sites associated with other structures within 250 feet that would be affected by proposed activities. Recent data associated with a study of *Myotis thysanodes* day roosts (Weller and Zabel 2001) suggests some snags and decadent trees occurring within or adjacent to proposed treatment areas contain features suitable for roost use by this and other species of bats.

Although potential roosting habitat may occur in any proposed thinning unit, the potential is considered higher in units having remnant overstory trees and in units where snags were created after initial thinning a decade ago.

Direct, Indirect and Cumulative Effects - Pacific Fringe-tailed Bats

The direct effects to *Myotis thysanodes* is a habitat disturbance associated with activities such as falling and yarding, plus prescribed underburning and the subsequent potential disturbance resulting in loss or displacement of individuals that may be occupying affected habitat during these activities.

Direct effects to this species are judged by the amount of habitat modified or disturbed against that which is available in the Hehe Project planning area. All natural stands, 52% of the planning area, and 48% of previously managed stands within the project area would be unaffected by proposed thinning. Thinning activities are proposed in only previously harvested stands and would affect about 18% of the planning area. Prescribed underburning would occur in only two alternatives (3 & 4 respectively) and affect about 1 % of all acres thinned. A variable density component to the silvicultural prescription, measures to protect existing snags, along with a riparian no-harvest buffer and a variety of seasonal restrictions would apply to all action alternatives. The anticipated scheduling of harvest activities over a period of about 2-8 years would further stagger modification or disturbance of habitat spatially and temporally across the planning area.

These measures would provide a level of spatial and temporal refugia for individuals that may be exposed to direct effects from proposed activities. Nevertheless this project would result in

disturbance or modification of some habitat features known to be associated with use by *Myotis thysanodes*. Direct effects associated with thinning activities may therefore result in a short-term adverse effect to an undeterminable number of individuals. However current science also suggests that thinning activity as proposed may also result in short-term beneficial effects to bats (including this species) by attracting bats to areas of improved foraging habitat.

Indirect effects associated with habitat modification activities are considered beneficial to *Myotis thysanodes* for the following reasons. Implementing the silvicultural prescription as proposed would result in accelerating the transition from managed stands in a structurally simplified mid-seral condition, to habitat having late-successional characteristics as released trees respond by increasing size and structural diversity, and understory vegetation growth is stimulated.

One anticipated long-term result of the Hehe LSR Thin Project under all action alternatives would be that post thinning habitat would offer a greater amount of edge habitat, an overall reduced clutter yet with greater complexity in open habitat, and with abundant roost sites in both living and dead trees. These conditions would be expected to provide better overall foraging opportunities for most bat species including *Myotis thysanodes*.

There are no recognized indirect effects to this bat species related to disturbance associated with this thinning project as currently proposed.

For the evaluation of cumulative effects, effects to this species from proposed activities are considered limited to within the project area.

There are no activities that are reasonably certain to occur within the project area that would result in cumulative effects to *Myotis thysanodes* from modification or consequential disturbance of habitat.

Management of the project area under the Forest Plan as amended would provide a long-term increasing trend in amount and distribution of habitat capable of providing for the ecological requirements of this bat species. Cumulative effects from the Hehe LSR Thin Project in conjunction with past actions would be positive as overall biodiversity increases in response to the silvicultural treatments proposed within the project area. Any effect is considered equal under all action alternatives.

There is no known threat to known hibernacula or maternity roosts from activities proposed under the Hehe Project. Habitat in natural stands or open areas throughout the project area associated with highest potential to be utilized by *Myotis thysanodes* would not be modified or disturbed by Hehe LSR Thin Project activities. However the potential for activities to modify or disturb roosting or forage habitat, or disturb individuals that may be utilizing such habitat exists in about 18% of the project area. Therefore it is determined that activities as proposed under any action alternative could result in a situation that may impact individuals or their habitat, but the action will not likely contribute to a trend towards Federal listing or loss of viability to the population or

species for *Myotis thysanodes*. This potential impact is considered the same across all action alternatives.

Oregon Slender Salamander

Oregon slender salamanders have been documented at sites across the Willamette National Forest including the Middle Fork Ranger District, but no documented occurrences are within the Hehe LSR Thin project area. O'Neil et al. (2001) consider a general association between Oregon slender salamander and the Westside Lowland Conifer Hardwoods (WLCH) habitat type descriptive of the Hehe LSR Thin Project area.

Suitable habitat for this species occurs throughout portions of the project area, including areas proposed for thinning activities under all action alternatives. Large down logs in a variety of decay classes are a sporadically abundant habitat feature in both natural stands and portions of previously harvested stands. The presence of smaller woody debris and especially decaying stumps considered highly suitable for use by Oregon slender salamanders also provide patchy habitat for this species throughout areas proposed for thinning.

Specific field surveys for this species have not been conducted within the project area. However, they were conducted in area west of the project area, Clark Fire, and were found within the boundaries of the fire area. No Oregon slender salamanders have been detected as a result of other wildlife surveys or field reconnaissance surveys associated with this project throughout the project process to date. The only salamander species detected during cursory field surveys for this project has been *Ensatina (Ensatina eschscholtzii)* which is consistent with young stand study (YSS) survey results in similar habitat (Garman 2000).

Based on what is known about habitat preferences for Oregon slender salamander the most likely locations within the project area where this species may occur are in the approximately 52% of the project area is in old-growth habitat condition along with riparian stands where higher concentrations of large down wood and stumps still exist – especially when composed of Douglas-fir.

Direct, Indirect and Cumulative Effects - Oregon Slender Salamander

The direct effects to Oregon slender salamanders is the habitat disturbance associated with activities such as falling and yarding, plus prescribed underburning and the subsequent potential disturbance resulting in loss or displacement of individuals that may be occupying affected habitat during these activities.

Direct effects to this species are the amount of habitat modified or disturbed against that which is available throughout the Hehe LSR Thin project area. All natural stands, 75% of the project area, and 64% of previously managed stands within the project area would be unaffected by proposed thinning. Thinning activities are proposed in the previously harvested stands and would affect

about 18% of the project area. Prescribed underburning would occur in only Alternative 3 & 4 and affect about 1% of all acres thinned. A variable density component to the silvicultural prescription, measures to protect existing large down logs, along with a riparian no-harvest buffer and a variety of seasonal restrictions would apply to all action alternatives. The anticipated scheduling of harvest activities over a period of about 2-8 years would further stagger modification or disturbance of habitat spatially and temporally across the project area.

These measures would provide a level of spatial and seasonal refugia for individuals that may be exposed to direct effects from proposed activities. Nevertheless this project would result in unavoidable and incidental disturbance or modification of some habitat features known to be associated with use by Oregon slender salamander. Direct effects associated with thinning activities may therefore result in a short-term adverse effect to an undeterminable number of individuals. Protecting existing large down logs during all proposed activities, including underburning, as stated in the silvicultural prescription would ensure any negative direct effect to this species is minimized.

Indirect effects associated with habitat modification activities are considered beneficial to Oregon slender salamanders for the following reasons. Implementing the silvicultural prescription as proposed would result in accelerating the transition from managed stands in a structurally simplified mid-seral condition, to habitat having late-successional characteristics as released trees respond by increasing size and structural diversity, understory vegetation growth is stimulated, and as additional levels of larger down wood continue to accumulate. Indirect effects are recognized as the same across all action alternatives.

There are no recognized indirect effects to this salamander species related to disturbance associated with this thinning project as proposed.

For the cumulative effects evaluation, effects to this species from proposed activities are considered limited within the project area.

There are no activities that are reasonably certain to occur within the project area that would result in cumulative effects to Oregon slender salamanders from modification or consequential disturbance of habitat.

Management of the project area under the Willamette Forest Plan as amended by the ROD, and would provide a long-term increasing trend in amount and distribution of habitat capable of providing for the ecological requirements of this salamander species. Cumulative effects from the Hehe Project in conjunction with past actions would be positive as overall biodiversity increases in response to the silvicultural treatments proposed within the project area. Any effect is considered equal under any action alternative.

There is no known threat to local populations of Oregon slender salamander from activities proposed under the Hehe LSR Thin Project. Certain activities associated with this project such as

falling, yarding, and fuels treatment have the potential to modify or disturb potential breeding, cover, or forage habitat, or disturb individuals that may be utilizing such habitat. These activities would affect less than 25% of the project area where suitable habitat for this species is patchily distributed. Although the risk is considered short-term and the likelihood of occurrence may be low, it is determined that activities as proposed under any action alternative would result in a situation that may impact individuals or their habitat, but the action will not likely contribute to a trend towards Federal listing or loss of viability to the population or species for Oregon slender salamander. This potential impact is considered to be the same across all action alternatives.

Cascade Torrent Salamander

R. cascadae can reach high densities in appropriate habitat (Leonard et al. 1993) which may help to explain why a surprising number of individuals were documented at sites during habitat surveys conducted between August 1995 and August 1997 on the Middle Fork Ranger District. During that timeframe at least 66 individuals were documented at 13 locations. Two of these locations were within the NFMFW watershed, and one site is just across the NFMFW River adjacent to the project area boundary.

Potential effects to habitat for *R. cascadae* from activities proposed under any action alternative are considered limited to habitat within the project area boundary. Suitable habitat for this species exists within limited stretches of aquatic and immediately adjacent moist forested habitat within Riparian Reserves throughout this area. These limited areas are expected to provide nesting, cover, foraging, and possibly very limited dispersal opportunities for these aquatic salamanders.

No formal surveys for Cascade torrent salamanders have been conducted associated with the Hehe LSR Thin Project, and project personnel have reported no observations of this species during field reconnaissance in support of the Hehe LSR Thin Project.

Because of Riparian Reserve buffers, areas associated with commercial thinning activities proposed under all Action Alternatives do not contain suitable habitat for Cascade torrent salamanders and are considered beyond a distance that would create the potential for disturbance of the species would it occur in suitable habitat.

Direct, Indirect and Cumulative Effects - Cascade Torrent Salamander

The Hehe Project as proposed would not modify or otherwise disturb suitable habitat, or cause any level of negative effects that would influence the potential for persistence of the Cascade torrent salamander in the limited amount of suitable habitat occurring in portions of the project area.

Due to protection measures listed in the silvicultural prescription that apply to riparian habitat associated with any thinning activity, no management activities are proposed that would affect

suitable habitat allied with some sections of streams in the project area. No direct effects to Cascade torrent salamanders are anticipated as a result of activities proposed under all action alternatives associated with the Hehe Project.

Suitable habitat for Cascade torrent salamanders may likely improve as a result of this project's influence on riparian habitat responding to silvicultural objectives such as increasing growth, structure, and overall diversity. Indirect effects are considered the same across all action alternatives.

For the cumulative effects evaluation, effects on this species from proposed activities are considered limited within the project area.

There are no reasonably foreseeable activities that would result in contributing to cumulative effects to habitat for Cascade torrent salamanders within the Hehe LSR Thin Project area.

Because suitable habitat for Cascade torrent salamanders exists in portions of the project area and would not be modified by or result in any disturbance from activities associated with proposed thinning under all action alternatives, it is determined this project would have no impact on Cascade torrent salamanders or their habitat.

Survey and Manage (S&M) and Protection Buffer Species

Non-Significant Issue - Numerous Survey and Manage and Protection Buffer species are known or suspected to occur within the project area. These include mollusk species, the great gray owl, red tree voles and numerous lichens, bryophytes and fungi. Harvest associated activities could affect known sites or habitat of S&M and Protection Buffer species.

Existing Conditions – Survey and Manage and Protection Buffer Species

Species listed below in

Table 35 were compiled from the 2003 Annual Species Review (IM-OR-2004-034) and include those vertebrate and invertebrate species whose known or suspected range includes the Willamette National Forest according to the following documents: Survey Protocol for the Great Gray Owl within the range of the Northwest Forest Plan v3.0, January 12, 2004; Survey Protocol for the Red Tree Vole v2.1, October 2002; Survey Protocol for S&M Terrestrial Mollusk Species From the Northwest Forest Plan v3.0, 2003. The following list includes category A and C species; there are no known category B, D, E, or F species to consider in this area.

Table 35 - Survey and Manage Wildlife Species Known or Suspected on the Forest

Species Species	S&M Category	Survey Triggers			Survey Results			Site Management
		Within Range of the Species?	Project Contains Suitable habitat?	Project may negatively affect species habitat?	Surveys Required?	Survey Date (month/year)	Sites Known or Found?	
<i>Vertebrates</i>								
Great Gray Owl (<i>Strix nebulosa</i>)	A	Yes	Yes	No	No	NA ¹	NA	NA
Red Tree Vole (<i>Arborimus longicaudus</i>)	C	Yes ²	Yes	No	No Exempted (thinning in less than 80yr stand)	NA	NA	NA
<i>Mollusks</i>								
Crater Lake Tightcoil (<i>Pristiloma arcticum crateris</i>)	A	Yes	Yes	No	No	NA	NA	NA

¹ NA = Not Applicable

² Species removed from Survey and Manage list within Mesic Zone portion of its range under 2003 Annual Species Review. This project is located within the Mesic Zone, therefore whether or not suitable habitat is present surveys not required (Thinning in stands less than 80yrs old)

Pre-disturbance surveys and management of known sites required by protocol standards to comply with the 2001 Record of Decision and Standard and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measure Standards and Guidelines (as the 2001 ROD was amended or modified as of March 21, 2004) were either completed or not required for the Hehe LSR Thin Project. There are no known Category B, D, E, and F species within the project area.

Direct, Indirect and Cumulative Effects - Survey and Manage and Protection Buffer Species

Great gray owl

Under the 2001 amendment to the Northwest Forest Plan (USDA, USDI 1994) the status of the great gray owl changed from a protection buffer species to a Category C Survey and Manage species (USDA, USDI 2001). The species was changed to a Category A species following the 2002 Annual Species Review where it remains considered rare, and for which pre-disturbance surveys are practical if habitat is present.

Based on the evaluation criteria listed in the Survey Protocol for the Great Gray Owl version 3.0 (Quintana-Coyer et al. 2004) to determine the need to conduct a survey, surveys for this species are not required for this project. The following criteria were used to justify no surveys:

- The project does not propose any modification of suitable nesting habitat.
- All proposed activities occur in non-habitat for the species.
- Prescribed burning would occur outside of habitat areas for the Great Gray Owls.
- Negative effects from habitat modification or disturbance would be avoided entirely and the persistence of the species, if present in the project area would not be compromised.

Proposed thinning activities would not modify or disturb any habitat associated with sighting locations on private lands and in the Fall Creek area. Because measures would be taken to protect suitable nesting habitat for this species against modification or disturbance from effects associated with proposed activities, there are no recognized direct or indirect effects to this species or its habitat from the project.

Crater Lake tightcoil

The Crater Lake tightcoil has been listed as a Survey and Manage species since the 1994 Northwest Forest Plan ROD (USDA, USDI 1994). Under the 2001 ROD (USDA, USDI 2001) it was classified as a Category B species. The species was changed to a Category A species following the 2002 Annual Species Review where it remains considered rare, and for which pre-disturbance surveys are practical if habitat is present. This species is also included on the Regional Forester's Sensitive Species List, and a more thorough discussion of how proposed activities may impact this species is conducted in the biological evaluation for this project.

Suitable habitat for Crater Lake Tightcoil exists within the riparian and numerous small springs or perennially wet areas in portions of the project area. These areas would be avoided in all action alternatives and would be protected by riparian buffers thereby precluding further surveys (N. Duncan 2007 Pers.Comm.).

Based on the three evaluation criteria listed in the Survey Protocol for Survey and Manage Terrestrial Mollusk Species from the Northwest Forest Plan version 3.0 (Duncan et al. 2003) to determine the need to conduct a survey, surveys for Crater Lake Tightcoil are not considered to be required for this project. This consideration is made because each of the three criteria necessary to trigger a survey would not be met for the following reasons:

- Perennially wet habitat associated with springs in portions of the project area would be protected against disturbance from activities including prescribed burning.
- Riparian buffers should protect any potential habitat from modification or disturbance. Consequently, the species should be avoided entirely and the persistence of the species, if present in the project area should not be compromised (N. Duncan Per. comm. 2007).

Because measures would be taken to protect suitable habitat for this species against disturbance or modification from effects associated with proposed activities, there are no recognized direct, indirect, or cumulative effects to this species or its habitat from the project.

Red tree vole

The red tree vole was initially listed as a Survey and Manage species in the 1994 Northwest Forest Plan ROD (USDA, USDI 1994). In the 2001 ROD the red tree vole was classified as a Category C species. Under that classification it was considered uncommon, where pre-disturbance surveys were considered practical, and where survey requirements applied across the known or suspected range of the species. Based on survey results that revised the understanding of occurrence, distribution, and habitat use, the 2003 Survey and Manage Annual Species Review removed the red tree vole from the Survey and Manage list within the Mesic Zone portion of its range. This project is within the Mesic Zone therefore Survey and Manage requirements for this species do not apply to this project and would meet the exception for thinning projects in stands younger than 80 years from the November 6, 2006, Ninth Circuit Court opinion in Klamath-Siskiyou Wildlands Center et al v. Boddy et al., No. 06-35214 (CV 03-3124, District of Oregon).

Suitable habitat for this species is not generally associated with the younger stands that are proposed for thinning within the project area. There are late-successional and old-growth areas within the project area, however, no thinning activities are proposed within these areas. Consequently, it is expected that there would be no effect to red tree voles from the Hehe LSR Thin Project.

Other ROD Species/Habitat:

Cavity-nesting birds - White-headed woodpecker, black-backed woodpecker, pygmy nuthatch, and flammulated owl: These species would not be sufficiently aided by applying mitigation measures for riparian habitat protection or other elements of the Northwest Forest Plan (USDA, USDI 2001 and 2004). These four species occur primarily on the periphery of the range of the northern spotted owl on the east slope of the Cascade Range in Washington and Oregon. However they are known to occur in Westside Oregon Cascades habitat.

Among these species, the black-backed woodpecker would be the most likely to occur in the vicinity of the project area (Johnsgard 1988, Marshall et al. 2003, O'Neil et al. 2001, NatureServe 2005). Surveys are not required for these species, and there is no confirmation of their occurrence from recent or historic sighting reports within the project area.

To ensure the distribution and numbers of all four species do not decline on BLM Districts and National Forests within the range of the northern spotted owl, adequate numbers of large snags and green-tree replacements for future snags in appropriate forest types would be maintained in sufficient numbers to maintain 100 percent of potential population levels (USDA, USDI 2001 and 2004).

The proposed Hehe LSR Thin Project does not involve activities that would directly affect current habitat associated with dead wood or defective trees. A discussion of how proposed activities may impact this habitat component is conducted in the Snags and Down Wood section of this document.

The influence of this project on these species is considered either neutral or beneficial. Proposed activities would generally occur outside the breeding season, and the likelihood that they occur in the project area is considered low. Beneficial influences are associated with a potential to improve foraging habitat and overall biodiversity that may attract their presence in the area.

Bats listed in the NWFP include species that have been located in surveys along Fall Creek such as: *Myotis lucifugus*, *Myotis volans*, *Myotis yumanensis*, *Myotis evotis*, *Myotis californicus*, *Corynorhinus townsendii*, and *Myotis thysanodes*. These species only roost and nest in bridges, caves and buildings. There is strong evidence (P.Ormsbee Pers. Comm. 2007) that maintaining large diameter, thick barked trees (old-growth) in riparian areas is important. No caves, mines, abandoned wooden bridges or buildings occur within the project area that would need to be protected from activities associated with this project. Surveys would be conducted on the bridges proposed for repair on Road 1800 prior to start work to determine if bats are present, species identification, and if maternity colonies exist. If maternity colonies are found, mitigation measures would be imposed according to District Wildlife Biologist and or by Regional bat expert. Further information on NWFP mentioned bats are discussed later in this document.

Management Indicator Species

The Willamette Forest Plan has identified a number of terrestrial wildlife species with habitat needs that are representative of other wildlife species with similar habitat requirements for survival and reproduction. These Management Indicator Species (MIS) include spotted owl, bald eagle, peregrine falcon, cavity excavators, pileated woodpecker, deer, elk, and marten. Spotted owls, bald eagles, and peregrine falcons are addressed in a separate Biological Analysis/Evaluation. The other MIS have potential to occur in or near the project area and are addressed below. Activity associated with the proposed action is consistent with, or exceeds Willamette Forest Plan Standards and Guidelines as they pertain to MIS management.

Habitat for terrestrial MIS modified by activities associated with the proposed Hehe LSR Thinning Project would be limited to primarily foraging use by these species. Activities could result in disturbance to MIS that may be present in or adjacent to proposed treatment sites. However, any modification or disturbance that may occur associated with this project is not of a scale that would threaten the viability of any MIS to persist within the project area or throughout the range of these species, and is considered locally beneficial.

Summary of Effects - Management Indicator Species

Although proposed activities would modify some suitable habitat, and likely disturb some individual terrestrial MIS that may be present, they should not threaten the capability of any local population of these species to persist or become established in the project area. Any project effect considered negative in this regard would be short-term and minimal compared to the amount of habitat available in the surrounding landscape. Cumulative effects to MIS from proposed activities would be small in scale yet generally beneficial as they contribute to long-term improvements in the overall diversity of habitat in the Hehe LSR Thin Project area.

Pileated Woodpecker

Current, as well as historic, composition and structure associated with habitat type and plant associations surrounding the project area favor nesting and foraging use by pileated woodpeckers (Csuti et al. 1997, Marshall et al. 2003, NatureServe 2005, O'Neil et al. 2001). The species is known to occur within the Middle Fork Ranger District, and its presence has been documented in the project area (D. Quintana 2006).

Effects from proposed activities previously addressed in this report pertaining to snags and down wood as habitat important to cavity nesting birds, are also relevant to how this restoration project may affect this MIS. This project would not modify nesting habitat or result in disturbance during the pileated woodpecker's breeding season. The amount of dead wood that may be providing foraging habitat potentially affected by prescribed burning is considered inconsequential relative to this type of habitat component in the surrounding landscape where fire is recognized as the major natural disturbance (Chappell et al. 2001).

Currently the Oregon Natural Heritage Program (ONHP), The Nature Conservancy (TNC), and the Oregon Department of Fish and Wildlife (ODFW) show the status of the pileated woodpecker to be secure, which suggests the changing trend in timber management that has occurred within the past decade, and projected for the future, may positively influence occupancy of suitable habitat by this species as previously harvested stands redevelop, and more emphasis is placed on retention of key structural components in unharvested stands (USDA 1985, USDA 1994).

Marten

Marten occupy a narrow range of habitat types found in or near coniferous forests. More specifically, they associate closely with late-successional stands of mesic conifers – especially those with complex physical structures near the ground such as large low snags and down wood (Chapin et al. 1997, NatureServe 2005, Ruggiero et al. 1994, Verts and Carraway 1998, Zielinski et al. 2001). Current habitat surrounding the project area possesses such characteristics. Marten are not known to occur within the project watersheds; however, since potential habitat exists it should be assumed the species is likely a member of the local faunal community.

In the General Wildlife Overview section of this report the marten was identified as a species closely associated with habitat in and adjacent to this project area. Effects identified pertinent to general wildlife, as well as to snags and down wood, apply to this MIS. Because marten prefer a more interior setting, large snags or down logs that could function as denning habitat would not be affected by this project. Foraging habitat for marten would likely improve as a result of habitat restoration beneficial for prey species known to be favored by marten such as voles, rabbits, squirrels, and mountain beaver (Csuti et al. 1997).

Currently the ONHP, TNC, and the ODFW show the status of this species to be secure or not immediately imperiled, which suggests species viability may be assured as long as adequate protection measures such as Standards and Guidelines governing activities proposed by this type of project continue to be implemented. The changing trend in timber management that has occurred within the past decade, and is projected for the future, may positively influence occupancy of suitable habitat for marten as previously harvested stands redevelop, and more emphasis is placed on recruitment of key structural components missing from harvested stands and retention of key structural components present in unharvested stands.

Cavity Excavators

The significance of snags as one component characterizing both old-growth and younger timber stands, and the dependence of primary cavity excavators on this component as MIS that provide nesting and denning habitat for numerous additional species of birds and mammals (secondary cavity nesters) is thoroughly addressed in the Willamette National Forest Land and Resource Management Plan (1990). The significance of this relationship is further emphasized by management S&Gs under the Northwest Forest Plan ROD (1994, 2001, 2004) and elsewhere throughout published literature (Hagar et al. 1996, Hallett et al. 2001, Lewis 1998, Muir et al. 2002, Olson et al. 2001, Rose et al. 2001).

Except for the downy woodpecker, all species of primary cavity excavators used as ecological indicators in the Willamette Forest Plan (USDA 1990) have current and/or future potential to occupy habitat surrounding the project area based on recognized associations with the Montane Mixed Conifer Forest Habitat type (O'Neil et al. 2001). A complete list and discussion of these species can be found on page 74 in Chapter III of the Forest Plan FEIS.

Effects from proposed activities previously addressed in this report pertaining to snags as habitat important to cavity nesting birds, are also relevant to how this restoration project may affect this group of MIS cavity excavators. This project does not propose modification of current nesting habitat or result in disturbance during the breeding season for this group of species. The number of small snags identified as a safety hazard to work areas that may be felled or that could be affected by prescribed burning is considered inconsequential relative to this type of habitat component in the surrounding landscape where fire is recognized as the major natural disturbance (Chappell et al. 2001).

Thinning activities proposed by this project include measures that maintain and protect habitat components important to support use by the group of cavity excavators listed as MIS. Implementing any of the Action Alternatives as proposed should have no direct or indirect effect on these species such that their ability to persist within the project area or throughout their ranges would be compromised. Current Standards and Guidelines governing management of this area provide direction that promotes long-term maintenance of amount and distribution of suitable habitat for this group of species. With respect to restoring historic habitat and biodiversity (by thinning the young dense plantations) that may benefit these species or their prey, project effects should result in a positive yet marginal overall contribution to cumulative effects that have occurred from past actions affecting the project area.

Land Birds / Neotropical Migrants

Existing Conditions – Land Birds / Neotropical Migrants

Forest management practices over the last 50 years have included fire suppression, disease control, salvage logging, shorter rotations, clear-cutting, slash burning, herbicide applications, and thinning. These practices tend to reduce variability in natural forests, resulting in decreased structural diversity which landbirds require. Management prescriptions that increase stand structural diversity are now being implemented, including green tree retention, snag retention and creation, enhancing late-successional characteristics in stands, and group selection cuts that create different sizes of patches and gaps. Implementation of these new management prescriptions coupled with long-term species declines emphasizes the need to develop conservation strategies for maintaining functional ecosystems for landbirds.

Land bird species exhibit a response to the vegetation height, seral stage, canopy structure, and spatial distribution associated with forest habitat where greater numbers of birds are associated with more complex heterogeneous forested landscapes (Altman 1999). The current amount of forested and open ecotonal habitat characteristic throughout the project area should be attractive for use by a variety of avian species (Gilbert and Allwine 1991). The thinning of early –seral or young dense stands should prove to be a benefit in the short-term (3-5yrs) for land birds and neotropical migrants, while gradually enhancing LSOG habitat for late-successional species in the long-term (>5yrs).

Direct and Indirect effects - Land Birds / Neotropical Migrants

Summary of Effects

The effects to this group of species from proposed activities are considered limited to within the project area. Consideration of project effects (direct and indirect) to native bird species from proposed activities is directed to the potential for habitat modification and disturbance to occur associated with thinning units, and how thinning may affect habitat use.

Loss or displacement of individuals that could be unknowingly occupying habitat during implementation of proposed activities such as falling, yarding, and prescribed burning could occur. The number of individuals and/or species potentially affected by proposed activities is unknown and considered unquantifiable. The spatial and temporal extent of proposed activities that could result in disturbance to nesting birds in a small portion of the project area should mitigate the overall potential for disturbance and provide protection for nesting birds as intended under Migratory Bird Treaty Act (Seitz et al 2006). Based on management activities proposed for all action alternatives, risk to individuals that may be present and directly affected by project activities is considered equal for all action alternatives.

Short and long-term suitability of habitat in and near proposed treatment areas should improve for the majority of bird species that are likely to forage and nest in this area – albeit on a small scale compared to the surrounding landscape. Current science (Hagar et al 2004, 2007) suggests these indirect effects are generally considered neutral or beneficial for all affected species, and are equal under all action alternatives.

Effect of Alternatives

Alternative 1 (No Action) - Under the no action alternative, no direct or indirect effects are expected to occur to any of these of species because no activities would take place..

Alternative 2, 3 and 4 - The effects to this group of species from proposed activities are considered limited to within the project project area. Consideration of project effects (direct and indirect) to native bird species from proposed activities is directed to the potential for habitat modification and disturbance to occur associated with thinning units, and how thinning may affect habitat use.

The timing of activities would mitigate potential short-term (< 5 years) negative effects from habitat modification such as temporary loss of some potential nesting habitat, or disturbance such as temporary displacement of individuals or their prey from prescribed burning activities. The number of individuals and/or species potentially affected by proposed activities is unknown and considered unquantifiable without reliable survey data. Thinning activities proposed by this project should not affect this group of species such that their ability to persist in the vicinity of the project area or throughout their ranges would be compromised, as 52% of the area would remain in an unmanaged old-growth state.

Because the activities are proposed to aid in the restoration of a Late-Successional Reserve (LSR) and within areas adjacent to occupied northern spotted owl habitat, most noise generating activities would occur outside the breeding season for these species and/or at a time when many may have migrated from the area (Csuti et al. 1997, Marshall et al. 2003, O’Neil et al. 2001, NatureServe 2005).

Felling of trees associated with the thinning operations may unintentionally take individual migratory birds, but is not expected to have a measurable negative effect on bird populations

because of the limited extent of habitat removal. Thinning and removal of younger, ~40 year old stands may negatively impact certain species such as Hutton's vireo, golden-crowned kinglet, hermit thrush, and Swainson's thrush. Species which use early seral stages, such as winter wren, American robin, and grouse may benefit from created forest openings from regeneration harvest (Hagar 2007). Some snag habitat used by landbirds would be lost due to roadside hazard tree removal. Snag creation activities within units following logging may mitigate this loss in the long-term, although it would take approximately ten or more years before these created snags become functional. Snag habitat which is used by landbirds such as western bluebirds or swallows would be improved in the long-term by snag creation activities on green trees retained in units, as per Hagar 2007 all legacy deadwood would be retained where possible in units.

Forest underburns associated with the thinning proposals which take place during spring may impact some bird species if they are nesting in the remaining green trees. This may cause nest failure in some cases, especially for those birds which nest relatively low to the ground such as hummingbirds, flycatchers, warblers, sparrows, and thrushes. Most landbirds generally fledge in June or July, although this can be later when second nest attempts are made. Juveniles of some species may not be able to fly long distances until late summer, however, many species are independent much earlier and would be able to escape a fire and smoke situation that could harm them.

Short and long-term suitability of habitat in and near proposed treatment areas should improve for the majority of bird species that are likely to forage and nest in this area – albeit on a small scale compared to the surrounding landscape. Current science (Hagar et al 2004, 2007) suggests these indirect effects are generally considered neutral or beneficial for all affected species, and are equal under all action alternatives.

Given these considerations, both short and long-term suitability of open forest, meadow, and edge habitat in and near proposed treatment areas should improve for the majority of bird species that are likely to forage and nest in this area providing legacy components are maintained in the units post action activities (where feasible).

Cumulative Effects - Land Birds / Neotropical Migrants

The cumulative effects analysis area was the project area. Previous fire history and past management actions related to timber harvest activity are generally responsible for defining the current condition of habitat throughout the project area relative to suitability for land birds / neotropical migrants. These actions have affected the overall amount and seral stage distribution of forested habitat largely by reducing the amount of old-growth habitat and increasing the amount of mid-late seral habitat. There are no foreseeable actions that would affect seral stage habitat in this area and influence future suitability for this group of species.

Current science applied to Standards & Guidelines governing management activities in this area provide direction that would ensure the long-term maintenance of amount and distribution of suitable habitat for native resident and migratory land bird species. Due to the location of treated and untreated areas within the project area, cumulative effects from this proposed thinning project under all action alternatives would result in a positive yet minor contribution to overall effects from past actions.

Snags and Down Wood

Existing Conditions – Snags and Down Wood

The importance of the ecological role of snags and down wood in influencing ecosystem diversity and productivity is well addressed in the Willamette National Forest Land and Resource Management Plan (1990). The significance of this relationship in coniferous forests of the Pacific Northwest is further emphasized by management S&Gs under the Northwest Forest Plan ROD (1994, 2001, 2004) and elsewhere throughout published literature (Hagar et al. 1996, Hallett et al. 2001, Laudenslayer et al. 2002, Lewis 1998, Muir et al. 2002, Rose et al. 2001).

Under the Willamette Forest Plan as amended by the ROD, snag habitat shall be managed at levels capable of providing for at least 40% or greater potential populations of cavity-nesting species. Current science has questioned the validity of the potential population approach to species management. Strong support for identifying more appropriate amounts of snag and down wood habitat is being given to new approaches in addressing these habitat components. One such approach devoted to identifying appropriate levels of snag and down wood in selected habitat types is DecAID - the decayed wood advisor for managing snags, partially dead trees, and down wood for biodiversity in forests of Washington and Oregon (Mellen et al. 2003).

The coarse woody debris prescriptions were developed using the recommendation in the LSRA and consulting DecAid (Mellen et al 2006). The LSRA provided a process for determining the appropriate coarse woody debris (CWD) levels (page 124-132) in LSRs during commercial thinning treatments. Since we are managing for LSOG characteristics (for wildlife) and attempting to mimic natural conditions we compared our data with Spies et al. (1998) tolerance levels as projected in the DecAid model. Spies also suggests that in the Western Cascades where our objectives are to manage for wildlife, ecosystem functions and natural conditions at the 50% tolerance level, a reasonable interpretation would be to provide for stand average down wood cover of about 10%.

The process involves an assessment of landscape conditions and site specific stand conditions in determining the appropriate strategies for CWD. Three strategies are proposed which provide specific ranges for snags and down wood. The coarse wood debris levels are designated by plant series and include the percent groundcover of down wood, number of large > 20" dbh snags per acre, total snags per acre > 10" dbh, and total volume of down wood in cubic feet per acre.

These current down wood levels compare with the upper level (3000 cubic feet per acre) recommended in the strategy to meet short-term needs by creating an immediate pulse of coarse woody debris in the young stands of the LSRA.

Snags:

Current snag estimates were based on data obtained from field exams that sampled managed plantations throughout the analysis area, a review of data specific to the Fall Creek LSRA, Clark Fire Final Wildlife Report, and the Mid-Willamette LSR Assessment. For snags, the current estimated number of snags per acre in sampled managed plantations ranged from 12-20 snags per acre ranging from 9-20 inches diameter and 1-2 snags per acre >20 inches diameter snags. The LSRA recommendations for number of snags ranges from about 35-50 total snags protected per acre and about 2-10 large snags per acre over time (>7-10 years). The Hehe analysis area is expected to exceed snag suggestions from both the DecAID charts for wildlife species using this type of habitat and the Mid-Willamette LSRA due to 52 % of the analysis area currently being in late-successional or old growth forest conditions with good snag habitat conditions.

The Fall Creek Watershed Analysis (WA) did an analysis of estimated snag levels within the 5th field watershed as well as the various 6th field sub-watersheds. This information was developed using local knowledge of stands in the watershed, past harvest history of managed stands, and recent wildlife tree retention requirements. The current estimated level in the Lower Fall Creek subwatershed averages 1.7 snags per acre. The median snag level for the entire Fall Creek and Hehe Creek watersheds averages 2.06 snags per acre.

Post treatment snag sizes and quantities would also be consistent within the range of average levels recently provided from plot data from unharvested stands in a Western hemlock vegetation series such as those influencing habitat throughout the project area (McCain 2006). These data are presented in terms of tolerance levels and tolerance intervals described in DecAID. They reveal that 50% of individuals in all populations of species using snags in a Western hemlock-warm to mesic series type can be expected to occur where a range of 4-7 snags $\geq 20''$ dbh exist. Although these data apply to stands in a large tree condition class, 53% of all snag habitats throughout the Hehe LSR Thin project area would fall within this range, or the natural range of variability for this area.

Snag levels for this project were compared against those listed in DecAID for Westside Lowland Conifer-Hardwood habitat type, in the Western Oregon Cascades, with a Small/Medium Tree Vegetation Condition (WLCH_OCA_S). A review of DecAID data discloses that current snag levels throughout 52% of project area (currently in LSOG habitat within the Fall Creek LSR) are well above average values (within the upper end of the 50% tolerance range) representative for snags in unharvested areas in this habitat type and condition. Snag levels are also well above average values (within the 80% tolerance range) representative for snags where harvested areas are included.

Snag levels in the Hehe LSR Thin Project area (Hehe) compare to DecAID data as follows:

For all inventory plots (previously thinned and unthinned managed stands)

- Hehe snags $\geq 10''$ dbh represents the 79th percentile for similar WLCH_OCA_S
- Hehe snags $\geq 20''$ dbh represents the 89th percentile for similar WLCH_OCA_S

When dead wood management objectives are aimed at mimicking natural conditions, DecAID values associated with unharvested plot data are considered. Implementing the post-harvest snag creation prescription of 1-5 large snags/ac would mitigate the expected loss of some snags, and maintain values as displayed above (see Appendix C). Smaller snag values would likely decrease and stabilize around the 50% tolerance level when averaged throughout the project area.

Down wood:

To compare the down wood levels with DecAID (Figure WLCH_OCA_S.inv.10), the down wood volumes were converted to percent cover. The estimated average down wood percent cover in sampled managed plantations was 2.4 % cover per acre for 6-20 inch diameter down wood, and 6.9 % cover per acre for >20 inch diameter down wood. These down wood levels compare with the Westside Lowland Conifer-Hardwood habitat type, in the Western Oregon Cascades, with a Small/Medium Tree Vegetation Condition (WLCH_OCA_S) in DecAID are well above average values (within or exceeding the upper end of the 50% tolerance range

Down wood estimates for current size and distribution were made based on data obtained from 26 fixed area plots that sampled managed stands throughout the project area. Tree mortality largely associated with self-thinning competition, cull logs from previous harvest activity, localized breakout from snow loading, blowdown and areas of wildfire has resulted in down wood levels as follows:

- 12.3 tons/acre $\geq 6''$ diameter down wood in previously managed stands
- 34.9 tons/acre $\geq 6''$ diameter down wood in managed stands

These current down wood levels compare with the upper level (3000 cubic feet per acre) recommended in the strategy to meet short-term needs by creating an immediate pulse of coarse woody debris in the young stands of the LSRA. Smaller logs are generally in decay class I and II, while larger logs are in decay class II and III. Many of the largest pieces of down wood (cull logs from initial harvest activity) exist in decay class III. Plot data and extensive field reconnaissance indicate existing down wood occurs in a patchy rather than even distribution across the project area.

Existing down wood would be protected to the greatest extent feasible under the silvicultural prescription. Some loss or disturbance of existing down wood associated with the proposed commercial thinning is inevitable. However, recruitment of sub-merchantable tops and debris not yarded to landings during the commercial thinning, the old stumps not included in the calculation

of the down wood inventory, and some recruitment from retained trees would result in a stable or slightly elevated level of down wood in areas treated.

In addition to dead wood levels associated with down logs, it is estimated that decaying wood habitat associated with stumps would cover 0.5% of areas treated under all Action Alternatives. The amount is considered to be relatively similar under all action alternatives. Use of stumps throughout a range of decay classes has been documented for a wide variety of organisms (O'Neil et al. 2001, NatureServe 2006, Rose et al. 2001, Zabel and Anthony 2003). This type of dead wood provides a valuable, long-lasting habitat component which contributes to maintaining native biodiversity throughout the project area.

Direct and Indirect Effects - Snags and Down Wood

Summary of Effects

The Hehe LSR Thin Project involves activities having the potential to both reduce and create dead wood habitat within a forest ecotone setting, however project effects relative to this type of habitat component in the surrounding landscape are considered inconsequential. If implemented as proposed, all Standards and Guidelines and LSRA and REO recommendations applicable to this type of management activity would be met.

Effects of Alternatives

Alternative 1 (No Action)- No action alternative is expected to have no direct, indirect or cumulative effects changes on deadwood through out the Hehe LSR Thin project area.

Action Alternatives 2, 3, & 4

Under all action alternatives, the Hehe LSR Thin Project proposes commercial thinning in about 3,186 to 4,179 acres of early to mid-seral (stem exclusion) habitat throughout the project area. This relates to approximately 48% of the entire project area. There is essentially no difference between any of the action alternatives and their effect on dead wood.

The silvicultural prescription calls for protection of existing snags and down logs. However some amount of loss or disturbance of snags and down wood is inevitable as a result of safety and logging feasibility issues. Mitigation measures are identified to address this loss or disturbance. Effects analysis reveals that proposed activities in conjunction with later occurring mitigation measures would result in stable or slightly increasing in dead wood levels associated with areas treated. Direct and indirect effects would be limited to an undetermined number of snags and logs that may be unavoidably affected or created within harvest units.

Cumulative Effects - Snags and Down Wood

The cumulative effects analyses area for snags and down wood was assessed at the Hehe Creek 6th field sub-watershed. Proposed treatments (less than 18 % of the total project area) would result in a negligible contribution to cumulative effects that have already occurred from past

management actions on the landscape surrounding the project area (see Appendix B). Current science and the changing trend in timber management that has occurred within the past decade, and projected for the future, should positively influence management of decaying wood as previously harvested stands redevelop, and more emphasis is placed on retention of key structural components in unharvested stands (53% of the project area).

There are no foreseeable additional actions that would affect dead wood habitat in this area. Data analysis reveals the amount and distribution of snag and down wood habitat would essentially remain unchanged or experience a slight increase under all action alternatives. Commercial thinning as proposed under all action alternatives for the Hehe LSR Thin Project is therefore likely to have little or no cumulative effect on dead wood habitat throughout the project area

Dead wood habitat should exist in a sufficient amount and distribution to support the local wildlife community, including MIS such as pileated woodpecker, marten, and cavity nesters such that their ability to persist or become established would not be limited by this habitat component important to most members of the wildlife community in this area.

Soils

Soils Erosion and Detrimental Soil Disturbance

Non-significant Issue - Various soils types within the project area have high surface soil erosion potential and a high potential for land failures (mass wasting) which could be a source of fine grain sediments to the streams. Some level of soil disturbance (soil compaction and displacement) has occurred from past timber harvest activities. Various soils of the project area are susceptible to cumulative soil disturbance (soil compaction and displacement), which will affect the long-term potential for soil erosion and soil productivity of the project area.

Existing Conditions - Soils

The Willamette National Forest Soil Resource Inventory (USDA, 1973) (SRI) provides a general soil description which has been grouped into categories based on similar soil properties and expected behavioral response to management activities. The soil categories were first used in the watershed analysis (USDA, 1995). The table below summarizes the soil categories and the amount of acres within the project area. Detailed descriptions of the soil categories can be found in the Integrated Aquatic Report (Ellingson and Lewellen, 2007). Soils in Category 1 and 2 are susceptible to cumulative soil disturbance (soil compaction and displacement) due to high clay content.

Table 36 - Project Area Soil Category Acreages

Soil Category	Definition of SRI Soil Categories	Acres of Hehe 6 th field watershed
Category 1	Nearly 100% clayey soils	1006.2
Category 2	At least 50% clayey soils	849.5
Category 3	Nearly 100% steep ground and shallow soils	11,598.4
Category 4	At least 50% steep ground and shallow soils	4059.5
Category 5	All others	3386.2
Totals		20,900

For the majority of units which were originally cable yarded, the current detrimental soil conditions range from 2.2% to 10.7% (See Appendix in Integrated Aquatics Report in the Project File) Of the entire project area only two units proposed for commercial thin fall within a relatively flat 800-900 acre area (sideslopes 30% or less). These two units have been estimated to having 15-20% current detrimental soil conditions. These are the only two units where past ground based or tractor yarding have compacted soil near the threshold levels (FW-081). Aerial photo interpretation of the amount of old skid trails and the field verification of the visible signs of past entry provided the quantification of the impacts of this previous ground-based activity. For this commercial thinning entry into the two units (#528 and #620) that fall within these 800-900 acres area, implementing the mitigating measures of skyline logging system and staying on existing roads would lessen any adverse impacts to the soil resource. The impacts to the soil from skyline logging are slight and are believed to be less than 1% potential impact to the soil resource due to potential displacement. There would not be any new compacted areas generated as a result of skyline logging the two units that fall within this relatively flat area. The remaining project area is considerably steeper (sideslopes greater than 30%) and past entries would not have been ground-based. The Forest Plan indicates that the total area of cumulative detrimental soil conditions should not exceed 20% of the total acreage within the activity area, including roads and landings (FW-081).

Direct and Indirect Effects - Soils

Summary of Effects

The no action alternative would not properly maintain, close roads or decommission any of the current road system. Chronic erosion of the existing problem roads would continue. Additional failures are likely to occur over time, potentially delivering large volumes of sediment to the stream network. The 1831 road and Hehe Creek would experience the greatest impacts by selecting the no action alternative.

Alternative 2 - Temporary roads would be closed after use and have no long-term impact to soil conditions. There would be 0.45 miles of road decommissioning and 102 miles of maintenance

and reconstruction. Most miles of high aquatic risk roads would remain untreated and connected to the stream network. This would continue to pose a risk for road failure and subsequent delivery of sediment to the stream network. Road maintenance, road work, timber haul, and in-stream wood additions would increase sediment being generated into streams including Fall Creek. Culvert replacement specifically on Pernot Creek would also disturb soil, generating sediment into the stream. Bridge maintenance on Hehe and Alder Creeks would cause the greatest increase of sediment into streams. Soil would experience the smallest effect with alternative 2 compared to alternatives 3 and 4.

Alternative 3 (Proposed Action) - Bridge work, Pernot Creek culvert, in-stream restoration activities, and road maintenance would have the same effect as described as alternative 2.

Additional effects would occur due to increased road closure and decommissioning compared to Alternative 2. There would be 6.2 miles of road decommissioning and 115 miles of road maintenance and reconstruction. This would reduce road density and restore proper hydrologic function to the affected areas more than Alternative 2 but not as much as Alternative 4.

Alternative 3 would close about 38 miles of road that would eliminate all aquatic resource issues. This would greatly reduce the risk for road failure and subsequent delivery of sediment to the stream network. Soils would experience a greater short-term effect compared to alternative 2, however the effect would be less than alternative 4.

Alternative 4 - Bridge work, Pernot Creek culvert, in-stream restoration activities, and road maintenance would have the same effect as described as alternative 2.

Additional effects would occur due to increased road closure and decommissioning compared to alternative 2 and 3. There would be 9.97 miles of road decommissioning and 127 miles maintenance and reconstruction. This would reduce road density and restore proper hydrologic function to the affected areas greater than all action alternatives. Alternative 4 would also close about 38 miles of road that would eliminate all aquatic resource issues. This would greatly reduce the risk for road failure and subsequent delivery of sediment to the stream network. Soil would experience the greatest short-term effect in alternative 4 compared to all action alternatives.

For all the action alternatives, all units would be within Forest Plan standards and guidelines for detrimental soil (FW-081).

Effects of Alternatives

The new and existing landings as well as the new temporary road work would impact less than 5% of the project area. The average skyline harvest unit results in less than 1% soil impact, helicopter harvest results in less of a soil impact than skyline harvest.

Table 37 - Detrimental Soil Conditions by Alternative

	Alternative 1 (No Action)	Alternative 2	Alternative 3 (Proposed Action)	Alternative 4
New Temporary Roads	0 ac	6.6 ac (3.9 mi)	6.4 ac (3.8 mi)	8.1 ac (4.8 mi)
New Landings	0	6.6 ac	7.6 ac	9.3 ac
Skyline Yarding (1%)	0	19.9	25.8	29.3
Helicopter Yarding (<1%)	0	11.9	11.9	12.5
Totals	0	45.0 ac	51.7ac	59.2 ac

Alternative 1 (No Action) - No new detrimental soil impacts are expected under this alternative as no new timber harvest or road building would occur.

Alternative 2 - This alternative would result in 45.0 acres of new detrimental soil impact as 6.6 acres (3.9 miles) of temporary roads and 6.6 acres of new landings are built to accommodate thinning operations. These landing and temporary road acres are generally located on stable ridge tops. About 31.8 of those acres would be attributed to the yarding operations. In addition where road decommission occurs, soil remediation of 3.7 acres would reduce soil compaction between fill removals, increasing infiltration and beginning the process of reincorporating organics in these soils. Full recovery of macro-pore space and soil biota would take decades following treatments on these sites.

As shown in research (Rashin, et al, 2006), very minor impacts to soil would be expected from corridors associated with skyline harvest on 1,996 acres of thinning in this alternative. Helicopter harvest would show even lower soil impacts given the absence of corridors. This is common for all action alternatives.

Alternative 3 - This alternative would result in 51.7 acres of new detrimental soil impact as 6.5 acres (3.8 miles) of temporary roads and 7.6 acres of new landings are built to accommodate thinning operations). These landing and temporary road acres are generally located on stable ridge tops. About 37.7 of those acres would be attributed to the yarding operations. In addition, where road decommission occurs, soil remediation of 7.6 acres would also occur to reduce soil compaction between fill removals, increasing infiltration and beginning the process of reincorporating organics in these soils. Full recovery of macro-pore space and soil biota would take decades following treatments on these sites.

Alternative 4 - This alternative would result in 59.2 acres of new detrimental soil impact as 8.1 acres (4.8 miles) of temporary roads and 9.3 acres of new landings are built to accommodate thinning operations. These landing and temporary road acres are generally located on stable ridge tops. About 41.8 of those acres would be attributed to the yarding operations. In addition, where

road decommission occurs, soil remediation of 8.7 acres would also occur to reduce soil compaction between fill removals, increasing infiltration and beginning the process of reincorporating organics in these soils. Full recovery of macro-pore space and soil biota would take decades following treatments on these sites.

Table 38 - Acres of New Temporary Road by Soil Category

Soil Category	Alternative 1 (No Action)	Alternative 2	Alternative 3 (Proposed Action)	Alternative 4
Soil Category 1	0	0.1 ac	0.1 ac	0.2 ac
Soil Category 2	0	0.4 ac	0.3 ac	0.5 ac
Soil Category 3	0	0.9 ac	1.0 ac	1.3 ac
Soil Category 4	0	1.7 ac	1.9 ac	2.0 ac
Soil Category 5	0	3.4 ac	3.2 ac	4.1 ac
Totals	0	6.6 ac	6.5 ac	8.1 ac

This table summarizes the positioning of the new temporary roads in the watershed by SRI soil category. Most of the impact of new temporary roads would be in soil categories 4 and 5. Soil categories 4 and 5 have lower total clay content and a reduced risk of soil erosion. This supports the field verification of the new temporary road sites as high in the system along ridges where there would be no hydrologic connection.

Table 39 - Acres of Thinning Prescription by Soil categories

Soil Category and Thinning Intensities	Alternative 1 (No Action)	Alternative 2	Alternative 3 (Proposed Action)	Alternative 4
Soil Category 1				
Heavy Thin	0	26.3	26.4	76.8
Moderate Thin	0	104.0	178.5	138.7
Light Thin	0	8.0	47.1	47.1
Soil Category 2				
Heavy Thin	0	139.4	137.8	149.9
Moderate Thin	0	38.0	55.2	68.1
Light Thin	0	32.7	32.7	33.1
Soil Category 3				
Heavy Thin	0	495.1	605.3	835.9
Moderate Thin	0	752.5	757.8	579.6
Light Thin	0	356.5	458.7	566.9
Soil Category 4				
Heavy Thin	0	144.2	135.7	234.5
Moderate Thin	0	308.3	436.3	404.5
Light Thin	0	50.0	51.3	52.8
Soil Category 5				
Heavy Thin	0	148.5	160.1	177.2
Moderate Thin	0	364.5	417.8	423.4
Light Thin	0	218.0	261.3	390.5
Totals	0	3,186.0	3,762.0	4,179.0

This table describes the proposed thinning prescriptions by SRI soil category and shows that very little thinning would be occurring in soil categories 1 and 2. Soil categories 1 and 2 have a high level of clay content and are more susceptible to erosion and mass wasting.

Several areas within proposed harvest units were identified with unstable soils. Unit's #10C, #206 and #221 had areas along the upper Road #1832, and Units #248, #3563 and #258 had areas below Road #1831 and between Road #1831 and Hehe Creek that had areas deleted from harvest because the unstable soils.

Effects common to Action Alternatives 2, 3 and 4

All units would be within Forest Plan standards and guidelines for detrimental soil (FW-081). New temp spurs, landings, and yarding would add about 1% to 3% to the existing conditions after mitigation to rehab the temp spur and landings (See Appendix in Integrated Aquatic Report in Project File). The two units that were previously ground based yarded would remain within threshold levels with mitigation by changing yarding system to skyline and temp spur and landing rehabilitation.

Cumulative Effects – Soils

The cumulative effects analysis for soils considered the total area proposed for treatment in each alternative. The effects of the current, past, present, and reasonably foreseeable future projects were considered in the analysis and portray the extent and duration of detrimental soil conditions cumulative effects. Refer to Appendix B for summaries of timber harvest and road system development histories. For past projects, the detrimental soil analysis includes effects from past logging, and current roads and landings within the project activity areas. There are no present and foreseeable project effects within the project area.

Alternative 1 (No Action) – This alternative would have no cumulative effects because no activities would take place.

Alternative 2, 3 (Proposed Action), and 4 – All the action alternatives would affect an additional 1-3 percent of the total project treatment areas with soils defined to be in a detrimental condition, thus contributing to the cumulative effects of management activities.

Water Quality and Stream Conditions

Non-significant Issue - There are four principal ways in which roads and timber harvest treatments interact with and may affect water resources: 1) Road and timber harvest treatments interact and influence the production of both fine and coarse textured sediments. If generated sediment is not collected by cross drain culverts and allowed to filter onto the hillside, then water quality may be negatively impacted; 2) Their position on steep hillsides often intercepts and

daylights subsurface flow. This may route such flow more quickly to adjacent stream channels and potentially increasing peak flows. 3) Road location within Riparian Reserves can influence the meander patterns of adjacent streams affecting a stream's ability to move sediment. Finally, 4) roads within riparian areas potentially affect a host of processes and resources associated with areas functions such as the availability of large wood.

Water Quality

Existing Conditions – Stream Temperature / Stream Shade

The Oregon Department of Environmental Quality is the agency responsible for implementation of the Clean Water Act (PL92-500, as amended in 1977 and 1982) within the State. Oregon Administrative Rules (Chapter 340, Division 41) identifies beneficial uses, which may include: potential anadromous fish passage, salmonid rearing, salmonid spawning, resident fish and aquatic life.

The State of Oregon has established water quality standards set out in Chapter 340, Division 41 of the Oregon Administrative Rules. The waterbodies that do not meet water quality standards are called “water quality limited”. Such waterbodies are then placed on a list in accordance with Section 303(d) of the Federal Clean Water Act (303(d) list).

The ODEQ provides temperature and turbidity concern thresholds, with limits on allowable increases.

In 2005, the State of Oregon agreed with the FS and BLM that implementation of the “Northwest Forest Plan Temperature TMDL Implementation Strategies” would meet our requirements for protection of water temperature.

The Oregon Department of Environmental Quality (ODEQ) summer temperature standard in the project area is 64°F measured as an average of the daily maximum water temperatures over a seven day consecutive period.

Monitoring of stream temperature has occurred within the Hehe sub-watershed. The 7-day average maximum temperatures recorded from 1997 through 2003 are shown in Table 40. In 1998, the ODEQ listed Fall Creek as water quality limited on the 303 (d) list due to temperatures above the standard during the summer period from river mile 0 to 7 and from river mile 13 to 32.7.

This portion of the Fall Creek is also listed on the final 303(d) list for the year 2006. All of Fall Creek including within the project area boundary has been listed as water quality limited for temperature.

No other streams in the project area are currently listed as water quality limited. A Water Quality Management Plan for water bodies listed on the 303(d) list is required. The Forest Service is in the process of completing one for the Fall Creek Watershed.

Temperatures within the project boundary have been impacted by past management allowing timber harvest to occur near the stream channel. Although harvest within the Riparian Reserve has impacted stream temperature, that natural geology of Fall Creek is also a key factor for current stream temperatures. See Soils section above for geology of Fall Creek.

Table 40 - Water Temperatures within the Hehe Ck. Sub-Watershed

Stream	7-day Average Maximum Water Temperature		DEQ Listing Criteria	
	°C	°F	°C	°F
Fall Creek above Hehe Creek	18	64.4	17.78	64
Fall Creek below Alder Creek	21	69.8	17.78	64
Hehe Creek at Mouth	17	62.6	17.78	64

Direct and Indirect Effects - – Stream Temperature / Stream Shade

Summary of effects

Fall Creek within the project area is listed as water quality limited for temperature because it exceeds the temperature criterion of 17.0°C for salmonids. Planned harvest would not occur within the primary shade zone and harvest would not remove more than 50% canopy closure in the secondary shade zone, as described in the TMDL implementation strategy. All of the alternatives for this project would have a neutral short-term effect on stream water temperature, and would potentially reduce stream water temperature in the long-term due to improved tree health, height, and canopy size with the proposed silvicultural treatment.

Effects of Alternatives

The effect that this project would have on stream shade was estimated using the model described in the “Northwest Forest Plan Temperature TMDL Implementation Strategies” (USDA and USDI 2005). This model provides the process for calculating the width of the riparian area adjacent to perennial stream channels that provides stream shade for the period of greatest solar loading (between 1000 and 1400 hours), known as the primary shade zone. It also provides the process for calculating the width of the riparian area that provides shade in the morning and afternoon (0600-1000 hours; 1400-1800 hours), considered to be the secondary shade zone. In over-dense riparian areas, optimum shade can be provided by the primary shade zone alone, and the secondary shade zone may contribute little to shade since trees in the primary shade zone are already blocking the sun’s solar radiation (USDA and USDI 2005).

The TMDL document suggests that thinning in Riparian Reserves should be considered as long as they meet the following conditions:

1. Vegetation density is high and would benefit from thinning.
2. Vegetation thinning would not occur in the primary shade zone. Vegetation thinning in the secondary shade zone would not result in less than 50% canopy closure post harvest.
3. NWFP Standards and Guidelines and BMPs still apply.
4. The width of the primary shade zone would be set using the values below, unless a shade model is used for site specific analysis.

Table 41 - Minimum width of primary shade zone (feet) based on slope and tree height

Tree Heights	Hillslopes		
	<30%	30 to 60%	>60%
< 20 feet	12	14	15
20 to 60 feet	28	33	55
>60 to 100 feet	50	55	60

The width of the primary shade zone for units in the Hehe project area ranges from 50 feet to 60 feet with the secondary shade zone ranging from 60 feet to 90 feet.

The proposed acres of thinning in the Riparian Reserves for each of the action alternatives is displayed in Table 47 and summarized in the Cumulative Effects on Stream Condition.

Alternative 1 (No Action) - Untreated riparian areas would continue to slowly recover from past management, and eventually riparian tree heights would provide maximum vegetative stream shade and water temperatures may be cooler over time.

Effects Common in all Action Alternatives - The three action alternatives include restoration activities that selectively cut up 100 young second growth trees within the primary shade zone for in-stream wood complexity along Hehe Creek. Trees would be selected in overstocked stands within the primary shade zone that are not contributing to the canopy cover. There would be no effects to stream temperature because trees cut would not decrease the canopy cover within the primary shade zone. Yarding corridors would not cross perennial streams and there would be no loss of streamside shade as a result of thinning operations. Road work and haul would have no more than a negligible effect on streamside vegetation for all action alternatives and no change in stream water temperature is expected.

Alternative 2 - This alternative would not thin trees within the primary or secondary shade zone adjacent to any perennial stream. Natural recovery processes within the near-stream riparian area where thinning would not occur, would continue to allow for a slow rate of improvement over time. Stream protections would ensure that sufficient shade would remain for the perennial

streams in the Hehe project area and no increase in stream temperature is expected for this alternative

Alternative 3: The effect this alternative would have on stream temperature is similar to that described for Alternative 2. Primary and secondary shade zones would not be thinned. Fuels treatment has the potential to reduce stream shade, especially in the units scheduled for broadcast burning. This activity would not be conducted within the no-cut buffers along perennial streams. It is unlikely that there would be any loss of vegetation from within the primary shade zone for any perennial stream, or associated increase in stream temperature.

Alternative 4: This alternative would have the greatest potential to impact stream temperature. Decreased buffers would allow thinning to occur in the secondary shade zone and directly near the primary shade zone. Thinning in the secondary shade zone would retain at least a 50% canopy closure. The no-cut buffer would allow for the retention of shade-providing vegetation, and there would be no change in the existing stream temperature. Increased tree health in the secondary shade zone, due to the thinning, would ultimately result in taller trees, with broader canopies, and may eventually result in improved levels of stream shade and reduced stream temperature.

Turbidity

Existing Conditions - Turbidity

Based on visual estimates Hehe Creek is quite flashy, meaning it raises quickly with increased rainfall. This steep rising limb can cause rapid increase in stream volume and velocity in response to a storm. Hehe Creek is similar to the other creeks in the larger Fall Creek watershed in that it does become turbid rather quickly in response to a storm event, but it doesn't appear any more turbid than any of the other 6th field watersheds in this area. Due to the amount of valley bottom roads in this project area and the Road #1831 road that runs right along Hehe Creek the existing road system has increased the amount of fine-grained sediment eroding into the stream network in any given time period, leading to turbidity levels that are higher than natural. The upper portion of the 1831 road where we are planning decommissioning work has a culvert on Hehe Creek which is plugged and the stream has created a new channel through the road fill. This area is a persistent source of sediment that needs to be properly decommissioned and stabilized. Another area along the 1832 road is quite narrow and with a series of side-cast debris torrents that reach all the way to the stream networks below. It would be beneficial to stabilize this portion of road and prevent further input. From an extensive aerial photo interpretation of the area, several landslides were identified, but after further field investigation, no large-scale landslides appear to be currently active and/or chronic sources of fine-grained sediment to the stream network.

Direct and Indirect Effects - Turbidity

Summary of Effects

All alternatives would temporarily increase turbidity levels in streams within the project area, primarily due to road improvements and road decommissioning. These effects are not expected to exceed the point-source turbidity thresholds established by ODEQ. All action alternatives would result in short-term negative effects that would be offset by short-term and long-term reductions in chronic sediment sources, and reduced risk of episodic large-scale sediment delivery to streams, thereby resulting in reduced turbidity levels in the future.

Effects of Alternatives

Effects Common to all Action Alternatives

Alder Creek Bridge Work

Bridge abutment work on the Alder Creek Bridge would involve excavation below and around the existing bridge abutment. This would cover an area of approximately 4' in width, 18' in length and 3' in depth to reach bedrock. The bedrock is just below a shallow layer of surface material and it is necessary to key the new footing into the bedrock. All stream flow would be kept on the opposite side of the stream channel and away from the work area. This work would establish a new footing for this side of the bridge, where currently the stream has worked its way under the existing footing. This would result in an increase in turbidity that could travel as far as 1000 feet down Alder Creek in the first storm event.

Hehe Creek Bridge Work

Bridge abutment work on the Hehe Creek Bridge would involve excavation below and around the bridge abutments. The area excavated would be approximately 3' in width, 6' in length and 3' in depth to reach bedrock. The bedrock is just below a shallow layer of surface material and it is necessary to key the new footing into the bedrock. All stream flow would be kept on the opposite side of the stream channel and away from the work area. This work would establish two new footings for the bridge, where currently the stream has worked its way under the existing footings. Due to the size of the material that exists here, and because the bed material here is rather shallow a small amount of fines may enter and travel in the stream system. The material would become mobile in the first storm event. This would result in an increase in turbidity that could travel as far as 1000 feet down Hehe Creek in the first storm event.

Pernot Creek Culvert Replacement

The existing stream crossing at Pernot Creek is a large double-pipe fish barrier. This culvert is located on the Road #1831 that runs on the valley bottom along Hehe Creek. The existing culverts are 4 feet in diameter and are placed side by side. In large storm events, flow could compromise the double-pipe culverts if wood and debris span or block culvert inlet. Replacement of both 4 ft. pipes with one large pipe arch that would allow fish passage and better accommodate

flow in high water events. Replacement would be done during the in-stream work window designated by the state and by following a strict dewatering plan. Due to the close proximity to Hehe and the fill/culvert removal immediately following the replacement and as water is allowed to reenter the stream channel a small amount of sediment may enter the stream channel and travel to Hehe Creek increasing the turbidity very slightly (1/4 of cubic yard). During the first storm event sediment may be washed from the new stream channel (perhaps 1-2 cubic yards) resulting in an increase in turbidity that may travel up to 500' down stream into Hehe Creek.

In-stream Habitat Enhancement

In-stream wood enhancement may result in some streamflow diversion into streambanks, potentially causing a short-term increase in bank erosion, increasing turbidity at the site scale. There may be some turbidity created from local bank erosion as streams adjust to wood placement. This sediment could travel up to 100 feet on average below areas of large wood placement. Structures would also capture new sediment and gravel in gravel bars.

A large log trash rack that spans Hehe Creek just above the bridge would be removed over several years. This would result in the redistribution and movement of a large gravel bar that has developed behind the trash rack since it was built in the late 1980s. The partial removal is necessary to ensure that the removal of the trash rack does not cause any damage to the Hehe Creek Bridge.

Road Maintenance

Road maintenance, blading, ditch work, brushing and the addition of ditch relief culverts would happen throughout the area prior to haul. The details surrounding this type of work are difficult to pinpoint prior to implementation. Ditches that are not currently functioning properly would be cleaned, if necessary, ditch relief culverts would be added to ensure ditch flow is filtered onto the hillside and not transported directly to stream channels. Road blading and the addition of rock would coincide with road use (wet and dry season haul) and current condition.

Alternative 1 (No Action) - Turbidity would continue to exist at elevated levels as a result of the continuation of chronic sediment delivery to the stream network from existing road system and past road failures. Poorly maintained roads would continue to be at high risk of failure, potentially delivering large volumes of sediment to the stream network and leading to periodic pulses of high turbidity. Turbidity levels increase naturally in many streams during high flows and expected natural fluctuations would be expected (Mills et. al., 2005). Streams that experience the greatest impact of unnatural turbidity levels are Hehe and Alder Creeks.

Alternatives 2 - This alternative would improve water drainage on the existing road network, reducing sediment delivery to streams, and subsequently reducing the periodic increases in stream turbidity. Turbidity would be slightly elevated from proposed road maintenance, road work, timber haul, and culvert replacement on Pernot Creek and in-stream wood enhancement projects.

Wet season haul would be permitted on some aggregate surfaced roads. Culvert replacement on small perennial or intermittent stream channels would typically result in a short-term, low magnitude increase in stream turbidity immediately downstream from the work site. Each stream channel culvert replacement planned near or on Fall Creek and lower Hehe Creek along with bridge abutment work on Hehe Creek and Alder Creek would cause the greatest increase in turbidity into Fall Creek. Because lower Hehe Creek and Fall Creek have less instream complexity, it is expected that turbidity would be of increase magnitude and duration. BMPs required for the described work would greatly reduce the magnitude and duration of turbidity, but would likely not eliminate all sources.

Timber yarding is not expected to cause any increase in delivery of eroded soil to the stream network, so no increase in turbidity is expected. There are no yarding corridors across any perennial streams, yarding corridors are well spaced and thinning prescriptions would leave down wood and are not likely to expose mineral soil. The no-harvest buffers would prevent any overland transport of soil from reaching stream channels.

Timber haul would likely increase stream turbidity. Wet season haul would be permitted on some aggregate surfaced roads. BMPs required for this work would greatly reduce the magnitude of turbidity increases, but would likely not eliminate all sources. Haul is not permitted during rainy periods on native surfaced roads, and other identified aggregate surfaced roads that have a higher potential for sediment delivery to streams. Wet weather haul would be allowed on aggregate surfaced roads 1824-163, 1825-217, 1825-218, 1825-219, 1825-240, 1828-402, 1828-407, 1830 and 1832 between November 1 and May 31 and paved surface road 1800, approximately 40 miles in total. Aggregate surfaced roads used for winter haul were surveyed and it was determined that with pre-haul reconstruction and maintenance, haul on these roads would only result in a minor increase in fine-grained sediment movement off road surfaces. Drainage would be adequate to prevent most of this material from entering the stream system, with additional ditch relief culverts installed where needed. Additional surfacing would be added to aggregate surfaced winter haul routes, reducing the probability of sub-grade exposure through rutting. BMP, R-20 Traffic Control during Wet Periods would be incorporated into the timber sale contract, which would allow the timber sale administrator to stop haul if and when the haul results in the delivery of sediment to streams. Sediment routing would be reduced through the use of silt fencing or straw bales (or similar) if monitoring reveals any areas of concern.

Road maintenance and reconstruction would likely increase turbidity in streams. A culvert replacement on a perennial stream channel would typically result in a short-term, low magnitude increase in stream turbidity immediately downstream from the work site. This effect would be realized upon completion of the perennial stream culvert replacements when streamflow is allowed to reenter the stream channel and pass through the new culvert, with a delayed impact during the first storm event. BMPs greatly limit the magnitude and duration of effect. It is estimated that the stream channel culvert replacements occurring at each perennial stream road

crossings of a minor tributary stream would result in approximately less than ¼ cubic yard of sediment delivered to the stream channel. The finer grained sediments would be suspended in the water column and transported downstream. The channel complexity in these minor tributaries is high; therefore, a visible turbidity plume is not expected to extend more than 200 feet downstream from work sites. Each perennial stream channel culvert replacement planned near Fall Creek and lower Hehe Creek could potentially deliver approximately ¼ to ½ cubic yard of sediment to the stream channel. These streams have less instream complexity, and therefore it is expected that there may be a visible turbidity plume extending as far as 500 feet downstream.

Approximately 8 (including Pernot Creek) perennial stream crossing culverts are identified for replacement by this project. Also depending on where it occurs in the watershed, replacing the small stream crossing culverts may or may not see the increase in turbidity reaching Hehe or Alder Creeks. If the work is taking place on roads across tributaries to the larger stream channels the turbidity reaching the adjacent tributary would likely be captured by the wood embedded throughout the small stream channels. New temporary road construction would not result in any increase in turbidity because there are no hydrologic connections.

Intermittent culvert replacements would not have a measurable effect on turbidity.

This alternative would defer the closure of roads within the project area, so there would be no immediate effect on turbidity. Future chronic and episodic delivery of soil from the road system to the stream network should be expected, with subsequent increased turbidity levels. Road #1831-381 would be reopened for project implementation and upon completion closed and more properly stabilized. A short, narrow portion of the Road #1832 has experienced numerous areas of side-cast failure. In this area the ground is steep (50-70% slopes) both above and below the road. The soil is shallow and rocky and units adjacent to this portion of the road are being excluded from harvest due to concerns of slope stability and the long-term need for this road.

The smallest short-term effects on water quality would be with Alternative 2 as compared to Alternatives 3 and 4, however not all aquatic risks would be resolved and after implementation of the project unnatural turbidity levels would still exist.

Alternative 3 - Bridge work, Pernot Creek culvert, in-stream restoration activities, and road maintenance would have the have the same effect as described as Alternative 2.

Turbidity would be elevated compared to Alternative 2 from increased soil into the stream from proposed road closure and decommissioning. Effects from culvert replacement on small perennial or intermittent stream channels would be slightly elevated due to increase road work but the effect would be similar to alternative 2. Effects to water quality would be the same on Fall Creek and lower Hehe Creek because road work within these reaches are similar between alternatives. BMPs required for the described work would greatly reduce the magnitude and duration of turbidity, but would likely not eliminate all sources.

The effect on turbidity would be similar to that described in Alternative 2 for all small stream crossing culvert replacements. This alternative would improve water drainage on the existing road network, reducing sediment delivery to streams, and subsequently reducing the periodic increases in stream turbidity. Timber yarding is not expected to cause any increase in soil erosion to the stream network, so no increase in turbidity is expected. There are no yarding corridors across any perennial streams, yarding corridors are well spaced and thinning prescriptions would leave down wood and are not likely to expose mineral soil. The no-harvest buffers would prevent any overland transport of soil from reaching stream channels. Timber haul would likely increase stream turbidity. Wet season haul would be permitted on some aggregate surfaced roads. BMPs required for this work would greatly reduce the magnitude of turbidity increases, but would likely not eliminate all sources. The same haul restrictions apply to this alternative as in Alternative 2.

Alternative 3 would have a greater level of short-term turbidity increase than Alternative 2 due to the implementation of road decommissioning work. The fill removed during the culvert removal would create some surface erosion from laid back slopes. This would be mitigated with mulching or placing of slash to reduce the effect of direct raindrop impact from the first winter storms. Sediment produced is dependent on the amount of road fill excavated to remove the culvert. It is estimated that a culvert with a small fill would generate <1 cubic yards of sediment, for a medium fill < 3 cubic yards and for large fill < 5 cubic yards over the first winter. Segments of the decommissioned road in between fill/culvert removals would either be waterbarred to disperse surface drainage and prevent connection to streams or sub-soiled to cause sediment-laden runoff to infiltrate. Berm closures would prevent further use that could cause more rutting and erosion in winter. All unstable sidecast would be pulled from above steep slopes below and placed against the hill slope side of the road bed. All waste from fill removals would also be compacted and shaped on the hill slope side of the road bed. All bare mineral soil would be grass seeded to prevent surface erosion. There would also be an immediate and long-term reduction in sediment erosion potential due to this work, and therefore there would be a net decrease in road-related stream turbidity throughout the watershed over time. This work is expected to reduce and prevent the delivery of sediment to Hehe Creek from this portion of failing road.

Fuels treatment is not expected to occur near streams. Research indicates that hill slope overland flow rarely occurs in this area with these soil types (Horton, 1933). The no-harvest buffers would adequately filter any sediment eroded from the treated areas prior to reaching the stream network. This activity would not increase turbidity.

The effects to water quality would be greater in alternative 3 compared to alternative 2, however the effects would be less than alternative 4.

Alternative 4: Bridge work, Pernot Creek culvert, in-stream restoration activities, and road maintenance would have the same effect as described as alternative 2.

Turbidity would be elevated compared to alternative 2 and 3 from increased soil into the stream from proposed road closure and decommissioning. Effects from culvert replacement on small perennial or intermittent stream channels would be slightly elevated due to increase road work but the effect would be similar to alternative 2. Effects to water would be the same on Fall Creek and lower Hehe Creek because road work within these reaches are similar between alternatives. BMPs required for the described work would greatly reduce the magnitude and duration of turbidity, but would likely not eliminate all sources.

This alternative would have the same level of positive effects on long-term turbidity levels, but a slightly higher short-term increase in turbidity compared to Alternative 3 because of the associated reconstruction of Road #1831-381. The work to decommission this portion of the Road # 1831 is expected to reduce and prevent the delivery of sediment to Hehe Creek. During reconstruction and use of the road proposed by this alternative there would be an initial increased risk of sediment delivery to Hehe creek. In order to use this currently failing road, equipment and road fill would have to be brought in and the road would essentially need to be rebuilt for approximately ½ a mile along and across Hehe Creek. This work is not implemented in the other alternatives.

This alternative would improve water drainage on the existing road network, reducing sediment delivery to streams, and subsequently reducing the periodic increases in stream turbidity.

Timber yarding is not expected to cause any increase in soil erosion to the stream network, so no increase in turbidity is expected. There are no yarding corridors across any streams, yarding corridors are well spaced and thinning prescriptions would leave down wood and are not likely to expose mineral soil. The no-harvest buffers would prevent any overland transport of soil from reaching stream channels.

Timber haul would likely increase stream turbidity. Wet season haul would be permitted on some aggregate surfaced roads. BMPs required for this work would greatly reduce the magnitude of turbidity increases, but would likely not eliminate all sources. The same haul restrictions apply to this alternative as in Alternative 2.

Fuels treatment is not expected to occur near streams. Research indicates that hillslope overland flow rarely occurs in our area with our soil types (Horton, 1933), and the no-harvest buffers would adequately filter any sediment eroded from the treated areas prior to reaching the stream network. This activity would not increase turbidity.

Alternative 4 has the greatest effect on water quality of the action alternatives.

Cumulative Effects – Water Quality

The cumulative effects analysis area for water quality was the entire Fall Creek watershed. Existing conditions are a result of past management effects described in previous sections. No additional Forest Service management actions are planned in the foreseeable future in the Fall Creek watershed, limiting the cumulative effects to water quality. Current projects (primarily timber sales) with potential cumulative effects occurring within the Fall Creek watershed in conjunction with the Hehe LSR Thin Project are listed in Appendix B. All ongoing timber projects besides the Fall Creek Special Interest Area (SIA) Fire Recovery project are commercial thinning projects and leave large riparian no-cut buffers. The Fall Creek SIA Fire Recovery Project includes the work related to the Clark Fire that burned directly along the Road #1800 within the primary and secondary shade zones of Fall Creek. Effects from the ongoing projects would last between 5-20 years after completion of the projects. About 18.5% of the watershed in private ownership is lower in the watershed and along Fall Creek. The private ownership is mostly residential. Given the amount of federal land ownership in this watershed, very little cumulative effects on water quality would result from management on the private land.

The Fall Creek SIA Fire Recovery Project had to remove approximately 45 large high rated hazardous trees in the primary and secondary shade zones. Trees removed contributed approximately 3% of the total large trees within the zone from 0 to 100 feet from the edge of Fall Creek. It is estimated that the trees removed contributed approximately 0.7% of the total potential stream shade. The loss of this small percent of potential shade would not result in a measurable increase in stream temperature over the stream reach, (Johnson, 2004). All alternatives in the Hehe LSR Thin Project would retain suitable riparian buffers and canopy cover. In conjunction with the Fall Creek SIA, these actions would have no cumulative effects to stream temperature in Fall Creek watershed.

Alternative 1 (No Action) - Alternative 1 (no action) would not create any new disturbance, but it would not enhance the recovery of any existing disturbed areas.

Current sediment delivery from degraded road systems would continue to increase stream turbidity. Water quality and in-stream characteristics would continue to be below desired conditions. As existing roads along the valley bottoms persist with very little road maintenance chronic sediment delivery would continue. Overstocked Riparian Reserve stands would recover over a long period of time and stream temperature would slowly decrease as a result.

Alternative 2 - This alternative would result in additional watershed disturbance. All timber harvest and most road work would occur on previously disturbed areas. Project disturbances would affect a relatively small percentage of the affected watershed and in the short-term would likely result in a slight increase in stream turbidity, increased fine substrate in streams, and change the wood delivery rates to streams (see subsequent analysis). All of these short-term effects are expected to be offset by long-term positive benefits.

Timber felling would affect 3,186 acres of previously disturbed timber stands, with no new disturbance. Disturbance effects associated with timber yarding would be very limited due to the implementation of BMPs, and relatively small log size. Landings constructed for this project would disturb 6.6 acres of previously intact land but would disturb 36.3 acres of previously impacted land. Road reconstruction and maintenance would occur on existing disturbed sites, and would therefore not cause any new disturbance. The construction of new temporary roads would impact about 7.8 acres of previously undisturbed land. Road decommissioning would disturb previously impacted sites, but would allow for the recovery of these sites in the long-term, beneficially affecting this indicator.

Fuels treatment would impact 2,137 acres of the project area, but would all be within units or on landings, so there would be no new disturbance to previously intact areas. In-stream wood additions would likely not result in any change in the watershed disturbance condition, the disturbance would likely result in minor negative effects to stream turbidity and channel substrate. The extents of these effects were discussed previously in this document.

Implementation of this alternative would not allow for road closures that address all concerns identified with the road system. Maintenance dollars over the next 10 years would not align with the cost of road work necessary to address sediment sources that could reach the streams. This would result in continued and chronic sources of increased turbidity. Stream crossings on unused roads that are not properly maintained can plug and fail and cause debris torrents and delivery of sediment and road fill material to the stream channels. A lack of maintenance can also lead to increased ditch flow, where adequate cross drain culverts do not exist or are not maintained ditch flow can dig and travel long distances to stream channels also increasing turbidity. Alternative 2 would not have as great long-term benefits to the Fall Creek watershed because the acreage treated is much less, however, some areas of the Riparian Reserves would function more naturally as stands reach old growth characteristics and as a result provide additional stream shade.

Alternatives 3 and 4 – These two alternatives would affect the watershed disturbance in a similar manner as that described for Alternative 2. For Alternative 3, the magnitude of effect would be slightly higher, with 2.7% more area disturbed, due to larger unit size, additional units, and more landings and fuel treatment areas. For Alternative 4, the magnitude of effect would be slightly higher, with 4.7% more area disturbed than in Alternative 2, and 2% more than Alternative 3, due to larger unit size, additional units, and more landings and fuel treatment areas. This higher level of disturbance would likely result in slightly higher short-term negative effects to stream turbidity, channel substrate, and instream woody material, when compared to Alternative 2.

Cumulative effects would greatly reduce unnatural levels of sediment delivery to the Hehe Creek watershed, contributing to decreasing levels of sediment in the Fall Creek watershed. Treated

areas of the Riparian Reserves would function more naturally as stands reach old growth characteristics and as a result provide additional stream shade.

Table 42 - Watershed Disturbance Levels

	Scale	Existing Conditions		Percent of Project Area Affected by New Disturbance							
				Alt 1		Alt 2		Alt 3		Alt 4	
		Total	Recent	New	Prev	New	Prev	New	Prev	New	Prev
% Area Disturbed	Fall Ck 5 th field Watershed	48.7	9.7	0	0	3.3	9.7	3.9	9.7	4.3	9.7
	Hehe Ck 6 th field Sub Watershed	47.3	9.4	0	0	15.2	9.4	17.9	9.4	19.9	9.4

AA = Analysis Area

Recent = disturbed within the last 20 years.

New = total % area disturbed with the action that was previously unaffected by natural or human-caused disturbance.

Prev = total % area disturbed with the action that was previously disturbed.

Aggregate Recovery Percent

The hydrologic condition of the project area was assessed using the Aggregate Recovery Percent (ARP) method as described in the LRMP. This is a method for assessing the potential effects of past management (created openings) on runoff patterns by predicting the current vegetative condition of the landscape, and assessing the rate of snow accumulation and melt via rain and wind. The Forest Plan divided the landscape up into planning sub-drainages based on the average drainage slope and percent of the area in the transient snow zone. Each sub-drainage is assigned a mid-point ARP value. This mid-point value is used as a threshold of concern; when current conditions or planned conditions drop below the mid-point value, there is the potential for an increase in peak flows which may result in channel scour or streambank erosion. Table 43 shows that all sub-drainages within the Hehe Creek sub-watershed are well above the assigned mid-point values, so it is unlikely that there would be any current peak flow issues. There has been no timber harvest within the federally managed portion of the Hehe Creek sub-watershed (97.5% of the watershed area) for the last 25 years, allowing for the reestablishment of previously managed timber stands, and the attenuation of past management effects on flow.

Alternative 1 (No Action): This alternative would not change the condition of any overstory vegetation. Existing stand conditions would continue to recover to hydrologically functioning condition. Stream flows would remain at near natural levels.

Alternative 2: Activities associated with the implementation of this alternative, specifically timber felling, and road construction, would reduce the ARP values as compared to the No Action

Alternative. However, these activities would not reduce ARP below the mid-point value for any of the alternatives. Timber harvest and new temporary road construction would have some effect on the rate of snow accumulation and melt. It is estimated that this would only result in a very minor, non-discernible change in stream flows. Recovery of the treated stands would naturally occur with understory development and canopy closure expected in the years following the thinning. New road effects would be short-term, as the roads would be decommissioned following use.

Alternative 3: This alternative would have a very low, non-discernable, effect on stream flows similar to Alternative 2. Slightly lower ARP levels correspond to the greater extent of the harvest units, but values remain above mid-point thresholds.

Alternative 4: This alternative would also have a very low, non-discernable, effect on stream flows similar to Alternatives 2 and 3. This alternative has the greatest negative effect on ARP levels, due to the greatest extent of the harvest units, but values still remain well above mid-point thresholds.

Table 43 - Aggregate Recovery Percentages

ARP Model Result	Existing Condition	Midpoint Value	ARP Condition After Project Implementation ¹			
			Alt 1	Alt 2	Alt 3	Alt 4
15I Upper Hehe	94	80	95.8	90.3	89.4	88.3
15G Sunshine-Pernot	89	80	91.9	88.6	87.9	87.6
15F Alder	89	85	93.7	92.8	92.5	91.7
15H East Hehe	88	80	93.3	92.1	90.8	90.6
15J Tiller	84	75	89.3	87.1	85.9	85.7
15E Jones	92	75	88.9	87.7	87.7	87.7
15R Puma	95	75	95.9	94.9	94.9	94.9
15Q Pacific-Marine	88	75	91.4	91.3	90.8	90.8
Hehe Sixth Field Sub watershed	89	79	91.4	91.3	90.9	90.4

Note: 1 = ARP values are constantly recovering as previously harvested stands of trees grow and regain their hydrologic function. The values reported are the expected condition at a point in time 3 years from present, when projects would be in the midst of completion.

Consistent with Clean Water Act (PL92-500, as amended in 1977 and 1982)

Fall Creek within the project area is listed as water quality limited for temperature because it exceeds the temperature criterion of 17.0°C for salmonids. Planned harvest would not occur within the primary shade zone and harvest would not remove more than 50% canopy closure in the secondary shade zone, as described in the TMDL implementation strategy. All of the alternatives for this project would have a neutral short-term effect on stream water temperature, and will potentially reduce stream water temperature in the long-term due to improved tree health, height, and canopy size with the proposed silvicultural treatment.

All alternatives would increase turbidity levels in streams within the project area, primarily due to road improvements and road decommissioning. These effects are not expected to exceed the point-source turbidity thresholds established by ODEQ. All action alternatives would result in short-term negative effects that would be offset by short-term and long-term reductions in chronic sediment sources, and reduced risk of episodic large-scale sediment delivery to streams, thereby resulting in reduced turbidity levels in the future.

All alternatives are consistent with this direction.

Stream Conditions

Existing Conditions – Instream Riparian Wood

Field reviews and stream survey data indicate that tributary streams in the Hehe Creek sub-watershed have abundant instream wood, although the mean piece size is often small. Large sized instream wood is infrequent, especially in the riparian areas previously impacted by timber management. Lower Hehe Creek and Fall Creek have the lowest frequency of large wood. Table 44 shows the existing condition for surveyed tributaries. Past timber harvest and road locations have reduced the total amount of trees available for recruitment to the stream network, especially along Hehe Creek and Fall Creek. These two stream systems respond very quickly to rainfall events, with rapidly increased stream volume and energy. This produces a high level of stream energy to rapidly transport woody material out of the watershed.

Direct and Indirect Effects - – Instream/Riparian Wood

Summary of effects

All of the action alternatives include stream restoration projects which would improve the wood components and stream channel conditions in the short-term. The thinning treatments in the Riparian Reserve zones would remove a portion of the wood which could potentially be routed into the stream network in the future. The effect of thinning in the Riparian Reserves which increases the size of trees would have a long-term beneficial affect to stream conditions by contributing larger wood piece sizes to the stream network.

Effects of Alternatives

Alternative 1 (No Action) - This alternative would forego instream placement of trees, and instream wood levels would remain approximately the same as existing conditions but made up of small piece sizes until riparian stands slowly develop.

Alternative 2 - Short-term effects: All action alternatives would include the placement of 600 large pieces of woody material into three stream reaches as shown in Table 44. Wood frequencies would increase, and this wood would be immediately available for downstream transport to Fall Creek. Logs used for restoration would come from a variety of resources such as blow down, hazard tree removal or decks of logs from old timber sales that are no longer of value. Logs harvested with the Hehe LSR Thin project would not be used for restoration activities. Log placement would take place using helicopters during the in-stream work period. Selective riparian thinning would also add up to 100 trees by directionally falling trees in to the upper stream reaches of Hehe Creek.

Long-term: The zone that provides the majority of instream woody material extends from the channel up slope approximately one tree height. This is defined as the Stream Influence Zone (SIZ). This alternative would thin within 70 feet of this zone on perennial streams other than Fall Creek, Hehe Creek, or Alder Creek. Harvest and subsequent yarding within this zone removes potential stream recruitment trees from the watershed, potentially reducing the number of pieces of wood, over time, which would be in the stream network. However, this work is returning the tree density in the managed plantations to a more natural level. Residual trees would typically grow to a large size in a quicker timeframe, so in the long-term treated stands would be a better source of large sized trees, important for the establishment of high quality fish habitat and anchor points for debris jams. This alternative would not thin within the older stands (> 60 years old). No harvest buffers would also retain the streamside trees, most likely to be recruited to the stream network over time. This management would provide a complex series of tree ages, sizes, and densities throughout the Hehe Creek sub- watershed. This would provide a constant source of small to large wood at varying times to the stream network. Overall, there may be a slight, site specific negative effect to this indicator, but the source material for the long-term recruitment of instream wood would be improved, more closely matching natural recruitment levels.

Alternative 3 (Proposed Action) - The effects associated with the implementation of this alternative are similar to those described for Alternative 2. Short-term effects may be slightly higher based on a greater extent of riparian area to be treated with additional harvest units. However, this alternative would experience greater long-term benefits by providing a constant source of small to large wood at varying times to the stream network.

Alternative 4 - The effects associated with the implementation of this alternative are similar to those described for Alternative 3. Short-term effects would be slightly higher, based on a greater extent of riparian area to be treated with additional harvest units. The SIZ would be thinned to a

lesser density and some of the streamside trees that would be recruited would take longer to contribute to the stream network. In the long-term the tree density in the managed plantations would resemble a more natural level.

Table 44 - Existing in-stream woody material frequency and short-term project effects

Streams	In-stream Wood Frequency (pieces/mile)						
	Existing Conditions		Immediately After Project Implementation				
	Large	All Pieces (including small and mediums)	Alt 1		Alt 2, 3, 4		
			Large	All Pieces (including small and mediums)	Large	Medium/Small	All Pieces (including small and mediums)
Alder Creek	2-8	96	2-8	96	~93	96	~190
Tiller Creek	2-8	126	2-8	126	~95	126	~220
Lower Hehe Creek	2-8	100	2-8	100	~94	100	~195
Upper Hehe Creek	2-8	150	2-8	150	2-8	250	~260
Fall Creek	2-8	48	2-8	48	2-80	48	48

Table 45 - Long-term effects on wood recruitment potential

% PWRZ Previously Affected	Percentage of Potential Wood Recruitment Zone Affected			
	Alt 1	Alt 2	Alt 3	Alt 4
40%	0%	13%	16%	18%

Existing Conditions – Channel Complexity

Hehe Creek and Fall Creek have simplified channel structure partially from their natural characteristics, low levels of instream wood and high energy runoff that easily mobilizes recruited wood and channel substrate. Streambanks in Hehe and Fall Creeks appear to be rather stable and both creeks in the low reaches have a fairly wide valley floodplain area. Both are constrained by main valley bottom roads that run along one side.

Table 46 - Pools per mile within Project Area

Alder Creek	Tiller Creek	Lower Hehe Creek	Upper Hehe Creek	Fall Creek
33	50	22	40	34

Direct and Indirect Effects - – Channel Complexity

Summary of Effects

Stream complexity and large wood per mile ratios would benefit from restoration activities in all of the action alternatives. The road work associated with the action alternatives would have a short-term effect that would impact the pool frequency and habitat quality. However, in the long-term the effects would increase pool frequencies and improve pool quality.

Effects of Alternatives

Alternative 1 (No Action): This alternative is not anticipated to affect stream channel complexity features. The stream channels would continue to change during high flow events and stabilize in a cyclical and dynamic way depending on rainfall and wood recruitment events. The lack of road maintenance would continue to allow unnatural levels of fine sediment that could potentially reduce pool frequencies.

Alternative 2: Planned additions of large wood to Hehe Creek, Tiller Creek, and Alder Creek would result in an immediate increase in pool frequency, as the added stream roughness elements would create scour points and dam water. Pool quality would increase because of added cover and depth and the creation of areas of reduced stream velocity. There may be a short-term negative effect on streambank stability as the stream adjusts to the newly added woody material. This action mimics a natural disturbance event. Over the longer term the added stream complexity would create meander and velocity breaks that would ultimately result in a reduction in bank scour. Wood additions would allow streams to connect to side channel habitat and more frequently interact with their floodplains. All of these immediate effects would also be realized in the longer term, as the riparian thinning increases the quality of potential stream recruitment trees, providing larger key pieces of wood that would help capture smaller wood pieces, resulting in complex woody material jams.

Road work is proposed to treat low miles of at-risk roads to aquatic habitat. There would be short-term effects on pool frequency and habitat quality. Because few miles of at-risk roads would be addressed, channel complexity would be more affected in the long-term by unnatural sediment delivery that would decrease pool frequency and pool quality.

Alternative 3 (Proposed Action): Effects would be similar to those described for Alternative 2. Differences occur from increased road maintenance and closure that would result in an increase in

the sediment delivery rates in the short-term, potentially filling in pool habitat immediately downstream from the work sites. However, this work is designed to greatly reduce the potential long-term sediment delivery rates, and reduce the existing chronic sediment sources. Therefore, in the long term it is expected that this alternative would lead toward increased pool frequencies, and improved pool quality.

Alternative 4: Effects would be similar to those described for Alternatives 2 and 3. Increased road work would have a slightly higher short-term effect that could potentially fill in pool habitat. However, in the long-term the effects would be similar to Alternative 3 by potentially increasing pool frequencies and improving pool quality.

Riparian Reserves

Approximately 40 percent of the 9,037 acres of Riparian Reserve in the Hehe 6th field sub watershed have been impacted by past management or natural disturbances. Field observations and review of aerial photographs found that most riparian areas are slowly recovering to a more natural condition. Riparian management in the Hehe sub watershed has not occurred in the last 25 years.

Alternative 1 (No Action) - This alternative would allow for the continued slow rate of recovery toward natural condition. No restoration would occur. Some areas of the Hehe project area have riparian stands with overstocked plantation trees of uniform age, with limited diversity.

Alternative 2 - This alternative would affect 1,138 acres of the Riparian Reserve network (table 18) in previously managed stands. 340 acres would be thinned using the heavy thinning prescription (50 trees/acre, ~35% canopy cover), 596 acres would be thinned using the moderate thinning prescription (75 trees/acre, ~45% canopy cover), and 202 acres would be thinned using the light thinning prescription (100 trees/acre, ~50% canopy cover). Thinning would increase the stand structural diversity. Broadcast burning would not occur as a fuel treatment in Alternative 2 and Riparian Reserves would not be affected. New landings or existing landings would not be built or used in Riparian Reserves. Restoration efforts would selectively thin up to 100 small, non-dominant firs directly within the Riparian Reserve that are over crowded. Efforts would increase in-stream complexity and provide opportunity for increase growth among overcrowded trees. The management proposed for the riparian areas would be carefully controlled to minimize any short-term negative effects, with the intention of increasing the health and vigor of the treated stands, allowing for a more rapid recovery toward natural condition. Trees in thinned riparian stands would grow to a larger size than untreated areas, therefore potentially providing larger-sized instream wood, and taller trees with broader canopies may provide more stream shade than in the untreated areas. There may be minor short-term negative effects associated with loss of woody material. These effects are described in more detail in subsequent sections of this document.

Alternative 3 (Proposed Action) - This alternative would affect 1,387 acres, a slightly higher percentage (Table 47) compared to alternative 2. 374 acres would be thinned using the heavy thinning prescription, 285 acres would be thinned using the moderate thinning prescription and 728 acres would be thinned using the light thinning prescription (see alternative 2 for definition of thinning prescriptions). Proposed fuel treatments would include broadcast burning 281 acres that are primarily near the no-cut buffers of the Riparian Reserves. Fire line would not be constructed and water resources would be used to prevent burning from occurring in the no-cut buffer. The magnitude of effect to the riparian areas would be similar to that described for Alternative 2, and the long-term positive effects would also be similar. There would be minor short-term negative effects associated with loss of woody material. These effects are described in more detail in subsequent sections of this document.

Alternative 4 - This alternative would affect the most acres in the Riparian Reserve network. A total of 1,597 acres would be affected by thinning 526 acres using the heavy thinning prescription, 329 acres using the moderate thinning prescription and 742 acres using the light thinning prescription (see alternative 2 for definition of thinning prescriptions). No-cut buffers are also reduced by thinning closer to the stream. This reduction in stream buffer width would potentially result in additional negative effects to water quality. Proposed fuel treatments would broadcast burn 363 acres that are primarily near the no-cut buffers of the Riparian Reserves. Other long-term beneficial effects would be slightly higher than identified for Alternatives 2 and 3, as the treated stands of trees would potentially grow more vigorously, resulting in larger sized instream wood upon recruitment, and taller canopies may provide a better source of stream shade. There would be minor short-term negative effects associated with loss of woody material. These effects are described in more detail in subsequent sections of this document.

Table 47 - Riparian Reserve Treatment Summary

Stream Category	Total Riparian Reserve Acres	Acres and Percentage of Riparian Reserves Treated						
		Alt 1	Alt 2		Alt 3		Alt 4	
		Acres and %	Acres	%	Acres	%	Acres	%
Fish bearing	2,295	0	126	1.4	203	2.3	255	2.8
Perennial	563	0	52	0.6	61	0.7	69	0.8
Intermittent	6,179	0	960	10.6	1,128	12.5	1,273	14.1
Total	9,037	0	1,138	12.6	1,392	15.5	1,597	17.7

Cumulative Effects – Stream Conditions

The cumulative effects analysis area for stream conditions was the Fall Creek watershed. Existing conditions are a result of past management and these effects have been described in the previous sections. No additional Forest Service management actions are planned in the foreseeable future in the Fall Creek watershed and as a result will greatly limit the cumulative effects to stream structure indicators. Current projects (primarily timber sales) with potential cumulative effects occurring within the Fall Creek watershed in conjunction with the Hehe LSR Thin Project can be viewed in Appendix B. All ongoing timber projects besides the Fall Creek SIA Fire Recovery Project are commercial thinning projects and leave large riparian no-cut buffers resulting in no cumulative effects to the stream structure indicators. The Fall Creek SIA Fire Recovery Project includes the work related to the Clark Fire that burned directly along the Road #1800 within the primary and secondary shade zones of Fall Creek. Affects from the ongoing projects would last between 5-20 years after completion of the projects.

The Fall Creek SIA Fire Recovery project had to remove approximately 45 large high rated hazardous trees in the stream influence zone (SIZ). Trees removed could have contributed to in-stream wood levels that would have helped stabilize stream complexity by improving pool frequency/quality, streambanks, w/d ratio, floodplain, and side channels. The trees removed contributed approximately 3% of the large trees within the SIZ. Restoration activities completed by the Fall Creek SIA Fire Recovery Project included placement of large logs directly into Fall Creek affected by the fire. Due to the small percentage of trees removed and the logs placed by restoration activities, stream structure indicators are not measurably impacted.

Alternative 1 - Cumulative effects generated from the no action alternative would include suppressed stream influence zones within the Riparian Reserves in the Hehe Creek watershed and would prevent any restoration activities from occurring. Sections of the SIZ in the Hehe Creek sub-watershed are not actively contributing key pieces of wood to live streams and the prevention of restoration activities would not place large logs that could be transported downstream that would help stabilize stream conditions within the Fall Creek watershed. Without management bank stability, wood recruitment rates and in-stream wood counts would recover over an extended period of time.

All Action Alternatives: Cumulative effects generated from all action alternatives include past restoration efforts from the Fall Creek SIA Fire Recovery project, placement of 600 large logs directly into live streams from the Hehe LSR Thin Project and treated stands in SIZ. Placed logs have the potential to move downstream and would cumulatively benefit the entire Fall Creek watershed by improving pool frequency/quality, streambanks, width/depth ratio, floodplain, and side channels.

Thinning in the SIZ would increase stand health. Remaining trees would experience increased growth rates and as a result would help stabilize stream banks within the Hehe Creek sub-

watershed. As these trees grow they would become better key pieces for stream recruitment within the Hehe Creek sub-watershed. These cumulative effects to the SIZ would not be as great in alternative 2 due to the lesser degree of treatment.

Aquatic Conservation Strategy (ACS)

All action alternatives prescribe management within the Riparian Reserves. This management was designed to improve the long-term function of the reserves in regard to providing high quality water and fish habitat conditions. This may involve some short-term negative effects that would be offset by long-term improvements. The project area is not in a key watershed. Watershed analysis was completed for the Fall Creek watershed in 1995. General recommendations from that analysis regarding riparian management were incorporated into project design. Other watershed restoration is planned, with the addition of woody material into streams, road decommissioning, and road drainage improvements.

The Project addresses these recommendations directly by the scale, scope, and methods chosen for harvest, road decommissioning, soil remediation, culvert replacement, and low-impact fuels treatments. Any of the action alternatives would result in a stable or an increase on fish populations based on the increase of larger tree sizes that are supplied to stream channels, an increase in habitat connectivity as barrier culverts are replaced, a decrease of road-generated fine sediments as roads are maintained or closed, and a reduced risk of wildfire as fuels are removed or consumed by fuels treatments. The end result would be the project area and watershed that is on a trajectory towards greater functionality through increased resilience to local disturbances and resistance to large scale, catastrophic instability.

The Project activities would be in accordance with the ACS objectives since maintenance of the existing aquatic habitat would be insured through the no-treatment buffers. Road maintenance and road decommissioning would lead to a reduction in fine sediment delivered to fish habitat. Road maintenance would include the addition of necessary cross drain culverts to establish disconnect of ditch flow from stream channels. This would allow ditch flow to filter out in vegetation on the hillslope, rather than travel in the ditches and directly deliver at stream crossings. Road decommissioning is planned to remove impact of valley bottom roads. Riparian habitat would endure a short-term moderate degradation due to the thinning; but this same activity would, within several decades, produce a substantially enhanced riparian condition as the remaining trees respond with increased growth rates and a more diverse understory develops beneath these trees. Habitat connectivity would be enhanced through the replacement of a culvert that is currently a migratory barrier. Flow regime would remain largely unchanged given the present and estimated future ARP values for the Project area.

This project is consistent with the ACS because it is designed to contribute to maintaining or restoring the project area and watershed condition over the long-term, with only minor short-term

negative effects. Refer to Appendix F for the ACS management direction and more information on how the project addresses the ACS objectives.

Fisheries

Non-Significant Issue - The project area contains habitat for spring Chinook salmon, a fish species listed as threatened. The project area also contains numerous sites with unstable slopes, soil erosion, and sedimentation sources that can reach the stream network. During fall and winter rains, major streams in the area such as Fall Creek and Hehe Creek currently carry a heavy suspended sediment load. Physical impacts from increased concentrations of suspended sediment can be detrimental to fish of various life stages, resulting in egg abrasion and direct mortality.

Existing Conditions - Fisheries

Fish presence/absence surveys have been recently conducted for all perennial streams throughout the Hehe Creek sixth field subwatershed. These surveys documented a diverse assemblage of fish species in Fall Creek, including Chinook salmon, steelhead, rainbow trout, cutthroat trout, mountain whitefish, redbreast shiner, speckled dace, large-scale sucker, brook lamprey, and sculpin species. Tributaries to Fall Creek provide habitat for fewer fish species, typically only minor use by Chinook salmon and steelhead, and more use by rainbow trout and cutthroat trout. Fish bearing streams with known distribution of Chinook salmon, steelhead, rainbow and cutthroat trout, are shown in appendix A.

More specific habitat use data is available for Chinook salmon. Chinook salmon spawning habitat within the project area is limited to Fall Creek, and is heavily utilized. Use of lower Hehe Creek is limited to juvenile foraging and rearing habitat. Migration of anadromous fish is partially restricted by the presence of Fall Creek dam, located approximately 22 road miles downstream from the project area. Upstream migration past the dam is facilitated by the USACE via trap and haul, and continued distribution of these fish is dependent on this effort. Fry mortality through the dam is approximately 0%-10% while juvenile mortality ranges between 10%-50% depending on flow. (Taylor, *et al.* pers. com. 2007)

All potential habitats for MIS-Resident fish within the project area is currently accessible and utilized, with the exception of one existing culvert in Pernot Creek that blocks the upstream movement of cutthroat trout.

The field examination for fish within the Hehe Creek sub-watershed show relatively high densities of both anadromous and native fish. Natural production is successful at maintaining viable populations. Low levels of juvenile Chinook salmon production in some years are likely attributable to the flashy nature of the hydrograph for the Fall Creek fifth field watershed, which

may displace these fish or scour eggs from redds. Warmer than ideal water temperature in adult holding habitat and juvenile rearing habitat may be slightly reducing growth and survival.

Human impacts exist, related to the high fishing pressure for rainbow trout along Fall Creek that allows bait, lures, and fly harvesting methods, and recreational harassment at swimming areas. Chinook are not allowed to be targeted or harvested because of ESA protection and ODFW regulation, but do experience indirect fishing related stress and mortality because of trout fishing.

Direct and Indirect Effects -- Fisheries

Summary of Effects

The harvest activities associated with all action alternatives may have a short-term negative effect of fish population, but long-term beneficial effect on habitat conditions which would increase the population numbers. Consultation has been completed with the regulatory agency (National Marine Fisheries Service) and a Biological Opinion is pending. The activities associated with Alternatives 2, 3, and 4 would have an effect determination of “may affect, likely to adversely affect” for the spring Chinook salmon. This project has been designed to promote the conservation of the ESA-listed spring Chinook salmon.

Effects of Alternatives

Alternative 1 (No Action) - This alternative would allow for the slow recovery of riparian and stream conditions. Chronic and episodic inputs of sediment from the existing road system would not be reduced and could result in negative effects to fish. The existing barrier culvert limiting upstream movement of cutthroat trout would likely remain in place

This alternative would have no immediate effect on fish growth or survival. Over the long-term, lack of road maintenance may result in large depositions of fine substrate, which would result in the loss of fish habitat, reduced spawning success, reduced fish fitness, and subsequent survival and even increased mortality depending on the size and location of the road failure.

Fish population sizes would likely continue to be maintained at current levels. This alternative doesn't upgrade existing problem roads, and therefore chronic and/or episodic sediment delivery from unstable road systems would continue to slightly depress the survival rates of fish in habitat near these roads, potentially leading to a slight reduction over time in the population size.

Effects Common to Alternatives 2, 3 and 4: Fish would likely continue to use the streams within the project area, with similar species distribution. Adverse effects to fish habitat would be localized, and minor in magnitude, with no long-term loss of habitat. The existing barrier culvert would be replaced, removing the isolation barrier, potentially benefiting the genetic health of the previously isolated group of cutthroat above the existing barrier.

Alternative 2: The analysis of effects on water quality in this document determined that there would be minor negative effects on stream turbidity and channel substrate, and wood recruitment

rates. These effects would be short-term in nature, with a longer term positive effect. Effects to turbidity and sediment are primarily caused by road work, haul, and instream wood additions, while effects to wood recruitment rates are caused by timber harvest. Wood recruitment would also be immediately benefited by direct placement of wood in tributary streams. Stream temperature would not be directly affected.

Fish would be affected by these changed habitat conditions. Predicted short-term increases in turbidity and fine-grained substrate would affect 2,820 feet of fish bearing streams. Turbidity increases may displace salmonids, or affect feeding rates. Increased fine-grained substrate may result in the loss of interstitial space between larger stream substrate material (gravels and cobbles), reducing the quality or availability of fish rearing habitat. Added fine substrate to fish bearing streams may result in covering of redds which reduces oxygen flow and could potentially reduce the egg-fry survival rate. Increased fines in Fall Creek may result in negative effects to Chinook salmon, with ESA implications.

The potential negative effect associated with the short-term reduction in wood available for recruitment to streams is very site-specific. When potential sources of wood throughout the Hehe SUB- watershed are considered, the short-term effect of the timber harvest would be very minor. Effects would also be offset by the addition of 600 off-site logs to three tributaries, and the streamside recruitment of 100 whole trees into Hehe Creek. Fish are unlikely to be negatively affected by the change in available wood due to harvest and beneficially affected in the short and long-term by in-stream wood additions and riparian silvicultural management.

This alternative may result in a slight negative effect to fish growth rates. Effects of sediment to fish are based on two key components, the concentration of the sediment and the duration of exposure (Macdonald and Newcomb, 1991). The most sensitive life stage for salmonids is the egg and fry stage during the incubation period, juvenile and adult life stages are more resilient to sediment effects (Anderson, 1996). Because sediment generated is predicted to be both of low concentration and short duration of exposure, there would be no mortality experienced to juvenile or adult life stages. These life stages would alter their locations to avoid the stressor and because sediment is predicted not to travel great distances, displacement would be very limited. The incubating process for egg and fry life stages would have a minor short-term impact that could generate a very slight decrease in survival rates. Increased turbidity levels may negatively affect the ability of fish to feed. Loss of interstitial space and fine sediment deposition may affect egg-fry survival in redds, and juvenile entrapment in channel substrate (Chapman, 1988). In the longer term, this alternative may eventually result in larger scale negative effects related to increased sediment delivery to streams as few at-risk aquatic roads are decommissioned.

This alternative would likely result in a minor reduction in fish population numbers immediately following project implementation, due to the potential for reduced survival during the incubating process associated with increased sediment delivery. Longer term, habitat conditions would

remain at risk due to the failure to improve the chronic road related sediment sources. Instream restoration may offset some of the sediment effects. Population numbers would likely stay static.

Alternative 3 (Proposed Action): Effects to the fish resource would be similar to those described for Alternative 2. There would be a higher level of sediment delivered to fish bearing streams with this alternative due to the increased number of roads identified for closure and decommissioning, a total of 3,820 feet of fish bearing streams would be affected. This extra work would also reduce the magnitude of negative sediment inputs in the long-term. In the longer term, the proposed work with this alternative would lead to a reduction in the chronic sediment delivery rate, and a large reduction in the potential volume of sediment that would be delivered during a infrequently occurring precipitation event, or road drainage failure. Planned improvements to the road drainage system and road closures would greatly diminish the risk of this occurring. The effect to wood level is the same.

This alternative would result in a higher rate of negative short-term effect than that described for Alternative 2 due to the increased level of road decommissioning and closure. This work causes some short-term addition of fine substrate to the stream channel. Longer term, road decommissioning would result in a reduction in the potential volume and frequency of sediment inputs, leading to positive effects for fish.

Alternative 4: Effects to fish resources would be similar to those described for Alternatives 3, affecting the same 3,820 feet of fish bearing streams. This alternative would reconstruct 3.43 miles of road prior to the road being decommissioned, and that activity would result in additional negative sediment effects to fish in Hehe Creek. These effects are still expected to be site specific and the long-term positive effects outweigh the short-term negative effects.

This alternative has the highest potential for negative short-term effect on fish. In addition to the effects identified for Alternative 3, there would be an additional 3.43 miles of road reconstruction near Hehe Creek. Therefore this alternative has the greatest probability of negatively affecting fish. The positive longer term effects would be similar to those described for Alternative 3.

Alternatives: 3 and 4: These alternatives would likely result in minor reduction in fish population numbers immediately following project implementation, due to the potential for reduced survival associated with increased sediment delivery. Longer term, habitat conditions would improve, and population numbers should slowly increase until carrying capacity is reached.

Cumulative Effects - Fisheries

For the cumulative effects analysis area on fisheries, the Fall Creek fifth field watershed was used. Existing conditions are a result of past management and these effects have been described in the previous section. No additional Forest Service management actions are planned in the foreseeable future in the Fall Creek watershed and as a result limit the cumulative effects to

fisheries. Current projects (primarily timber sales) with potential cumulative effects occurring within the Fall Creek watershed in conjunction with the Hehe LSR Thin Project can be viewed in Appendix B. All ongoing timber projects besides the Fall Creek Special Interest Area (SIA) Salvage Timber Sale are commercial thinning projects and leave large riparian no-cut buffers. The Fall Creek SIA Fire Recovery Project includes the work related to the Clark Fire that burned directly along the Road #1800 within the primary and secondary shade zones of Fall Creek. Affects from the ongoing projects would average between 5-20 years after completion of the projects.

Shade loss along the primary and secondary shade zone of Fall Creek from the Fall Creek SIA Salvage Timber Sale downstream of the project area is not contributing any measurable effects on stream temperature (Johnson, 2004) and MIS resident and anadromous species, including ESA listed spring Chinook salmon, are not greatly affected.

Alternative 1 - Cumulative effects to MIS resident and anadromous species, including ESA listed spring Chinook salmon, would primarily include effects from road maintenance. Due to lack of funding not all roads would be maintained and current unnatural sediment rates being generated from degrading road systems would continue to effect growth and survival rates resulting in a potential slight decrease to all MIS populations within the Fall Creek fifth field watershed. MIS fish populations would continue to maintain at current levels.

Alternative 2 - Cumulative effects to MIS resident and anadromous species, including ESA listed spring Chinook salmon, would primarily consist of degraded road systems within the project area that would not be treated and over the long-term continue to produce elevated rates of turbidity within the Hehe Creek sixth field sub-watershed and Fall Creek fifth field watersheds. Large wood placement from both the Fall Creek SIA Fire Recovery Project and Hehe LSR Thin Project along with improved stands within the Riparian Reserve in the project area would have long-term positive cumulative effects by increasing overall stream conditions and complexity within the Hehe Creek sixth field sub-watershed. This would create additional and higher quality fish habitat. Cumulative effects generated from Alternative 2 in conjunction with ongoing projects would not cause any long-term severe effects. Due to continued unnatural rates of turbidity being delivered into fish habitat within the Hehe sub-watershed all MIS fish populations would continue to be impacted. In the long term, fish populations would continue to maintain at current levels.

Alternative 3 and 4 - Cumulative effects to MIS resident and anadromous species, including ESA listed spring Chinook salmon, would include long-term reduction of elevated turbidity rates due to the amount of road closure and decommissioning. This will greatly reduce unnatural levels of sediment delivery to the Hehe Creek sub-watershed. Large wood placement from both the Fall Creek SIA fire Recovery project and Hehe LSR Thin project along with improved stands within the Riparian Reserve in the project area would have long-term positive cumulative effects by

increasing overall stream conditions and complexity within the Hehe Creek sub-watershed. This would create additional and higher quality fish habitat. Cumulative effects generated from action alternatives 3 and 4 in conjunction with ongoing projects would not cause any long-term negative effects to MIS fish populations within the Hehe Creek sub-watershed and Fall Creek watersheds. Although a small decrease in fish populations may occur directly after project implementation, the above cumulative effects would benefit all MIS species by increasing population size above pre-project implementation.

Consultation - Fisheries

Consultation for this project with the National Marine Fisheries Service has been initiated. The biological assessment prepared for this project concluded with an effects determination of may affect, likely to adversely affect Upper Willamette River (UWR) Chinook salmon and their designated critical habitat within the project area (Lewellen, 2007). This determination is based on short-term increases in stream turbidity and increased fine substrate levels in occupied Chinook habitat primarily due to road improvements and road decommissioning. These same causal mechanisms for the short-term negative effects would also alleviate chronic impacts, and lead to a reduction in sediment delivery over the long-term through risk avoidance. Overall, Chinook salmon and their critical habitat would benefit over time from the implementation of any of the action alternatives.

This project has been designed to promote the conservation of ESA-listed Chinook salmon. It is highly probable that all alternatives for this project would not jeopardize the continued existence of Chinook salmon, or result in the destruction or adverse modification of designated critical habitat. All alternatives are therefore consistent with ESA direction.

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) of 1996 as amended.

Section 305(b)(2) of the MSA directs that “Each Federal agency shall consult with the Secretary with respect to any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken, by such agency that may adversely affect any essential fish habitat (EFH) identified under this Act.” The MSA implementing regulations (50CFR part 600), specifically §600.920(a) states that “Federal agencies must consult with NMFS regarding any of their actions authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken that may adversely affect EFH.

Chinook salmon are the only MSA fish species on the Willamette National Forest. Essential fish habitat has been delineated in the Willamette River Basin based on the process described in MSA §303(a)(7). Federal agencies are to minimize to the extent practicable adverse effects on such habitat caused by fishing, and identify other actions to encourage the conservation and enhancement of such habitat (MSA §303(a)(7)).

All streams currently or historically occupied by spring Chinook salmon in the project area have been designated as essential fish habitat. Minor negative effects on occupied and critical habitat are predicted to occur with all action alternatives. These effects would be short-term and are not expected to result in biologically measurable changes in EFH conditions. This project is consistent with the MSA.

Air Quality

Existing Conditions - Air Quality

The State of Oregon has been delegated authority to enforce air quality standards set by the 1955 Federal Clean Air Act and its amendments. To do this, the state developed the Oregon Smoke Management Plan. All National Forests in Oregon are required to strictly adhere to the guidelines in the Oregon Smoke Management Plan.

The Oregon Smoke Management Plan was designed primarily to protect air quality in Designated Areas (such as Eugene), Class I Areas (such as Diamond Peak Wilderness), and Special Protection Zones (such as the Oakridge SPZ). In Designated Areas, smoke emission limitations are in place year-round. Class I Areas include certain wildernesses, and limitations have been established to protect these areas during the summer months (July 15-September 15). Special Protection Zones were established to limit smoke emissions during winter months (November 15-February 15) in areas where air quality often deteriorates as a result of the combined effects of weather and wood stove/backyard burning. Burning in restricted areas/seasons requires careful monitoring of weather conditions and daily coordination with the State of Oregon Smoke Management Office in Salem.

Direct, and Indirect Effects - Air Quality

Summary of Effects

With the No action Alternative 1, a buildup of fuels represents the threat of an uncontrolled release of large amounts of emissions (in the event of a wildfire). Large quantities of smoke from such a wildfire could flow into the Class I Areas. The action alternatives 2, 3 and 4 and the associated mitigating measures of prescribed fuel treatments would adhere to guidelines in the Oregon Smoke Management Plan and would not affect air quality and visibility in the project area. Smoke impacts on Class I areas should be negligible.

Effects of Alternatives

Alternative 1 (No Action)

There would be no direct/indirect effect on air quality as a result of the No Action Alternative. However, the buildup of fuels represents the threat of an uncontrolled release of large amounts of emissions (in the event of a wildfire). Eventually, a large fire would occur during the summer or

early fall months when fuels are driest, resulting in high consumption of fuels and large amounts of smoke. Large quantities of smoke from such a wildfire could flow into the Eugene DA, Bend DA, and the Diamond Peak or Three Sisters Class I Areas. This would decrease air quality and visibility in the affected area. The most likely time for a large wildfire to occur is between August 1-September 30, which coincides with outdoor recreation activities and high use of public lands. Table 9 gives an indication of the volume of common pollutants that would be released in the event of a 4000 acre wildfire in the planning area.

Effects of Alternatives 2, 3, and 4

If the Oregon Smoke Management Plan guidelines are not adhered to, air quality in Designated Areas, Class 1 Areas, or Special Protection Zones could be affected by treatments that include burning of fuels. The following table (Table 48) illustrates the estimated totals of PM 2.5 and PM 10 emissions (particulate matter 2.5 and 10 microns), according to treatment type.

Table 48 - Burning Emission Estimates (tons)

Emission Type	Alternative 2	Alternative 3	Alternative 4	Wildfire+
PM 2.5	38	147	280	2480
PM 10	44	159	319	2640
Totals	82	306	599	5120

*Calculations done in CONSUME (burning emissions prediction software).

+CONSUME calculation based on a wildfire burning on approximately 4,000 acres (late summer fuel conditions).

Prescribed pile burning would occur during fall and early winter, and broadcast burning would occur in mid-late spring or fall, depending upon stand objectives. By adhering to guidelines in the Oregon Smoke Management Plan, smoke impacts on sensitive areas should be negligible.

Cumulative Effects – Air Quality

The cumulative effects analysis area for air quality was the area encompassed by the Designated Area, Class I Area, and the Special Protection Area.

Alternative 1 (No Action) – This alternative would have no cumulative effects because no fuel treatments would take place at this time.

Alternatives 2, 3, and 4 - No long-term, cumulative effects on air quality are anticipated due to burning associated with this project. All burning would be completed within two years of harvest, and would create far fewer emissions than a wildfire occurring in an area of equivalent size. In order to protect air quality, the Oregon Smoke Management instructions would be strictly adhered to. The Middle Fork District's fire management strategy for prescribed burning is to avoid large, uncontrolled releases of smoke that are produced during large wildfires. By burning slash in one timber sale area at a time, residual fuels are treated gradually and in a controlled manner. For this reason, emissions from prescribed burning are far fewer than emissions caused by wildfires during the pre-suppression, natural fire regime. As noted earlier in this document, approximately 5000 acres burned annually on the 750,000 acres of the Middle Fork District under the natural

fire regime (150 year return interval). Since 1991, the district conducts prescribed burns on about 1000 acres annually. During the era of fire suppression when managers began maintaining thorough fire records (1970-present), wildfires burned only about 1,050 acres annually. This indicates that the combined total, annual acreage of wildfires and prescribed fires on the district is now far less than burned under the natural regime (2,050 acres annually vs. 5,000 acres annually).

Recreation and Scenic Quality

Existing Conditions - Recreation and Scenic Quality

Developed Recreation

There are two developed recreation sites in the Hehe project planning area; Puma Campground and Little Cowhorn Mountain Lookout. The Puma Campground contains 11 camp sites and is open from Memorial Day to Labor Day. An average of about 1,700 parties camp in this facility per year, though it has been used more than this in the last several years while the Broken Bowl campground (about five miles downstream of Puma CG) was closed for renovation, and while the Bedrock Campground (about 1.5 miles downstream of Puma) was closed for two seasons due to wildfire damage and subsequent restoration activities. The Puma Campground often serves as an overflow area for Bedrock Campground, the more popular place to camp along Fall Creek. The Puma Campground is typically used at 40 to 50 percent capacity during the summer months, and is usually full on holiday weekends and summer weekends when the weather is good. It also is a popular day use area for people recreating in Fall Creek.

Little Cowhorn lookout cabin is a relatively new structure, as lookouts go, built in the 1960's originally for wildfire detection. It sits atop 4,236 foot tall Little Cowhorn Mountain and provides a panoramic view of the Fall Creek, Little Fall Creek, and McKenzie River watersheds; the Upper Willamette Valley; as well as all the Oregon Cascades volcanic peaks, if the weather is clear. The Lookout cabin is accessed by a short trail (#3458; just over one half mile) that departs from Forest road #1817. The building's use for fire detection purposes ended in 1969. Since then it has become a popular day hike destination and is also used at least several times per week during the summer for overnight stays. The structure is in need of maintenance and the Middle Fork Ranger District is considering the inclusion of this structure in the cabin rental program to generate funding to accomplish the needed maintenance and repair.

Dispersed Recreation

The Fall Creek National Recreational Trail (#3455) parallels Fall Creek across the planning area. This trail is one of the most heavily used on the Middle Fork Ranger District due to its proximity to the Eugene/Springfield community and the fact that it is accessible year around. It is well known for its old-growth forests and views of the many pools and whitewater in Fall Creek. All these

characteristics resulted in this trail's inclusion in the National Recreational Trail system. The Fall Creek Trail is managed as a class I trail under the Willamette National Forest Plan. Standards and Guidelines for class I trail management can be found on pages IV-52 to 54 of the Forest Plan.

The Gold Point Trail (#3468) connects road 1825 (via its 220 spur) to Gold Point and also connects to the Alpine Trail (#3450; about two miles southeast of this planning area). This trail is on the southern boundary of the Hehe planning area. It is managed as a class I trail. The Jones Creek Trail (#3472) runs up the ridge between the Bedrock Creek and Jones Creek drainages, on the very western edge of the Hehe project planning area. This trail connects road #18 with the ridgetop road 1817. It is also classified as a class I trail, but was damaged by the 2003 Clark fire.

Many dispersed camping sites exist along Fall Creek and Hehe Creek. Fall Creek is a favorite swimming spot in the summer. There are a number of dispersed campsites along road 18 that are more or less centered on the use of Fall Creek, whether for day use or overnight camping. Fall Creek is a bedrock controlled river containing numerous deep pools and presents good fishing and swimming opportunities. Fall Creek contains a relict population of native spring chinook salmon which are not legal to catch. Hehe Creek has a steeper gradient and much less flow than Fall Creek. It is relatively shallow and has a boulder and cobble channel bottom so swimming does not occur in this stream, but there are several dispersed camping sites along road 1831 that are centered on Hehe Creek. These sites are primarily used during hunting season, or in the summer by fishermen and people wanting to distance themselves from the more heavily used Fall Creek corridor.

Though there are no use figures for general dispersed recreation in this planning area, it is evident by the well-used condition of the main road network that the area receives a fair amount of vehicle use. The project area contains about 121 miles of system roads, some 39 miles of which (32 percent) have been closed either by past management actions or natural processes. An unknown and continually increasing percentage of the open roads are either difficult or impossible to drive due to lack of general maintenance and/or growth of road-side vegetation. Typical activities that the road users are engaging in include driving for pleasure, hunting, fishing, mushroom picking, and firewood gathering.

There is also some small amount of rock climbing that occurs on Gibraltar Mountain in the center of the planning area.

Direct and Indirect Effects - Recreation and Scenic Quality

Summary of Effects

The proposed actions would have an effect upon recreational activities in the Hehe project area, primarily, indirectly, from increased ambient noise levels. The actions would also have a direct effect upon vehicle-based dispersed recreation. Given that the noise disturbance effects detailed above would be relatively ephemeral, the fact that logging related noise and log truck traffic has

been a common occurrence in this landscape since the existing road system was built, and the fact that safety concerns would be mitigated through advisory signing and/or temporary road closure, there would be no effect upon recreation in this area from noise and road use disturbance (Bailey, 2007).

A considerable amount of road closure would occur under all action alternatives. This road closure would directly reduce the amount of vehicle-based recreational opportunities, but given the fact that no main roads would be closed, and that under the highest road closure alternative (Alt. 4) there would still be over 44 miles of open road for dispersed recreational use, the proposed actions would not have a direct effect upon dispersed, vehicle-based recreation. Additionally, with no action many of the roads in the project area would eventually become closed due to natural events, and the action alternatives would provide for road maintenance that would make the remaining open roads more pleasant and safe to use.

Effects of Alternatives

Alternative 1 (No Action) - The No Action alternative would have no direct or indirect effects upon developed recreation in this area. The No Action alternative would not create any increase in the ambient noise level in any developed recreational facilities.

Alternative 2, 3, and 4

Proposed thinning in the action alternatives would have no direct effect on most of the recreation that occurs in this area. The one aspect of the proposal that could affect use of the Fall Creek corridor is the traffic that would be generated by log hauling. Since the timing and absolute duration of this increased traffic is not known, would be relatively ephemeral, and would be unlikely to occur much on weekends during heavy recreational use times, there is no serious concern for the effect of an increase in traffic upon the recreational use of the Fall Creek corridor. All the roads in this area were constructed primarily to facilitate log haul, and that activity has been occurring on these roads as long as people have been using the area for vehicle-based recreation, so log traffic would not create conditions that have not existed in this area over the last 40 to 50 years.

The yarding and hauling of logs would produce noise above and beyond the ambient noise levels (primarily associated with vehicle use on the road system) in the project area. Some of the log yarding would be by helicopter which can produce considerable noise at close distances. Such elevated noise levels would be especially noticeable from developed sites such as the campground and lookout cabin, as well as from the trails. This noise would be somewhat ephemeral and discontinuous, and would tend to occur during the week when recreation use in the area is not as high as during the weekends, but recreationists would still notice some increase in noise.

The proposed thinning in the action alternatives would likely enhance the dispersed, road-related recreation mentioned above, in the sense that log haul would provide for road maintenance that

should result in an improvement to the roads used in terms of surface rock replacement and road-side brushing, but would decrease it to the extent that roads are closed.

Aesthetic appearances in terms of scenic and viewshed management (see Forest Plan management guidelines discussion above) are essentially a recreational resource since it is at least in part the pleasant appearance of the forest that attracts and sustains recreational use. Timber harvest is often thought to have negative effects on visual conditions. The proposed thinning would be in full compliance with partial retention/middle ground scenic objectives (Forest Plan page IV-205) in that it would create stand conditions that would be visually subordinate to the characteristic landscape. Thinning as proposed would not create any forms, lines, colors or textures that vary from those currently occurring in this landscape.

None of the alternatives have any direct effect upon developed recreational facilities such as the campground and Cowhorn Lookout, nor to established trails, since all proposed thinning is at least one quarter mile or more from those features. The only direct effects any of the action alternatives pose is to disperse road use, since all would close some amount of existing system road. Indirect effects in terms of truck traffic and noise generation would occur and are discussed below.

Developed Recreation

Only indirect effects would accrue to the Puma Campground and the Little Cowhorn lookout. These effects would be comprised of an elevated noise level associated with most times fairly distant yarding related noise, as well as some potentially closer road related noise from log truck traffic and associated road maintenance. This noise would be intermittent during the day, and would not typically occur during weekend periods of higher developed facility use. This intermittently elevated noise level would occur for a total of 11 months (Alternative 2) to 14 months (Alternatives 3 and 4), depending upon which action alternative might be selected. This translates to elevated (though intermittently) noise levels through at least three and maybe four seasons of recreation use since it is not known exactly how long the Hehe timber sales would remain active. The absolute duration of these activities would be constrained by weather conditions, fire hazard levels, and prescribed seasonal restrictions to avoid wildlife disturbance. All these physical conditions and market conditions could combine to increase the absolute amount of time it would take to complete all the activities contained in the action alternatives.

Cumulative Effects - Recreation and Scenic Quality

There are no ongoing or reasonably foreseeable future actions that would increase the amount of truck traffic on the project area road system. Past management actions, almost entirely past harvest projects, have created the existing, extensive road system in the Hehe planning area. Action alternatives would reduce the amount of open roads for dispersed recreation use by four to 38 miles, or from five (Alternative 2) to 46 percent (Alternatives 3 and 4) of the currently open

road system. About 39 miles of this road system, (32 percent) have been closed by past management actions or by natural events. This amount of closed road, in accumulation with those proposed to be closed by the Hehe action alternatives result in 36 to 63 percent of all the system roads in the project area being inaccessible for dispersed, vehicle-based recreational use. While such road closure would negatively impact driving related dispersed recreational activities, some road closures would have a positive effect on other activities, particularly hunting for those who desire to hunt closed roads on foot without potential disturbance by vehicle travel. There are no reasonably foreseeable (in terms of site-specific proposals) future actions that would close additional road miles in this area.

Economics

Non Significant Issue – Economic efficiency is the determination of the cost of planning and implementing forest management treatments and the benefits or revenues those treatments generate. Forest Service Manuals (2430-2432) and Handbook (2409.18 Chapters 10-30) require financial and economic efficiency information be available to the decision maker prior to substantial investment of capital and resources in timber sales. The proposed action of thinning treatments in an LSR achieves forest stewardship objectives; therefore the sale of timber is secondary to achieving those objectives. Revenue produced from this timber is considered an offset to the cost of accomplishing the project.

Existing Conditions - Economics

The high cost of planning and implementing a timber sale project may affect the overall economic efficiency of the project. The economic efficiency is primarily dependent on the cost associated with planning the project, type and cost of log yarding systems used, amount and cost of road management work, the timber benefit produced from the thinning, amount and cost of fuel reduction treatments, cost of mitigating measures to reduce effects, and potential costs for funding other resource improvement projects within the sale areas. The designs and decisions made on these aspects of thinning projects influences the net revenues returned by the project.

Timber revenues are returned to the U.S. Treasury and a proportion of the revenues re-distributed back to local county governments. The thinning project also generates benefits to the economy by providing timber products, direct and indirect employment from the planning and implementation of the project to the processing, production, and manufacturing of the raw wood material.

Direction for the financial efficiency analysis can be found in the Forest Service Manual 2430-2432 (Amendments 2400-95-1 through 3) and Forest Service Handbook 2409.18, Chapters 10-30 (Amendments 2409.18-95-1 through 6). The financial efficiency analysis provides information

relevant to the future financial position of the program if the project is implemented. The analysis basically compares estimated Forest Service direct expenditures with estimated financial revenues. Financial efficiency analysis measures two things – revenue/cost ratio and financial present net value.

A financial efficiency analysis was completed for the project and can be found in the Analysis File. This analysis includes revenues generated from timber sale receipts, and costs of the planning, sale preparation, administration, roads, fuel treatments, other mitigating measures, and Knutson Vandenberg (KV) funded sale area improvement projects. The analysis did not include an estimate of non-market amenities values due to the unpredictable nature of these values. Non-market values are required “only when excess demand exists for non-market goods (Forest Service Handbook 2409.18 32.24) or the project has detrimental effects on non-market output. For a comprehensive discussion of the social and economic considerations at the forest level, refer to the Willamette Forest Plan FEIS, Chapter III, pages 213-235 and Chapter IV, pages 119-130.

Direct and Indirect Effects – Economics

Summary of Effects

All action alternatives would have a positive economic return. The no action alternatives would have a negative economic return due to the money spent on the planning effort without a return from the thinning timber sales.

Effects of Alternatives

Table 49 - Financial Efficiency of the Alternatives

	Alt 1 (No Action)	Alt. 2	Alt 3 (Proposed Action)	Alt. 4
Present Net Value	(-\$200,286)	\$9,516,807	\$10,891,190	\$11,376,434
Revenue/Cost ratio	0	1.46	1.44	1.41

Alternative 1 (No Action) would have a negative present net value because no benefits are produced to offset the cost of planning the project. The action alternatives 2, 3 and 4 are very similar in both their present net values and revenue/cost ratios. The differences correspond to the acres of treatment in each alternative and the road costs associated with the action alternatives.

Cumulative Effects - Economics

The cumulative effects of an alternative on the socioeconomic environment are quite difficult to estimate (Forest Plan FEIS, page IV-127). In terms of cumulative effects, District or Forest timber volumes for sale may have little influence on any one mill, for example an owner can purchase from Bureau of Land Management and private woodlot owners to get additional supply. They can also purchase logs from the Umpqua or Siuslaw National Forests. Or, at the owner's choice, they can increase or reduce the size of the mill operation, sell the operation to another company, or simply close the mill. All of these have occurred in the last decade and few, if any, of the changes to companies or communities can be tied directly to the sale of the Willamette National Forest timber.

Alternative 1 (No Action) would not produce any timber volume and does not provide timber volume to the District's or Forest probable sale quantity. The action alternatives 2, 3, and 4 would produce about 48-63 mmbf. This timber volume represents about 64 percent of the Middle Fork District's timber probable sale quantity for fiscal years 2007 to 2009 and 28 percent of the Forest's timber probable sale quantity for the next three years. The timber volume produced from these alternatives would have no cumulative effects to the economy of Lane, Linn, and Douglas counties given the timber land base in these three counties.

Other Disclosures

Short-term Uses and Long-term productivity

NEPA requires consideration of the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity (40 CFR 1502.16). As declared by Congress, this includes using all practicable means and measures to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101).

The Multiple Use – Sustained Yield Act of 1960 requires the Forest Service to manage National Forest System lands for multiple uses (including timber, recreation, fish and wildlife, range, and watershed). All renewable resources are to be managed in such a way that they are available for future generations. The harvest and use of standing timber can be considered a short-term use of a renewable resource. As a renewable resource, trees can be re-established and grown again if the productivity of the land is not impaired.

Maintaining the productivity of the land is a complex, long-term objective. All alternatives protect the long-term objective of the project area through the use of specific Forest Plan S&Gs, mitigation measures, and BMPs. Long-term productivity could change as a result of the various

management activities proposed in the alternatives. Management activities could have a direct, indirect, and cumulative effect on the economic, social, and biological environment. Those effects are disclosed in the analyses presented in this Chapter 3.

Soil and water are two key factors in ecosystem productivity, and these resources would be protected in all alternatives to avoid damage that could take many decades to rectify. Sustained yield of timber, wildlife habitat, and other renewable resources all rely on maintaining long-term soil productivity. Quality and quantity of water from the analysis area may fluctuate as a result of short-term uses, but no long-term effects to water resources are expected to occur as a result of timber management activities.

All alternatives would provide the fish and wildlife habitat necessary to contribute to the maintenance of viable, well distributed populations of existing native and non-native vertebrate species. The abundance and diversity of wildlife species depends on the quality, quantity, and distribution of habitat, whether for breeding, feeding, or resting. The alternatives vary in risk presented in both fish and wildlife habitat capability.

None of the alternatives would have an effect on the long-term productivity of timber resources.

Irreversible and Irrecoverable Commitment of Resources

NEPA requires that environmental analysis include identification of “. . . any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.” Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that the use of these resources have on future generations.

Irreversible effects primarily result from use or destruction of a specific resource (e.g., minerals) that cannot be replaced within a reasonable time frame. Irrecoverable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (e.g., disturbance of wildlife habitat); or is lost as a result of inaction (e.g., failure to monitor and treat forest vegetation to prevent infestation of insects).

The proposed thinning project would result in few direct and indirect commitments of resources; these would be related mainly to thinning operations.

The anticipated effects for all action alternatives described in this document are the same as those discussed in the FEIS for the Forest Plan (USDA, 1990) on page IV-178. Some erosion and soil movement would result from thinning activities. Small amounts of crushed rock from quarries would be committed to construction of temporary spur roads and landings or maintenance of the existing classified road system and would be irretrievable, if used. Energy used to grow, manage, and harvest trees, and in other management activities is also generally considered irretrievable

The analysis revealed no irreversible or irretrievable commitment of resources associated with implementing the alternatives that are not already identified in the Willamette National Forest Plan FEIS

Unavoidable Adverse Effects

Several expected adverse effects, including some that are minimal and/or short-term, were identified during the analysis. Resource protection measures or mitigations were identified and considered for each of these as a means to lessen or eliminate such effects on specific resources. See mitigation measures starting on Chapter 2. Resource areas determined to have potential adverse effects (resulting from any of the alternatives – including No Action and the Action Alternatives) are documented within the appropriate Environmental Consequences sections of each resource in this chapter. See the following sections:

- ❖ Late-successional Conditions – Interior Habitat
- ❖ Late-successional Conditions – Spotted Owl Habitat
- ❖ Fire and Fuel Loadings
- ❖ Vegetation – Invasive Plants
- ❖ Vegetation – Botanical TE&S and Survey and Manage Species
- ❖ Wildlife - Big Game Habitat
- ❖ Wildlife – Terrestrial TE&S and Survey and Manage Species
- ❖ Wildlife – Management Indicator Species
- ❖ Soils - Detrimental Soil Conditions
- ❖ Water Quality and Stream Conditions
- ❖ Fisheries- Aquatic TE&S Species
- ❖ Recreation and Scenic Quality
- ❖ Air Quality
- ❖ Economics

Cultural Resources

The areas proposed for ground-disturbing activities have been surveyed and evaluated for the presence of cultural resources. No new sites were discovered (Hylton, 2006).. The action alternatives do not include any areas with known historic or cultural resources. The action alternatives would have no effect to cultural resource (See Project Review for Heritage Resources from State Historic Preservation Officer (SHPO) in the Analysis File). If any cultural sites are found during any proposed activity, the activity would be discontinued, and timber sale contract

provisions would be invoked until the site is evaluated for significance and appropriate mitigation measures are performed.

Special Forest Products

There is increasing recognition of the economic value of special forest products (SFP) and their potential role in supporting the diversification of forest products dependent communities. The SFP program on the Forest provides a potentially wide range of products.

The Hehe LSR Thin treatments areas have a potential to contribute to the supply of special forest products. SFP's available within the proposed treatment areas are limited to some of the basic greenery plants species and some mushrooms. These species include salal, Oregon grape, sword fern, various mosses, and golden chanterelle and morel mushrooms. These SFP's are defined as "non-timber renewable, vegetative natural resources" that can be utilized either for personal or commercial use.

The collections of SFPs are directed by the Forest Plan Amendment No. 23 and the SFP's Management Plan (USDA, 1993). The latter document suggests that collection of certain SFP's be focused upon areas that are scheduled for harvest, so the proposed actions would provide for a greater amount of potential SFP harvest. This direction ensures resource protection that is consistent with current Forest Plan goals and resource protection and ensures a sustainable long-term supply of desired products. FW-323 to 338 provides direction, such as acceptable harvest levels of various plants/products, acceptable methods of harvest, measures needed to protect other resource values, and where harvesting would be allowed.

At this time, though SFP's provide a potential for economic development, there is a low amount of interest in their collection, and the supply of various renewable forest products existing in the project area and throughout the Fall Creek watershed far exceeds the demand for these products.

Effects on Recreational Fisheries (Executive Order 12962)

This 1995 order's purpose is to conserve, restore, and enhance aquatic systems to provide for increased recreational fishing opportunities nationwide. It requires federal agencies to evaluate the effects of federally funded actions on aquatic systems and document those effects relative to the purpose of this order.

There is a potential short-term impact of sediments into the streams as a result of the thinning and road management activities. This short-term impact would not threaten fish species. The short-term impacts are outweighed by the long-term benefits to the water quality and fisheries resource. Mitigating measures have been applied in the action alternatives to maintain anadromous fish and resident fish populations and habitat. These mitigating measures include no harvest zones adjacent to streams and other best management practices during harvest activities. Stream rehabilitation projects have been proposed to improve stream temperatures, channel complexity

and diversity. Road reconstruction and closures have been proposed to reduce the risk of sedimentation to water quality and fisheries resources.

All action alternatives including associated mitigation actions and BMPs are consistent with current management direction including Willamette Forest Plan Standards and Guidelines, Aquatic Conservation Strategy (ACS) Objectives and the Federal Clean Water Act. Implementation of required BMPs would insure protection of water quality and beneficial uses under all alternatives.

Effects on Consumers, Civil Rights, Minority Groups and Women

Implementation of any alternative may not by itself have any effect upon consumers, but in combination with other timber harvest projects may have an effect upon the local economy, especially on communities of Lowell, Oakridge, Springfield and Eugene. The Forest Plan FEIS addresses social and economic effects on pages IV 119-128.

Implementation of this project has not been planned to either favor or discriminate against any social or ethnic group. Contracting procedures would ensure that projects made available through this project would be advertised and awarded in a manner that gives proper consideration to minority and women-owned business groups and meet Equal Employment Opportunity requirements. Because of this consideration, there would be no direct, indirect, or cumulative effects to consumers, minority groups with implementation of any of the alternatives

Effects on Minorities, Low-Income Populations, or Subsistence Users (Environmental Justice – Executive Order 12898)

Hehe LSR Thin Project is located near the Cities of Oakridge, Westfir, and Lowell in Lane County, Oregon. These communities have minority populations of 8 percent, 7 percent and less than 1 percent, respectively. Lane County, in its entirety, has a minority population of 9 percent, (U.S. Census Bureau, 2000).

For the City of Oakridge, approximately 14.5 percent of the population is at or below poverty level; approximately 12.2 percent of the population of the City of Westfir is at or below the poverty level, while 11.5 percent of the City of Lowell is at or below poverty level, (U. S. Census Bureau, 2000). According to information from the Oregon Economic and Community Development Department (OECDD), Lane County, (excluding areas within the city limits of Eugene, Springfield, Coburg and Dunes City), is rated 1.30, (threshold 1.20), on the distressed area index. These Cities, as well as much of Lane County, have experienced a decline in timber-based jobs over the past decade, contributing to factors used to determine a distressed community.

Implementation of any alternative that provides the opportunity for employment may positively affect low-income families who are either unemployed or underemployed. Implementation of any alternative is not expected to impose a disproportionately high or adverse effect to those populations.

Subsistence and cultural use levels are difficult to quantify and differential patterns of subsistence consumption are unknown at this time. However, the Forest provides access to firewood, Christmas trees, mushrooms and other consumables through a personal-use permit system. Middle Fork Ranger District sells and issues permits for about 800 cords of firewood; about 2,000 Christmas tree permits; and about 300 personal-use mushroom permits per year.

The proposed thinning treatments have the potential to contribute to the supply of special forest products (SFP) available within the area, such as basic greenery plant species and some mushrooms. Interest in commercial harvest of SFPs is low in this area at this time, and supply far exceeds demand in the Fall Creek watershed. (See “Special Forest Products,” discussed above)

Effects on fisheries are mitigated in all action alternatives to maintain anadromous fish and resident fish populations and habitat.

Road closures may impact subsistence in the immediate project area, but these impacts would be mitigated by the availability of other access routes throughout the area.

The Willamette National Forest has Memorandums of Understanding (MOU) with the Confederated Tribes of the Grand Ronde, the Confederated Tribes of Warm Springs, and the Confederated Tribes of Siletz. These MOUs provide the mechanism for regularly scheduled consultations on proposed activities. Beyond this, the Forest notifies and consults with tribal governments in a manner consistent with the government-to-government relationship on any matters that ripen outside of the meeting schedule. Any potential impacts are discussed and mitigated through these processes.

All alternatives comply with Executive Order 12989 “Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations”.

Effects on American Indian Rights

The Confederated Tribes of the Siletz, Grand Ronde, and Warm Spring, Klamath Tribe and Kalapooya Sacred Circle Alliance were notified of the project during the scoping of issues as part of the public participation process.

The Hehe LSR Thin Project has been included in the annual Program of Work Review with the Conferated Tribes of the Siletz and Grand Ronde for the last couple of years. Presentations were given on the major Forest’s timber sale planning efforts. No specific comments were received from these tribes as a result of scoping letters and annual Program Review meetings. No specific sacred sites have been identified in the proximity of the project area. No impacts, as outlined in the American Indian Religious Freedom Act, are anticipated upon American Indian social, economic or subsistence rights.

All alternatives comply with Consultation and Coordination with Indian Tribal Governments Executive Order 13084 and Indian Sacred Sties Executive Order 13007.

Effects on Farmlands, Rangelands, Forest Land, and Floodplains

Executive Orders 11988 and 11990 direct Federal agencies to avoid, to the extent possible, both short-term and long-term adverse impacts associated with the modifications of floodplains and wetlands. None of the alternatives have specific actions that adversely affect wetlands and floodplains. Wetlands and streams with associated Riparian Reserves (includes adjacent floodplains) have been delineated for the Hehe LSR Thin project area. All of the wetlands and streams near treatment areas have been buffered to protect the natural and beneficial values and minimize any detrimental effects to those wetlands and streams. Proposed activities are compliant with the orders and USDA Departmental Regulation 9500-3. See discussions related to this topic in the hydrology, fisheries and soils resource sections in Chapter 3 for more information.

Monitoring

Based upon the purpose and need for the action, the issues identified during the scoping process and used in the design of the alternatives, the following Forest Plan S&Gs are recommended to be used as a guide for monitoring key components of the project. The primary type of monitoring conducted at the project level is implementation monitoring. Implementation monitoring is used to determine if plans, prescriptions, projects, and activities are implemented as designed and are in compliance with Forest Plan objectives, standards and guidelines

Road Closure (Purpose and Need)

Did the project implement the recommendations in the District's and Forest's Road Analyses?

Interior Habitat

Did the project implement thinning prescriptions adjacent to late-successional forest interior habitat that mitigates the effects as recommended in the Willamette LSR Assessment?

Spotted Owl Habitat

Did the timber sale contracts include provisions for seasonal restrictions to mitigate the effects to spotted owls?

Fuel Loading (Purpose and Need and Issue)

Did the project implement fine fuel treatments according to guidelines in FW-252 for management activity-created fuel loadings?

Commercial Thinning (Purpose and Need)

Did the project implement thinning prescriptions according to Management Area 14A – 13 about when commercial stocking level control, based on DBH, basal area, and economically feasible should begin?

Other Standard Monitoring

Monitoring would occur at many points in time during the implementation process of the project such as during timber sale layout and preparation, timber sale contract administration, and service contracts administration.

The Silviculturist would review marking guides or contract provisions for designation by description for the thinning prescription with the presale crew prior to marking or after a portion of the unit is completed by the purchaser and monitor quality both during and after the unit is completed marked.

Logging operation would be monitored by the sale administer, soil scientist, and Silviculturist. If S&Gs, best management practices, mitigation measures, or the silvicultural prescriptions are not being met, additional measures would be prescribed to insure compliance. The sale administrator would inform the appropriate staff member if logging feasibility issues may make it impossible to meet the desired conditions outlined in the environmental document.

The District fuels specialist, soil scientist, and Silviculturist would monitor post harvest fuel loading to determine if slash treatment is still warranted. If the unit's fuel loadings are within S&Gs, the slash treatments may be adjusted or waived to promote long-term site productivity.

The project would be subject to randomly selected implementation monitoring trips sponsored by either provincial, regional, forest, or district level management teams to determine if the objectives, standard and guidelines, and management practices specified in the Forest Plans are being implemented.

Additional information about monitoring can be found in the individual resource reports in the project's Analysis File.

Sale Area Improvements - Funded Project Priority List

Essential KV

No essential KV project was identified.

Mitigating Measures

1. Coarse Wood Debris - Snag and Down Wood Creation and Monitoring.
2. Under planting with shade tolerant species (on approximately 500 acres to develop another cohort to create multi-layer canopies).
3. Invasive Weed Control and Surveys.
4. Temporary Spur Road Closure and Rehabilitation (spurs not closed with timber sale contract).
5. Erosion Control Seeding and Fertilization.

Resource Opportunity Projects – Should money be available from timber stumpage payments after implementation of an action alternative or from other sources not connected with the proposed timber sale, the following projects would be implemented, in order of descending priority;

6. In stream structure placement of large woody debris on Hehe and Alder Creeks.
7. Riparian thinning along upper Hehe Creek.
8. Hehe trash rack breakdown.
9. Fire wood inventory and removal.
10. Fall Creek National Recreation Trail maintenance.
11. Restoration and maintenance of Little Cowhorn Lookout.
12. Wildlife Forage Enhancement projects.

Consultation and Coordination

This chapter provides a list of the interdisciplinary team who coordinated and designed the project and prepared the environmental assessment document, agencies and tribes consulted, and individuals and organizations that were contacted or commented during the development of the environmental assessment.

Table 50 - Forest Service Interdisciplinary Team

Team Members	Specialty
Gary Marsh	Team Leader/Silviculturist
Kami Ellingson	Hydrologist / Soils
Deborah Quintana	Wildlife Biologist
Corey Lewellen	Fisheries Biologist
Tim Bailey	Recreation
Kim McMahan	Botanist
Cathy Lindberg	Archeologist
Chris Hays	Fire / Fuels Specialist
Mary Lee Sayre	Transportation Systems
Jerry English	Presale / Sale Admin.
Bill Menke	Logging Systems

The Forest Service consulted the following individuals, Federal, State, and local agencies, tribes and non-Forest Service persons during the development of this environmental assessment:

Federal, State, and Local Agencies:

Oregon Department of Fish and Wildlife

USDI Fish and Wildlife Service

USDC Fisheries Division – National Oceanic and Atmospheric Administration

Oregon State Historic Preservation Office

Tribes:

Klamath Tribe

Confederated Tribes of the Grand Ronde

Confederated Tribes of the Siletz Indians

Confederated Tribes of the Warm Springs

Other Individuals and Organizations

Doug Heiken, Oregon Natural Resource Council

Sierra Club

Native Plant Society

Audubon Society

Forest Conservation Council

Diana Robin, Canopy Action Network

George Sexton

Joanne Vinton

James Johnston, Cascadia Wildlands Project

Ann Montgomery, Fall Creek Consensus Group

Cedric Hayden, adjacent private property owner

Warren Weathers, Lowell mayor

Ross Mickey, American Forest Resource Council

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Appendices

- Appendix A - Federal and State Laws, Regulations, and Executive Orders:
- Appendix B - Cumulative Effects Analyses
- Appendix C – Alternatives Unit Prescription Summaries
- Appendix D - Road Work Associated with the Action Alternatives
- Appendix E – Pre and Post Thin Stand Conditions
- Appendix F – Aquatic Conservation Strategy Objectives

Appendix A - Federal and State Laws, Regulations, and Executive Orders:

The National Environmental Policy Act (NEPA) of 1969, as amended

The purposes of this Act are "To declare a national policy which will encourage productive and enjoyable harmony between man and his environment, to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nations; and to establish a Council on Environmental Quality" (42 U.S.C. Sec. 4321). The law further states "it is the continuing policy of the Federal Government, in cooperation, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of the present and future generations of Americans. This law essentially pertains to public participation, environmental analysis, documentation and appeals.

NEPA establishes the format and content requirements of environmental analysis and documentation such as the Hehe LSR Thin project analysis. The entire process of preparing an environmental assessment was undertaken to comply with NEPA requirements, as codified by 40 CFR 1601 and the Forest Service Handbook 1909.15, Chapter 40.

The National Forest Management Act (NFMA) of 1976

This Act guides development and revision of National Forest Land Management Plans and addresses a range of activities from required reporting that the Secretary must submit annually to Congress to preparation requirements for timber sale contracts. There are several important sections within the act, including Section 1 (purpose and principles), Section 19 (fish and wildlife resources), Section 23 (water and soil resources), and Section 27 (management requirements that relate to perspective project planning).

All alternatives were developed to be in full compliance with NFMA via compliance with the Willamette National Forest Land and Resource Management Plan, as amended. This EA contains references as to how this project complies with Forest Plan and Northwest Forest Plan standards and guidelines. The Silvicultural Prescription in the Analysis File contains a discussion of compliance with NFMA's requirement to identify lands unsuited for management and the requirement to achieve reforestation within five years.

The Endangered Species Act of 1973, as amended

The purposes of this Act are to "provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such endangered species and threatened species, and to take such tests as may

be appropriate to achieve the purpose of the treaties and conventions set forth in subsection (a) of this section." The Act also states "It is further declared to be the policy of Congress that all Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of this Act."

Field surveys, Biological Evaluations, and Biological Assessments for all listed endangered, threatened, or sensitive species have been conducted to determine possible effects of any proposed activities in the Hehe LSR Thin project area (see the Wildlife and Plant Biological Evaluations, and Fish Biological Assessment in the Analysis File).

The Clean Water Act, as amended in 1977 and 1982

The primary objective of this Act is to restore and maintain the integrity of the Nation's waters. This objective translates into two fundamental national goals: 1. Eliminate the discharge of pollutants into the nation's waters; and 2. Achieve water quality levels that are fishable and swimmable. This Act establishes a non-degradation policy for all federally proposed projects. Under Section 303(d) of the Clean Water Act, the State has identified water quality-limited water bodies in Oregon. Fall Creek is the only water body in the project area that is on the 303(d) list due to elevated temperatures.

All action alternatives including associated mitigation actions and BMPs are consistent with current management direction including Willamette Forest Plan Standards and Guidelines, Aquatic Conservation Strategy (ACS) Objectives (at the watershed analysis area) and the Federal Clean Water Act. Implementation of required BMPs would insure protection of water quality and beneficial uses under all alternatives. Although the main stem of Fall Creek is currently listed as water quality limited due to elevated summer water temperatures, retention of no harvest buffers within the effective shade zone of Fall Creek would result in a negligible affect in the short-term on stream temperature in Fall Creek.

The Clean Air Act, as amended in 1990

The purposes of this Act are "to protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population; to initiate and accelerate a national research and development program to achieve the prevention and control of air pollution; to provide technical and financial assistance to state and local governments in connection with the development and execution of their air pollution prevention and control programs; and to encourage and assist the development and operation of regional air pollution prevention and control programs."

The action alternatives are designed to meet the National Ambient Air Quality Standards, as direction by the Oregon Smoke Management Act, through avoidance of practices which degrade air quality below health and visibility standards.

National Historic Preservation Act of 1966, as amended

This Act requires Federal agencies to consult with American Indian Tribes, and various State and local groups before nonrenewable cultural resources, such as archaeological and historic structures, are damaged or destroyed. Section 106 of this Act requires Federal agencies to review the effects project proposals may have on the cultural resources in the Analysis Area.

The areas proposed for ground-disturbing activities have been surveyed and evaluated for the presence of inventoried cultural resources. Several areas containing these resources have been identified. The alternatives were either designed to avoid or exclude these areas from any management activities, have mitigated the effects by protecting the sites with down logs, and or minimized the site disturbances with yarding log suspension requirements. (See Mitigation Measure section and the Project Review for Heritage Resources form in the Analysis File).

Executive Order 13186 (Migratory Bird)

On January 10, 2001, President Clinton signed an Executive Order (E.O. 13186) titled "Responsibilities of Federal Agencies to Protect Migratory Birds." This E.O. requires the "environmental analysis of Federal actions, required by NEPA or other established environmental review processes, evaluates the effects of actions and agency plans on migratory birds, with emphasis on species of concern."

Current science applied to S&Gs governing management of this area provide direction that would ensure the long term maintenance of amount and distribution of suitable habitat for native residents and migratory land bird species. The spatial and temporal extent of proposed activities that would result in disturbance to nesting birds in a small portion of the project area would mitigate the overall potential for disturbance and provide protection for nesting birds as intended under the Migratory Bird Treaty Act.

Prime Lands

The Secretary of Agriculture issued memorandum 1827 which is intended to protect prime farm lands and rangelands. The project area does not contain any prime farmlands or rangelands. Prime forestland is not applicable to lands within the National Forest System. National Forest System lands would be managed with consideration of the impacts on adjacent private lands. Prime forestlands on adjacent private lands would benefit indirectly from a decreased risk of impacts from wildfire. There would be no direct, indirect, or cumulative adverse effects to these resources and thus are in compliance with the Farmland Protection Act and Departmental Regulation 9600-3, "Land Use Policy".

Executive Order 13112 (Invasive Species)

This 1999 order requires Federal agencies whose actions may affect the status of invasive species to identify those actions and within budgetary limits, "(i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species... (iii) monitor

invasive species populations... (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded;... (vi) promote public education on invasive species... and (3) not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species... unless, pursuant to guidelines that it has prescribed, the agency had determined and made public... that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions."

The action alternatives implement the direction from the Willamette Forest Plan and the Integrated Weeds Management EA. The action alternatives include mitigating measure (see Chapter 2 – Mitigation Common to All Alternative – Invasive Weeds) which would limit the spread of invasive weeds. Mitigating measures include the cleaning of off road equipment between infested work sites, pre-treating roads before road maintenance and reconstruction, re-vegetating all disturbed areas with weed-free mulch and native seed, and monitoring weed infestations following treatments..

Energy Requirement and Conservation Potential

There are no unusual energy requirements for implementing any of the alternatives

Alternatives which involve tree removal would create supplies of firewood as a by-product of the timber harvest. This product would contribute to the local supply of energy for home space heating.

Both action alternatives propose helicopter yarding of timber. Helicopter yarding is often considered to have high fuel requirements. Though helicopters may use more fuel per unit of time than other yarding equipment, they are more productive and do not need to be operated for as long as more convention yarding equipment for a given timber volume. Helicopter yarding also avoids the need to consume fuel for road construction. Analysis has shown that the energy used for helicopter use is not unusually excessive in comparison with other methods of accessing large timber.

State Laws

Oregon State Best Management Practices (BMPs) - State BMPs are employed to maintain water quality and are certified by the Environmental Protection Agency for meeting the Clean Water Act.

The Oregon Smoke Management Plan - The Oregon State Implementation Plan and the Oregon State Smoke Management Plan would be followed to maintain air quality. See Fire and Fuel prescription the Analysis File.

Appendix B - Cumulative Effects Analyses

Past, Present, and Foreseeable Future Activities in the Fall Creek Watershed

For the majority of the cumulative effects analyses, the analysis area was defined by the boundary used in the 1995 Fall Creek Watershed Analysis. This analysis area was used in order to remain consistent and comparable with the Watershed Analysis. The boundary is a delineation of topographical and hydrologic boundaries of the watershed drained by Big Fall Creek. The cumulative effects analysis includes the history of harvest and road building which started in the 1940's and 1960's and the effects of timber harvest and road systems on wildlife habitat and the hydrology of the watershed. The analysis includes future harvest projects for which the NEPA process has begun. The table below presents a summary of activities which have occurred in the past, present and foreseeable future within the Fall Creek watershed. The listing includes lands administrated by Bureau of Land Management (BLM) and private lands. Harvest treatments for the private lands were estimated from aerial photography. The various resource analyses may have used a subset of these activities, depending on the size of the appropriate analysis area, for instance, either single or multiple 6th field sub-watersheds.

Tables B1. - Summary by decade of past, present, and future activities in Fall Creek watershed.

Decade	Activity	Acres
Past Activities		
1940's	Regeneration Harvest Treatments	5844
	Fuel Treatments	2960
	Road Construction	See section below
1960's	Regeneration Harvest Treatments	5915
	Fuel Treatments	5630
1960's	Regeneration Harvest Treatments	9203
	Fuel Treatments	8763
	Pre-commercial Thinnings	1760
1970's	Regeneration Harvest Treatments	6152
	Fuel Treatments	5969
	Pre-commercial Thinnings	3298
	Fertilization Treatments	1801
	Commercial Thinnings	26
1980's	Regeneration Harvest Treatments	6979
	Fuel Treatments	6205
	Pre-commercial Thinnings	8626
	Fertilization Treatments	12,338
	Pruning Treatments	20
	Commercial Thinnings	254
1990's	Regeneration Harvest Treatments	1113
	Fuel Treatments	904
	Pre-commercial Thinnings	2815
	Fertilization Treatments	2380
	Pruning Treatments	1065
	Commercial Thinnings	711
2000-2004	Regeneration Harvest Treatments	39
	Fuel Treatments	39
	Pre-commercial Thinnings	1818
	Fertilization Treatments	191

Decade	Activity	Acres
	Pruning Treatments	12
	Commercial Thinnings	962
Present and Future Activities		
2004-2010	Regeneration Harvest Treatments	29
	Fuel Treatments	29
	Pre-commercial Thinnings	1790
	Pruning Treatments	400
	Commercial Thinnings	5,902

Road Systems in the Fall Creek Watershed

The first primitive “truck trail” roads built in the watershed began in early 1900’s for the primary purpose of administrative access for fire protection. In the 1920’s, few roads were constructed. The emphasis was still to develop a road system for effective fire protection. In the late 1940’s demand for timber products increased significantly and lower use project roads, such as roads within a timber sale area, were constructed. In the early 1960’s the road design standards were improved and many of the main access roads were built. The vast majority of the roads in the watershed were constructed from the 1960’s through the 1980’s when the demand for timber and recreation access to public lands dramatically increased. Road construction was minimal in the 1990’s with the decline in timber targets and emphasis shifted toward decommissioning and closure of roads given limited road maintenance budgets.

The Fall Creek watershed has approximately 483 miles of roads. The current road system consist of about 19 miles of paved roads, 364 miles of aggregate surface roads, 52 miles of improved surface or pit run roads, and 48 miles of native surface roads. The Fall Creek ATM Road Management Plan proposes to close or decommission 221 mile of roads this decade.

Listing of recent past, present, and foreseeable future timber sales.

Fire Projects

Puma Hazard Tree Removal Project - 49 ac.
 Clark Fire – Post Fire Analysis –Fall Creek LSR - 0 ac.
 Clark Fire Roadside Salvage – 31 ac.
 Bedrock Campground Restoration Project – 8 ac
 Fall Creek SIA Salvage -101 acres

Commercial Thinning Project

Boundary Thin Timber Sale (TS) – 229 ac.
 Borderline Thin TS – 272 ac.
 Edge Thin TS – 352 ac.
 Fringe Thin TS – 326 ac.
 Periphery Thin TS – 537 ac.
 Portland Thin TS – 334 ac.
 Margin Thin TS – 337 ac.
 Fall Thin TS – 230 ac.
 Hehe Thin Project – 4,000 ac.
 Grin Thin – 189 ac.
 Pencil Thin – 242 ac.

Windy Thin – 93 ac.

Regeneration Harvest

Clark TS – 29 ac.

South Station – 128 ac.

Other Future Activities

The Fall Creek corridor would continue to have a high level of recreation use in the developed and dispersed sites, trails, and roads which would contribute to cumulative effects on the watershed. Many routine maintenance activities would continue to occur throughout the watershed. They include road maintenance, hazard tree assessment and management, and recreation facility maintenance, and silvicultural maintenance and improvements to the managed plantations.

New delineation of the 5th field Watersheds

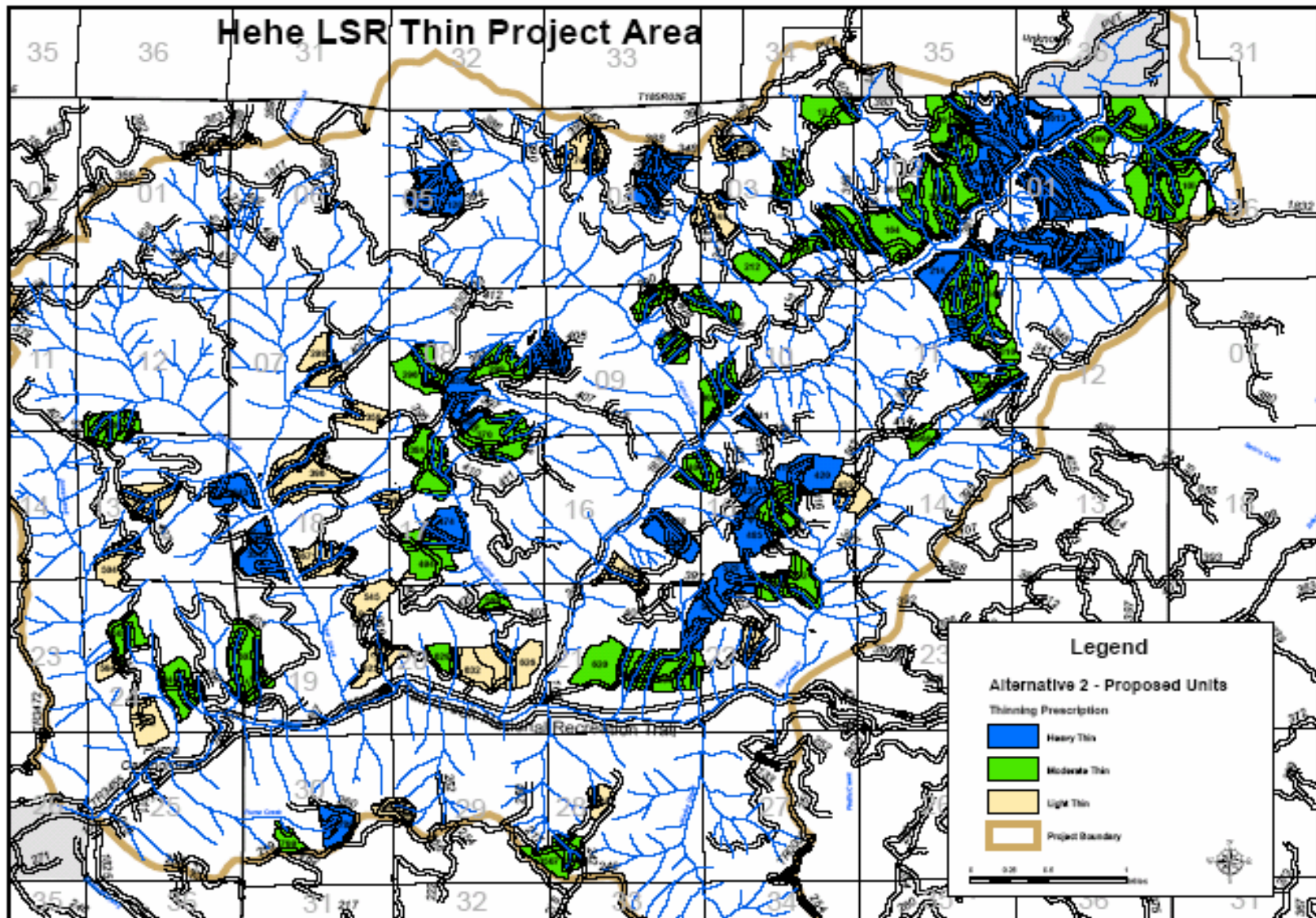
In 2004, the 5th field watersheds were re-defined in a Regional effort by the US Forest Service, Soil Conservation Service, US Geological Service, and State of Oregon Water Resources in order to apply a consistent national standard to watersheds. The Fall Creek 5th field watershed boundaries were re-delineated and expanded to include what was defined as the Winberry watershed and the lower portions of the watershed down to the confluence with the Middle Fork of the Willamette River, to meet size requirements. Although the boundaries do not match up exactly, the area defined by the new Fall Creek 5th field watershed is covered by the area analyzed in the Fall Creek Watershed Analysis (USDA, 1995) and the Winberry and Lower Fall Creek Watershed Analysis (USDA, USDI, 1996). The new 5th field watershed is approximately 123,538 acres in size and contains six 6th field sub-watersheds. The delineation of 6th field sub-watersheds remain approximately the same, but the names of the sub-watersheds have changed. The table below lists the old names and new names of the sub-watersheds as discussed in the Watershed Analyses.

Table B2 – Old and new Sub-Watershed Reference

Watershed Analyses Sub-Watershed Names	New Sub-Watershed Names
Fall Creek WA	
Lower Fall Creek	Fall Creek/Andy Creek
Hehe Creek	Fall Creek/Hehe Creek
Upper Fall Delp Creek	Fall creek/Delp Creek
Portland Creek	Fall Creek/Portland Creek
Winberry and Lower Fall Creek WA	
Winberry Creek	Brush Creek, North Winberry, Lower South Winberry, Upper South Winberry, and portion of South Reservoir
Lower Fall Creek	North Reservoir, and portions of South Reservoir

The cumulative effects analyses for water quality and spring chinook salmon were based on this new delineation of the Fall Creek 5th field watershed. Refer to both the Fall Creek Watershed Analysis (USDA, 1995) and the Winberry and Lower Fall Creek Watershed Analysis (USDA, USDI, 1996) for a description of the important physical and biological components of the existing conditions of this 5th field watershed.

Appendix C – Alternatives Unit Prescription Summaries



Map C1 - Alternative 2 – Proposed Units
Table C1 – Alternative 2 Unit Prescriptions

Appendix C – Alternative 2

Hehe LSR Thin Project

Unit#	Thin Acres	RR Thin Acres	Total Thin Acres	No Thin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging System
10A	6.1	7.1	13.2	46.1	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline
10B	60.2	39.7	99.9	14.3	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline	Helicopter & Skyline
10F	23.5	20.1	43.6	20.6	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	No Treatment	Helicopter
10G	29.5	28.0	57.5	17.3	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	No Treatment	Helicopter
10I	67.9	37.7	105.6	15.6	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	No Treatment	Helicopter
10K	16.1	14.2	30.2	18.4	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	No Treatment	Helicopter
10M	46.2	32.3	78.5	24.6	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	No Treatment	Helicopter

Appendix C – Alternative 2

Hehe LSR Thin Project

Unit#	Thin Acres	RR Thin Acres	Total Thin Acres	No Thin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging System
12	35.9	5.5	41.4	2.1	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
74	24.7	17.1	41.8	6.5	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
102	8.5	15.8	24.3	7.9	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
120	26.2	24.0	60.2	11.9	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
148	15.1	9.1	24.2	10.6	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline, Roadside Grapple Pile & Burn	Helicopter & Skyline
155	17.3	10.9	28.2	4.6	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline, Roadside Grapple Pile & Burn	Helicopter & Skyline
164	53.7	23.7	77.5	15.7	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline

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Unit#	Thin Acres	RR Thin Acres	Total Thin Acres	No Thin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging System
164A	13.8	5.2	19.1	1.8	Moderate Thin to 24' X 24"(\pm 25%) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' \pm 25% ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
212	22.3	6.6	28.9	2.5	Moderate Thin to 24' X 24"(\pm 25%) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' \pm 25% ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
214	23.2	7.7	30.9	7.9	Moderate Thin to 24' X 24"(\pm 25%) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' \pm 25% ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline	Helicopter & Skyline
214C	6.3	4.5	10.8	1.5	Moderate Thin to 24' X 24"(\pm 25%) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' \pm 25% ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	No Treatment	Helicopter
214D	7.2	24.0	31.2	12.8	Moderate Thin to 24' X 24"(\pm 25%) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' \pm 25% ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	No Treatment	Helicopter
214E	16.5	17.2	33.7	7.2	Moderate Thin to 24' X 24"(\pm 25%) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' \pm 25% ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	No Treatment	Helicopter
252	10.1	13.4	23.6	6.9	Moderate Thin to 24' X 24"(\pm 25%) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' \pm 25% ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	No Treatment	Helicopter

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Hehe LSR Thin Project

Unit#	Thin Acres	RR Thin Acres	Total Thin Acres	No Thin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging System
281	9.7	17.6	27.3	19.8	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline, Roadside Grapple Pile & Burn	Helicopter & Skyline
289	6.9	13.2	20.0	6.2	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	No Treatment	Helicopter
296	30.9	11.6	42.5	16.4	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline, Roadside Grapple Pile & Burn	Helicopter & Skyline
298	27.8	9.2	37.0	15.9	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
299	20.5	15.3	35.9	20.3	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline	Helicopter & Skyline
306	16.1	20.1	36.2	14.2	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline, Roadside Grapple Pile & Burn	Helicopter & Skyline
310	19.1	11.9	31.1	5.2	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	No Treatment	Helicopter

Appendix C – Alternative 2

Hehe LSR Thin Project

Unit#	Thin Acres	RR Thin Acres	Total Thin Acres	No Thin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging System
332	15.3	12.3	27.6	3.9	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline, Roadside Grapple Pile & Burn	Helicopter & Skyline
335	35.4	10.2	60.2	5.3	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
341	3.2	6.4	9.6	7.7	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline	Helicopter & Skyline
358	21.5	4.2	25.8	1.2	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline
361	16.6	19.6	36.2	11.1	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline
370	38.9	21.0	59.9	8.3	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline
384	35.2	19.2	54.4	9.2	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline

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Unit#	Thin Acres	RR Thin Acres	Total Thin Acres	No Thin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging System
396	45.5	32.9	78.4	23.4	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~200 listed fish on Alder and Hehe Ck, No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\% \sim 105$ TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline, Roadside Grapple & Burn	Helicopter & Skyline
408	16.8	15.7	32.6	13.8	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\% \sim 80$ TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn	Helicopter & Skyline
419	11.9	6.7	18.5	2.7	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\% \sim 55$ TPA	Moderate - Protect all existing CWD, Create 3 TPA >18"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
420	30.8	0.6	31.4	0.0	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\% \sim 55$ TPA	Moderate - Protect all existing CWD, Create 3 TPA >18"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
432	22.5	8.8	31.3	3.9	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\% \sim 105$ TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
433	32.9	1.9	34.8	0.3	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\% \sim 55$ TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline
442	23.4	15.8	39.3	6.8	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\% \sim 80$ TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline

Appendix C – Alternative 2

Hehe LSR Thin Project

Unit#	Thin Acres	RR Thin Acres	Total Thin Acres	No Thin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging System
447	17.8	18.1	35.9	8.4	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline Roadside Grapple & Burn	Helicopter & Skyline
449	6.6	6.1	12.6	8.4	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
474	22.7	13.1	35.8	6.7	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline	Helicopter & Skyline
478	28.5	11.9	40.5	7.1	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Moderate - Protect all existing CWD, Create 3 TPA >18"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline, Roadside Grapple Pile & Burn	Helicopter & Skyline
485	29.9	3.2	33.1	0.8	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
494	41.6	5.9	47.5	1.7	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
604	20.9	8.9	29.9	5.0	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline

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Hehe LSR Thin Project

Unit#	Thin Acres	RR Thin Acres	Total Thin Acres	No Thin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging System
514	11.1	11.2	22.2	9.3	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline, Roadside Grapple Pile & Burn	Helicopter & Skyline
522	21.6	10.1	31.7	4.3	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline, Roadside Grapple Pile & Burn	Helicopter & Skyline
528	23.4	9.8	33.2	2.9	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline, Roadside Grapple Pile & Burn	Helicopter & Skyline
545	30.8	0.0	30.9	2.6	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~200 listed fish on Alder and Hehe Ck, No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline
554	29.9	12.1	42.1	7.6	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline, Roadside Grapple Pile & Burn	Helicopter & Skyline
569	10.8	2.3	13.1	0.8	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline, Roadside Grapple Pile & Burn	Helicopter & Skyline
594	10.7	0.0	10.7	0.0	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline

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Unit#	Thin Acres	RR Thin Acres	Total Thin Acres	No Thin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging System
606	5.2	13.4	18.7	5.9	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline	Helicopter & Skyline
607	33.3	27.1	60.4	9.8	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline	Helicopter & Skyline
620	46.6	0.6	47.2	0.0	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	No Treatment	Helicopter
622	22.8	8.6	31.5	3.1	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Roadside Grapple & Burn	Skyline
626	45.1	10.8	55.9	5.0	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Underburn	Skyline
629	13.9	1.9	15.8	0.1	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline	Helicopter & Skyline
632	26.7	4.3	31.0	2.3	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline

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Unit#	Thin Acres	RR Thin Acres	Total Thin Acres	No Thin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging System
634	9.5	18.5	28.1	7.7	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline, Roadside Grapple Pile & Burn	Helicopter & Skyline
636	25.9	20.1	46.0	8.4	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline	Helicopter & Skyline
640	27.3	16.0	43.3	5.8	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline, Roadside Grapple Pile & Burn	Helicopter & Skyline
672	36.6	0.6	37.2	0.0	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn, Underburn	Skyline
765	14.4	5.2	19.6	1.7	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline	Helicopter & Skyline
780	24.8	5.8	30.6	2.2	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
799	12.8	3.0	15.8	0.9	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline

Appendix C – Alternative 2

Hehe LSR Thin Project

Unit#	Thin Acres	RR Thin Acres	Total Thin Acres	No Thin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging System
813	8.8	10.4	19.1	4.5	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline	Helicopter & Skyline
3602	25.0	6.2	31.3	1.8	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	No Treatment	Helicopter
3607	17.6	2.2	19.7	0.2	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline	Helicopter & Skyline
3512	31.2	15.8	47.0	14.6	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~200 listed fish on Alder and Hehe Ck, No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
3556	13.4	7.9	21.3	4.5	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
3557	35.1	19.1	54.3	7.9	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
3558	15.0	11.0	26.0	3.9	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline

Appendix C – Alternative 2

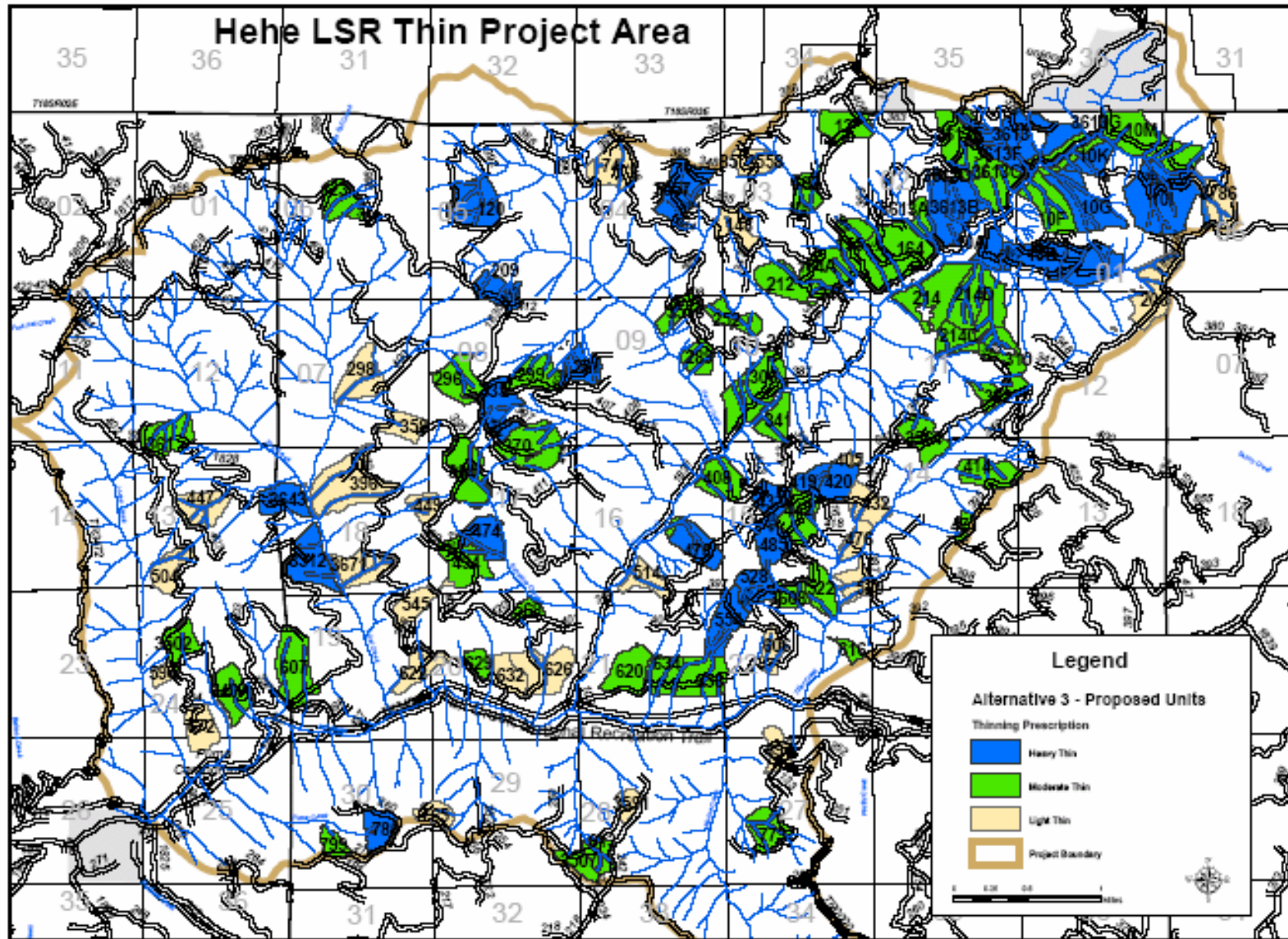
Hehe LSR Thin Project

Unit#	Thin Acres	RR Thin Acres	Total Thin Acres	No Thin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging System
3564	15.4	2.3	17.7	0.1	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Helicopter & Skyline
3569	0.0	1.2	1.2	0.0	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline
3591	11.2	4.3	15.5	1.5	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
3608	8.8	9.3	18.1	4.2	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
3613	42.1	28.5	70.9	15.4	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline	Helicopter & Skyline
3613A	5.9	8.9	14.8	3.2	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline	Helicopter & Skyline
3613B	36.3	39.0	75.4	15.7	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline, Roadside Grapple Pile & Burn	Helicopter & Skyline

Appendix C – Alternative 2

Hehe LSR Thin Project

Unit#	Thin Acres	RR Thin Acres	Total Thin Acres	No Thin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging System
3613C	17.2	21.6	38.9	6.2	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline	Helicopter & Skyline
3613D	11.5	11.6	23.0	5.0	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline
3613E	35.5	7.0	42.6	2.1	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline	Helicopter & Skyline
3613F	13.9	13.6	27.5	7.2	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline	Helicopter & Skyline
3643	21.9	11.3	33.2	7.8	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~200' listed fish on Alder and Hehe Ck, No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline, Roadside Grapple Pile & Burn	Helicopter & Skyline
3671	15.7	17.4	34.0	16.1	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~200 listed fish on Alder and Hehe Ck, No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline



Map C2 – Alternative 3 – Proposed Units

Table C2 – Alternative 3 Unit Prescriptions

Unit#	Thin Acres	RR Thin Acres	Total Thin Acres	NoThin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging Systems
10A	17.9	23.9	41.8	17.4	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline
10B	60.2	39.7	99.9	14.3	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline and Helicopter
10F	23.4	25.5	48.9	15.1	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn	Helicopter
10G	29.5	30.4	59.9	14.8	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn	Helicopter
10I	67.9	37.7	105.6	15.5	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn	Helicopter
10K	16.1	19.7	35.8	12.8	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn	Helicopter

Appendix C – Alternative 3

Hehe LSR Thin Project

Unit#	Thin Acres	RR Thin Acres	Total Thin Acres	NoThin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging Systems
10M	46.2	36.6	82.8	20.3	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn	Helicopter
12	35.8	5.5	41.3	2.1	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
74	24.7	17.0	41.7	6.5	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
102	8.5	15.8	24.3	7.9	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
120	26.2	24.0	60.2	11.9	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
123	21.3	13.8	35.1	6.3	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
148	15.1	9.1	24.2	3.2	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline, Roadside Grapple Pile & Burn	Skyline and Helicopter

Appendix C – Alternative 3

Hehe LSR Thin Project

Unit#	Thin Acres	RR Thin Acres	Total Thin Acres	NoThin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging Systems
155	18.1	12.6	30.7	5.7	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline and Helicopter
164	68.7	27.4	96.1	15.6	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
164A	22.1	16.8	38.9	8.9	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
206	34.6	16.4	51.0	12.9	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline, Roadside Grapple Pile & Burn	Skyline and Helicopter
209	14.9	13.7	28.6	11.6	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Moderate - Protect all existing CWD, Create 3 TPA >18"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
212	34.2	14.0	48.2	6.8	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
214	45.1	24.7	69.8	12.8	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline and Helicopter

Appendix C – Alternative 3

Hehe LSR Thin Project

Unit#	Thin Acres	RR Thin Acres	Total Thin Acres	NoThin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging Systems
214A	0.0	1.1	1.1	0.7	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn	Helicopter
214C	13.9	12.2	26.1	5.6	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn	Helicopter
214D	7.4	24.4	31.8	12.9	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn	Helicopter
214E	16.5	17.2	33.7	7.2	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn	Helicopter
248	0.5	0.3	0.8	0.0	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
252	10.1	13.4	23.5	6.9	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn	Helicopter
281	9.1	16.6	25.7	13.9	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline and Helicopter

Appendix C – Alternative 3

Hehe LSR Thin Project

Unit#	Thin Acres	RR Thin Acres	Total Thin Acres	NoThin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging Systems
289	6.9	14.3	21.2	5.1	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn	Helicopter
296	30.8	11.6	42.4	5.5	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline and Helicopter
299	20.5	15.3	35.8	11.2	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline and Helicopter
306	34.3	36.4	70.7	17.4	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline and Helicopter
310	19.1	11.9	31.0	5.2	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn	Helicopter
332	15.3	12.3	27.6	3.9	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline and Helicopter
335	35.4	10.2	45.6	5.3	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline

Appendix C – Alternative 3

Hehe LSR Thin Project

Unit#	Thin Acres	RR Thin Acres	Total Thin Acres	NoThin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging Systems
341	12.5	15.5	28.0	8.8	Moderate Thin to 24' X 24"(\pm 25%) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' \pm 25% ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline and Helicopter
358	21.5	4.2	25.7	1.2	Light Thin to 21' X 21"(\pm 25%) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' \pm 25% ~ 105 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline
361	16.6	21.4	38.0	9.3	Moderate Thin to 24' X 24"(\pm 25%) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' \pm 25% ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline
370	38.9	20.9	59.8	8.3	Moderate Thin to 24' X 24"(\pm 25%) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' \pm 25% ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline
384	35.2	19.2	54.4	9.2	Moderate Thin to 24' X 24"(\pm 25%) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' \pm 25% ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
396	45.5	36.9	82.4	19.4	Light Thin to 21' X 21"(\pm 25%) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~170 listed fish on Alder and Hehe Ck, No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' \pm 25% ~ 105 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline Roadside Grapple & Burn	Skyline and Helicopter

Appendix C – Alternative 3

Hehe LSR Thin Project

Unit#	Thin Acres	RR Thin Acres	Total Thin Acres	NoThin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging Systems
405	6.1	1.2	7.3	0.3	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline
408	16.8	19.4	36.2	10.1	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline and Helicopter
414	24.5	14.1	38.6	5.6	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline and Helicopter
419	11.9	6.7	18.6	2.7	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Moderate - Protect all existing CWD, Create 3 TPA >18"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
420	32.0	0.6	32.6	0.0	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Moderate - Protect all existing CWD, Create 3 TPA >18"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
432	22.5	8.8	31.3	3.9	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
433	32.8	1.9	34.7	0.3	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline

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Unit#	Thin Acres	RR Thin Acres	Total Thin Acres	NoThin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging Systems
442	23.4	15.8	39.2	6.8	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
447	17.8	18.0	35.8	8.4	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Roadside Grapple & Burn	Skyline and Helicopter
449	7.9	9.2	17.1	3.8	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
471	6.8	2.8	9.6	0.5	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline
474	22.7	13.1	35.8	6.7	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline and Helicopter
476	7.8	11.5	19.3	5.5	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline
478	28.5	13.3	41.8	5.7	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Moderate - Protect all existing CWD, Create 3 TPA >18"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline and Helicopter

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Unit#	Thin Acres	RR Thin Acres	Total Thin Acres	NoThin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging Systems
485	29.9	3.2	33.1	0.8	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
494	41.6	5.9	47.5	1.7	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
604	20.9	8.9	29.8	5.0	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
514	11.1	14.7	25.8	5.8	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline, Roadside Grapple Pile & Burn	Skyline and Helicopter
520	14.5	10.9	25.4	4.5	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline	Skyline and Helicopter
522	21.6	10.1	31.7	4.3	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline and Helicopter
528	23.4	9.8	33.2	2.9	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline and Helicopter

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Unit#	Thin Acres	RR Thin Acres	Total Thin Acres	NoThin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging Systems
545	30.8	0.0	30.8	2.6	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline
554	29.9	12.1	42.0	7.6	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline and Helicopter
569	10.8	2.3	13.1	0.8	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline and Helicopter
594	10.7	0.0	10.7	0.0	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline
606	5.2	13.4	18.6	5.9	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline, Underburn	Skyline and Helicopter
607	33.3	27.1	60.4	9.8	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Underburn	Skyline and Helicopter
616	9.0	1.1	10.1	0.1	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline

Appendix C – Alternative 3

Hehe LSR Thin Project

Unit#	Thin Acres	RR Thin Acres	Total Thin Acres	NoThin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging Systems
620	46.6	0.6	47.2	0.0	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Underburn	Skyline
622	22.8	8.6	31.4	3.1	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Roadside Grapple & Burn	Skyline
626	45.1	10.8	55.9	4.9	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Underburn	Skyline
629	13.9	1.9	15.8	0.1	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Underburn	Skyline and Helicopter
632	26.7	4.3	31.0	2.3	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
634	9.5	18.5	28.0	7.7	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline and Helicopter
636	25.9	20.1	46.0	8.4	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Underburn	Skyline and Helicopter

Appendix C – Alternative 3

Hehe LSR Thin Project

Unit#	Thin Acres	RR Thin Acres	Total Thin Acres	NoThin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging Systems
640	27.3	16.0	43.3	5.8	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline and Helicopter
672	36.3	0.6	36.9	37.0	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn, Underburn	Skyline
694	25.9	0.7	26.6	0.1	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline
765	14.4	5.2	19.6	1.7	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline	Skyline and Helicopter
773	15.1	17.6	32.7	9.1	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline
780	24.8	5.8	30.6	2.2	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
799	12.8	3.0	15.8	0.9	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline

Appendix C – Alternative 3

Hehe LSR Thin Project

Unit#	Thin Acres	RR Thin Acres	Total Thin Acres	NoThin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging Systems
813	8.8	10.4	19.2	4.5	Moderate Thin to 24' X 24"(\pm 25%) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' \pm 25% ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline and Helicopter
3602	25.0	6.2	31.2	1.8	Moderate Thin to 24' X 24"(\pm 25%) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' \pm 25% ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline and Helicopter
3607	17.6	2.2	19.8	0.2	Moderate Thin to 24' X 24"(\pm 25%) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' \pm 25% ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline and Helicopter
3512	31.2	22.2	53.4	8.2	Heavy Thin to 28' X 28"(\pm 25%) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~170 listed fish on Alder and Hehe Ck, No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' \pm 25% ~ 55 TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
3556	13.4	9.5	22.9	2.9	Moderate Thin to 24' X 24"(\pm 25%) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' \pm 25% ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
3557	35.1	19.1	54.2	7.9	Heavy Thin to 28' X 28"(\pm 25%) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' \pm 25% ~ 55 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
3558	14.9	11.0	25.9	3.9	Light Thin to 21' X 21"(\pm 25%) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' \pm 25% ~ 105 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline

Appendix C – Alternative 3

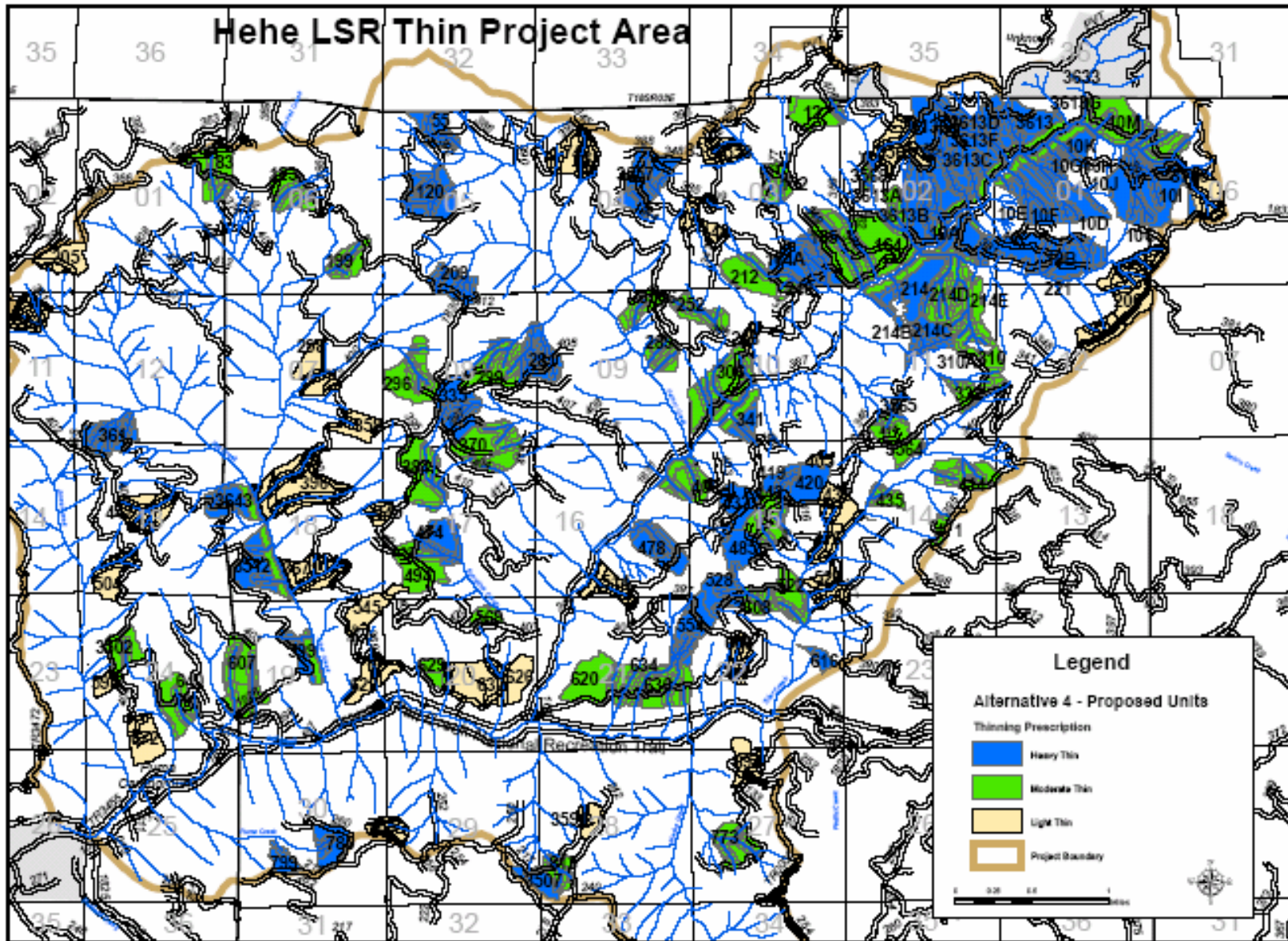
Hehe LSR Thin Project

Unit#	Thin Acres	RR Thin Acres	Total Thin Acres	NoThin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging Systems
3564	32.3	8.5	40.8	2.4	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline and Helicopter
3591	11.2	4.3	15.5	1.5	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline
3608	8.8	9.3	18.1	4.2	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
3613	42.1	28.5	70.6	15.4	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline and Helicopter
3613A	5.9	8.9	14.8	3.2	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline and Helicopter
3613B	36.3	38.9	75.2	15.7	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline and Helicopter
3613C	17.2	21.6	38.8	6.2	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline and Helicopter

Appendix C – Alternative 3

Hehe LSR Thin Project

Unit#	Thin Acres	RR Thin Acres	Total Thin Acres	NoThin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging Systems
3613D	11.5	11.6	23.1	5.9	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline
3613E	35.5	7.0	42.5	2.1	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline and Helicopter
3613F	13.9	13.6	27.5	7.2	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline and Helicopter
3643	21.9	14.6	36.5	4.4	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within~170' listed fish on Alder and Hehe Ck, No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline and Helicopter
3671	15.7	20.9	36.6	11.9	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~170 listed fish on Alder and Hehe Ck, No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline
3786	17.6	15.7	33.3	7.1	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn/ Skyline	Skyline and Helicopter



Map C3 – Alternative 4 – Proposed Units

Table C3 – Alternative 4 Unit Prescriptions

	Thin Acres	RR Thin Acres	Total Thin Acres	No Thin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging System
10A	17.9	23.9	41.8	17.4	Heavy Thin to 28' X 28" ($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 28' X 28' $\pm 25\%$ ~ 55TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Hand Pile & Burn	Skyline
10B	60.2	40.6	100.8	13.4	Heavy Thin to 28' X 28" ($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 28' X 28' $\pm 25\%$ ~ 55TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Hand Pile & Burn	Helicopter & Skyline
10F	23.4	25.6	49.0	15.1	Heavy Thin to 28' X 28" ($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 28' X 28' $\pm 25\%$ ~ 55TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn, Hand Pile & Burn	Helicopter
10G	29.5	30.4	59.9	14.8	Heavy Thin to 28' X 28" ($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 28' X 28' $\pm 25\%$ ~ 55TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn, Hand Pile & Burn	Helicopter
10I	67.9	37.7	105.6	15.5	Heavy Thin to 28' X 28" ($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 28' X 28' $\pm 25\%$ ~ 55TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Hand Pile & Burn	Helicopter

Appendix C – Alternative 4

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	Thin Acres	RR Thin Acres	Total Thin Acres	No Thin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging System
10K	16.1	19.7	35.8	11.2	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 28' X 28' $\pm 25\%$ ~ 55TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Hand Pile & Burn	Helicopter
10M	46.2	36.6	82.8	20.3	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn	Helicopter
12	35.8	5.5	41.3	2.1	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
55	15.9	12.1	28.0	4.8	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 28' X 28' $\pm 25\%$ ~ 55TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Helicopter & Skyline
74	24.7	19.0	43.7	4.5	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 21' X 21' $\pm 25\%$ ~ 105 TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
83	32.3	13.8	46.1	5.3	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Helicopter & Skyline

Appendix C – Alternative 4

Hehe LSR Thin Project

	Thin Acres	RR Thin Acres	Total Thin Acres	No Thin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging System
102	8.5	15.8	24.3	7.9	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
120	26.2	27.6	53.8	7.7	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 28' X 28' $\pm 25\%$ ~ 55TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn, Hand Pile & Burn	Skyline
123	21.3	15.8	37.1	4.3	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
148	15.1	9.1	24.2	9.7	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline, Roadside Grapple Pile & Burn	Helicopter & Skyline
155	18.1	13.6	31.7	4.6	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Helicopter & Skyline
164	68.7	42.3	111.0	11.7	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline

Appendix C – Alternative 4

Hehe LSR Thin Project

	Thin Acres	RR Thin Acres	Total Thin Acres	No Thin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging System
164A	25.4	21.4	46.8	8.9	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
199	14.4	10.8	25.2	4.5	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
205	30.4	1.9	32.3	0.2	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline
206	62.5	28.3	90.8	12.9	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline, Roadside Grapple Pile & Burn	Helicopter & Skyline
209	15.1	13.7	28.8	27.1	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Moderate - Protect all existing CWD, Create 3 TPA >18"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
212	34.2	14.0	48.2	6.8	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline

Appendix C – Alternative 4

Hehe LSR Thin Project

	Thin Acres	RR Thin Acres	Total Thin Acres	No Thin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging System
214	45.1	27.3	72.4	12.8	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Hand Pile & Burn	Helicopter & Skyline
214A	0.0	1.1	1.1	0.7	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn	Helicopter
214C	13.9	12.2	26.1	5.6	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn	Helicopter
214D	7.4	24.4	31.8	12.9	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn	Helicopter
214E	16.5	17.2	33.7	7.2	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn	Helicopter
248	0.5	0.3	0.8	0.0	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline

Appendix C – Alternative 4

Hehe LSR Thin Project

	Thin Acres	RR Thin Acres	Total Thin Acres	No Thin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging System
252	10.1	13.4	23.5	6.9	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn	Helicopter
254	10.3	15.3	25.6	4.3	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
258	4.0	4.0	8.0	2.1	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
281	9.7	23.3	33.0	14.0	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Helicopter & Skyline
289	6.9	14.3	21.2	5.1	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn	Helicopter
296	40.0	13.2	53.2	5.5	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Helicopter & Skyline

Appendix C – Alternative 4

Hehe LSR Thin Project

	Thin Acres	RR Thin Acres	Total Thin Acres	No Thin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging System
298	27.8	9.4	37.2	6.8	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
299	22.4	22.5	44.9	11.2	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Underburn	Helicopter & Skyline
306	34.3	37.4	71.7	16.4	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Helicopter & Skyline
310	19.1	11.9	31.0	5.2	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn	Helicopter
332	15.3	12.3	27.6	3.9	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Helicopter & Skyline
335	37.2	14.2	51.4	4.1	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 28' X 28' $\pm 25\%$ ~ 55TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn, Hand Pile & Burn	Skyline

Appendix C – Alternative 4

Hehe LSR Thin Project

	Thin Acres	RR Thin Acres	Total Thin Acres	No Thin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging System
341	12.5	15.5	28.0	8.8	Moderate Thin to 24' X 24" ($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Hand Pile & Burn	Helicopter & Skyline
358	21.5	4.2	25.7	1.2	Light Thin to 21' X 21" ($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline
361	16.6	21.4	38.0	9.3	Moderate Thin to 24' X 24" ($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline
370	38.9	21.0	59.9	8.3	Moderate Thin to 24' X 24" ($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline
384	35.2	19.2	54.4	9.2	Moderate Thin to 24' X 24" ($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline

Appendix C – Alternative 4

Hehe LSR Thin Project

	Thin Acres	RR Thin Acres	Total Thin Acres	No Thin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging System
396	45.5	39.1	84.6	18.1	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No Thin within ~170 listed fish on Alder and Hehe Ck, No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Top Pile & Burn/ Skyline Roadside Grapple & Burn	Helicopter & Skyline
405	6.1	1.2	7.3	0.3	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline
408	16.8	21.1	37.9	8.8	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn	Helicopter & Skyline
414	24.5	14.1	38.6	5.6	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn	Helicopter & Skyline
419	11.9	6.7	18.6	2.7	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 28' X 28' $\pm 25\%$ ~ 55TPA	Moderate - Protect all existing CWD, Create 3 TPA >18"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn, Hand Pile & Burn	Skyline

Appendix C – Alternative 4

Hehe LSR Thin Project

	Thin Acres	RR Thin Acres	Total Thin Acres	No Thin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging System
420	32.0	0.6	32.6	0.0	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 28' X 28' $\pm 25\%$ ~ 55TPA	Moderate - Protect all existing CWD, Create 3 TPA >18"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn, Underburn	Skyline
432	22.5	8.8	31.3	3.9	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
433	32.8	1.9	34.7	0.3	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 28' X 28' $\pm 25\%$ ~ 55TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Hand Pile & Burn	Skyline
435	8.5	5.6	14.1	6.8	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood		
442	23.4	15.8	39.2	6.8	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
447	17.8	18.0	35.8	8.4	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn / Skyline, Roadside Grapple & Burn	Helicopter & Skyline

Appendix C – Alternative 4

Hehe LSR Thin Project

	Thin Acres	RR Thin Acres	Total Thin Acres	No Thin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging System
449	6.5	6.1	12.6	3.8	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
471	6.8	2.8	9.6	0.5	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline
474	22.7	13.1	35.8	6.7	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Hand Pile & Burn	Helicopter & Skyline
476	7.8	11.5	19.3	5.5	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline
478	28.5	13.3	41.8	5.7	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 28' X 28' $\pm 25\%$ ~ 55TPA	Moderate - Protect all existing CWD, Create 3 TPA >18"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn, Hand Pile & Burn	Helicopter & Skyline
485	29.9	3.3	33.2	0.7	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 28' X 28' $\pm 25\%$ ~ 55TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn, Hand Pile & Burn	Skyline

Appendix C – Alternative 4

Hehe LSR Thin Project

	Thin Acres	RR Thin Acres	Total Thin Acres	No Thin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging System
494	41.6	5.9	47.5	1.7	Moderate Thin to 24' X 24" ($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
604	20.9	8.9	29.8	5.0	Light Thin to 21' X 21" ($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 21' X 21' $\pm 25\%$ ~ 105 TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
514	11.1	16.1	27.2	6.1	Light Thin to 21' X 21" ($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline, Roadside Grapple Pile & Burn	Helicopter & Skyline
520	14.5	10.9	25.4	4.5	Light Thin to 21' X 21" ($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline	Helicopter & Skyline
522	21.6	10.1	31.7	4.3	Moderate Thin to 24' X 24" ($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Helicopter & Skyline

Appendix C – Alternative 4

Hehe LSR Thin Project

	Thin Acres	RR Thin Acres	Total Thin Acres	No Thin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging System
528	23.4	11.2	34.6	1.5	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 28' X 28' $\pm 25\%$ ~ 55TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn, Hand Pile & Burn	Helicopter & Skyline
545	33.5	0.0	33.5	0.0	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline
554	29.9	12.1	42.0	7.6	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 28' X 28' $\pm 25\%$ ~ 55TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn, Hand Pile & Burn	Helicopter & Skyline
569	10.8	2.3	13.1	0.8	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Helicopter & Skyline
594	10.7	0.0	10.7	0.0	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline

Appendix C – Alternative 4

Hehe LSR Thin Project

	Thin Acres	RR Thin Acres	Total Thin Acres	No Thin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging System
599	13.4	15.7	29.1	4.8	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~170' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 28' X 28' $\pm 25\%$ ~ 55TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn, Hand Pile & Burn	Skyline
606	5.2	13.4	18.6	5.9	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline, Underburn	Helicopter & Skyline
607	33.3	27.1	60.4	9.8	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (>170', >100' & >60') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Underburn	Helicopter & Skyline
616	9.0	1.1	10.1	0.1	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Hand Pile & Burn	Skyline
620	46.6	0.6	47.2	0.0	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Underburn	Helicopter
622	22.8	8.6	31.4	3.1	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Roadside Grapple & Burn	Skyline

Appendix C – Alternative 4

Hehe LSR Thin Project

	Thin Acres	RR Thin Acres	Total Thin Acres	No Thin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging System
626	45.1	13.3	58.4	2.5	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Underburn	Skyline
629	13.9	1.9	15.8	0.1	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Underburn	Helicopter & Skyline
632	26.7	4.3	31.0	2.3	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 21' X 21' $\pm 25\%$ ~ 105 TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
634	9.5	20.1	29.6	6.2	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Helicopter & Skyline
636	25.9	20.7	46.6	7.9	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Underburn	Helicopter & Skyline
640	27.3	16.0	43.3	5.8	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Helicopter & Skyline

Appendix C – Alternative 4

Hehe LSR Thin Project

	Thin Acres	RR Thin Acres	Total Thin Acres	No Thin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging System
672	36.3	0.6	36.9	36.9	Light Thin to 21' X 21'($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn, Underburn	Skyline
694	25.9	0.7	26.6	0.1	Light Thin to 21' X 21'($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline
765	14.4	5.2	19.6	1.7	Light Thin to 21' X 21'($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline	Helicopter & Skyline
773	15.2	17.6	32.8	9.1	Moderate Thin to 24' X 24'($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline
780	24.8	6.7	31.5	1.3	Heavy Thin to 28' X 28'($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
799	12.8	3.0	15.8	0.9	Moderate Thin to 24' X 24'($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline

Appendix C – Alternative 4

Hehe LSR Thin Project

	Thin Acres	RR Thin Acres	Total Thin Acres	No Thin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging System
813	8.8	10.4	19.2	4.5	Moderate Thin to 24' X 24" ($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn	Helicopter & Skyline
3602	25.0	6.2	31.2	1.8	Moderate Thin to 24' X 24" ($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Helicopter
3607	17.6	2.2	19.8	0.2	Moderate Thin to 24' X 24" ($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn	Helicopter & Skyline
3512	31.2	25.3	56.5	5.8	Heavy Thin to 28' X 28" ($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No Thin within ~170 listed fish on Alder and Hehe Ck, No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 28' X 28' $\pm 25\%$ ~ 55 TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn, Hand Pile & Burn	Skyline
3556	13.4	9.5	22.9	2.9	Moderate Thin to 24' X 24" ($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline

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Hehe LSR Thin Project

	Thin Acres	RR Thin Acres	Total Thin Acres	No Thin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging System
3557	35.1	22.9	58.0	4.3	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 28' X 28' $\pm 25\%$ ~ 55TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn, Hand Pile & Burn	Skyline
3558	15.0	11.0	26.0	3.9	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~100' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline
3564	32.3	8.5	40.8	2.4	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Helicopter & Skyline
3565	2.3	2.4	4.7	1.0	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Helicopter
3568	2.0	4.7	6.7	2.4	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
3569	30.8	16.7	47.5	6.1	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline

Appendix C – Alternative 4

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	Thin Acres	RR Thin Acres	Total Thin Acres	No Thin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging System
3591	11.2	4.3	15.5	1.5	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams, Thin upland RR (. 170' >100' & >60') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline
3608	8.8	9.3	18.1	4.2	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn	Skyline
3613	45.9	33.9	79.8	8.9	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 28' X 28' $\pm 25\%$ ~ 55TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn, Hand Pile & Burn	Helicopter & Skyline
3613A	5.9	8.9	14.8	3.2	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn	Helicopter & Skyline
3613B	36.3	39.5	75.8	15.3	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~60' Class 4 intermittent streams,, Thin upland RR (>170', >100' & >60') to 28' X 28' $\pm 25\%$ ~ 55 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn, Hand Pile & Burn	Helicopter & Skyline
3613C	17.2	21.9	39.1	5.9	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' $\pm 25\%$ ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Hand Pile & Burn	Helicopter & Skyline

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Hehe LSR Thin Project

	Thin Acres	RR Thin Acres	Total Thin Acres	No Thin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging System
3613D	11.5	11.6	23.1	5.9	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' + 25% ~ 80TPA	High - Protect all existing CWD, Create 5 TPA >18"DBH snags (DF), Create 3 TPA >20"DBH down wood	Yard Tops Pile & Burn, Hand Pile & Burn	Skyline
3613E	35.5	7.0	42.5	2.1	Moderate Thin to 24' X 24"($\pm 25\%$) = 80 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 24' X 24' + 25% ~ 80TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn, Hand Pile & Burn	Helicopter & Skyline
3613F	13.9	13.6	27.5	7.2	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 28' X 28' + 25% ~ 55TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn, Hand Pile & Burn	Helicopter & Skyline
3643	21.9	16.2	38.1	4.4	Heavy Thin to 28' X 28"($\pm 25\%$) = 55 TPA, DTR 2 trees/5 ac.cut 60'radius	No Thin within ~170 listed fish on Alder and Hehe Ck, No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 28' X 28' + 25% ~ 55 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn, Roadside Grapple Pile & Burn, Hand Pile & Burn	Helicopter & Skyline
3671	15.7	22.5	38.2	10.3	Light Thin to 21' X 21"($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No Thin within ~170 listed fish on Alder and Hehe Ck, No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 21' X 21' + 25% ~ 105 TPA	Moderate - Protect all existing CWD, Create 3 TPA >20"DBH snags (DF), Create 2 TPA >20"DBH down wood	Yard Tops Pile & Burn	Skyline

Appendix C – Alternative 4

Hehe LSR Thin Project

	Thin Acres	RR Thin Acres	Total Thin Acres	No Thin Acres	Thin RX	Riparian Reserve Thin RX	Coarse Woody Debris RX	Fuels RX	Logging System
3786	17.6	15.7	33.3	7.1	Light Thin to 21' X 21" ($\pm 25\%$) = 105 TPA, DTR 2 trees/5 ac.cut 60'radius	No thin within ~60' Class 1&2&3 (perennials), no thin within ~25' Class 4 intermittent streams with <30% slide slopes, Thin upland RR (>60', & >25') to 21' X 21' $\pm 25\%$ ~ 105 TPA	Low - Protect all existing CWD, Create 1 TPA >18"DBH snags (DF), Create 1 TPA >20"DBH down wood	Yard Tops Pile & Burn/Skyline	Helicopter & Skyline

Appendix D - Road Work Associated with the Action Alternatives

Table D1- Road reconstruction/maintenance, by Alternative

Road Number	Wet Weather Haul	Miles	Reconstruction/ Maintenance Level by Mile	Reconstruction/ Maintenance Level by Mile	Reconstruction/ Maintenance Level by Mile	Remarks
			Alt 2	Alt 3	Alt 4	
1800	y	12.14	*0.10-high 9.68-moderate	*0.10-high 12.04-moderate	*0.10-high 12.04-moderate	*Bridge work: pier foundation stabilization @ Hehe & alder ck
1817	n	9.53	4.73-low	4.73-low	9.53-low	rock haul, cow horn 4.73 miles
1817361	n	0.16	n/a	n/a	0.16-low	
1817362	n	0.09	0.09-low	0.09-low	0.09-low	
1817381	n	0.09	n/a	n/a	0.09-low	
1817391	n	0.15	0.15-low	0.15-low	0.15-low	
1818	n	1.48	n/a	n/a	1.48-low	
1818424	n	2.59	0.40-low	0.40-low	0.40-low	rock haul, cow horn, .40
1818426	n	0.77	0.77-low	0.77-low	0.77-low	rock haul, cow horn, .77
1818433	n	0.07	0.07-low	0.07-low	0.07-low	rock haul, cow horn, .07
1824	y	4.31	4.31-low	4.31-low	4.31-low	rock haul, porcupine, 4.31
1824163	y	0.20	0.20-low	0.20-low	0.20-low	rock haul, porcupine, .20
1825	y	1.22	1.22-low	1.22-low	1.22-low	
1825217	y	3.17	0.10-moderate 3.07-low	0.10-moderate 3.07-low	0.10-moderate 3.07-low	live stream pipe replace @ mp 2.17
1825217	n	0.83	0.83-low	0.83-low	0.83-low	mp 3.17-4.00
1825218	y	0.64	0.64-low	0.64-low	0.64-low	
1825218	n	0.53	0.53-low	0.53-low	0.53-low	
1825219	y	1.65	1.65-low	1.65-low	1.65-low	
1825240	y	0.95	0.95-low	0.95-low	0.95-low	
1825242	y	0.82	0.82-low	0.82-low	0.82-low	
1825258	n	0.30	0.30-low	0.30-low	0.30-low	
1825260	n	0.79	0.79-low	0.79-low	0.79-low	
1828	y	0.47	0.47-low	0.47-low	0.47-low	
1828	n	4.18	4.18-moderate	4.18-moderate	4.18-moderate	
1828400	n	0.08	0.08-low	0.08-low	0.08-low	
1828402	y	4.49	4.49-low	4.49-low	4.49-low	
1828403	n	1.43	1.43-low	1.43-low	1.43-low	
1828404	n	0.89	0.89-low	0.89-low	0.89-low	
1828405	n	0.17	0.17-low	0.17-low	0.17-low	
1828407	y	1.15	1.15-low	1.15-low	1.15-low	
1828408	n	0.2	0.20-low	0.20-low	0.20-low	
1828412	n	0.14	0.14-low	0.14-low	0.14-low	

Road Number	Wet Weather Haul	Miles	Reconstruction/ Maintenance Level by Mile	Reconstruction/ Maintenance Level by Mile	Reconstruction/ Maintenance Level by Mile	Remarks
			Alt 2	Alt 3	Alt 4	
1830	y	4.34	4.34-low	4.34-low	4.34-low	
1830	n	0.94	0.94-low	0.94-low	0.94-low	
1830368	n	0.27	0.27-low	0.27-low	0.27-low	
1830369	n	0.06	0.06-low	0.06-low	0.06-low	
1830370	n	0.35	0.35-low	0.35-low	0.35-low	
1830372	n	0.11	0.11-low	0.11-low	0.11-low	
1830381	n	0.12	0.12-low	0.12-low	0.12-low	
1830382	n	0.08	0.08-low	0.08-low	0.08-low	
1830386	n	1.47	1.47-moderate	1.47-moderate	1.47-moderate	
1830394	n	0.27	0.27-low	0.27-low	0.27-low	
1830395	n	0.33	0.33-low	0.33-low	0.33-low	
1830397	n	0.31	0.31-low	0.31-low	0.31-low	
1830398	n	0.33	0.33-low	0.33-low	0.33-low	
1830400	n	5.44	5.44-moderate	0.30-moderate 5.14-low	0.30-moderate 5.14-low	
1830402	n	0.19	0.19-low	0.19-low	0.19-low	
1830403	n	0.26	0.26-low	0.26-low	0.26-low	
1830404	n	0.58	0.58-low	0.58-low	0.58-low	
1830405	n	0.46	0.46-low	0.46-low	0.46-low	
1830406	n	0.12	0.12-low	0.12-low	0.12-low	
1830407	n	0.70	0.70-low	0.70-low	0.70-low	
1830409	n	0.36	0.36-low	0.36-low	0.36-low	
1830410	n	0.26	0.26-low	0.26-low	0.26-low	
1830413	n	0.09	0.09-low	0.09-low	0.09-low	
1830423	n	0.07	0.07-low	0.07-low	0.07-low	
1831	n	9.11	0.25-high- 5.43-moderate	0.25-high- 5.43-moderate	1.00-high 8.11-moderate	realignment @ mps .75, 6.00, 7.59 Pernot replace mp.2.16,
1831338	n	0.09	0.09-low	0.09-low	0.09-low	
1831341	n	0.21	0.21-low	0.21-low	0.21-low	
1831345	n	0.09	0.09-low	0.09-low	0.09-low	
1831346	n	0.24	0.24-low	0.24-low	0.24-low	
1831347	n	0.28	0.28-low	0.28-low	0.28-low	
1831348	n	0.24	0.24-low	0.24-low	0.24-low	
1831349	n	0.28	0.28-low	0.28-low	0.28-low	
1831365	n	0.19	n/a	0.19-low	0.19-low	
1831366	n	0.13	n/a	0.13-low	0.13-low	
1831367	n	0.27	n/a	0.27-low	0.27-low	
1831368	n	0.12	n/a	0.12-low	0.12-low	
1831369	n	0.24	n/a	0.24-low	0.24-low	
1831370	n	0.19	n/a	0.19-low	0.19-low	
1831371	n	0.37	0.37-low	0.37-low	0.37-low	
1831381	n	2.14	0.60-moderate 1.64-low	0.60-moderate 1.64-low	0.60-moderate 1.64-low	
1831382	n	3.16	.60-low	3.16-low	3.16-low	
1831383	n	4.33	.20-moderate	.20-moderate	.20-moderate	live stream replacement @ 1.55

Road Number	Wet Weather Haul	Miles	Reconstruction/ Maintenance Level by Mile	Reconstruction/ Maintenance Level by Mile	Reconstruction/ Maintenance Level by Mile	Remarks
			Alt 2	Alt 3	Alt 4	
			4.13-low	4.13-low	4.13-low	
1831384	n	2.46	2.46-low	2.46-low	2.46-low	
1831385	n	2.05	2.05-low	2.05-low	2.05-low	
1831386	n	1.13	1.13-low	1.13-low	1.13-low	
1831388	n	0.19	0.19-low	0.19-low	0.19-low	
1831390	n	0.27	0.27-low	0.27-low	0.27-low	
1831395	n	0.13	0.13-low	0.13-low	0.13-low	
1831399	n	0.30	0.30-low	0.30-low	0.30-low	
1831401	n	0.20	0.20-low	0.20-low	0.20-low	
1831402	n	0.08	0.08-low	0.08-low	0.08-low	
1831403	n	0.23	0.23-low	0.23-low	0.23-low	
1831404	n	0.24	0.24-low	0.24-low	0.24-low	
1831406	n	0.44	0.44-low	0.44-low	0.44-low	
1831408	n	0.41	0.41-low	0.41-low	0.41-low	
1832	y	5.38	5.38-low	5.38-low	5.38-low	
1832	n	2.55	0.15-moderate 2.40-low	0.15-moderate 2.40-low	0.15-moderate 2.40-low	retaining wall @ 6.88
1832102	n	0.05	0.05-low	0.05-low	0.05-low	
1832103	n	0.04	0.04-low	0.04-low	0.04-low	
1832104	n	0.08	0.08-low	0.08-low	0.08-low	
1832342	n	0.45	0.45-low	0.45-low	0.45-low	
1832345	n	0.82	0.82-low	0.82-low	0.82-low	
1832387	n	0.26	0.26-low	0.26-low	0.26-low	
1832393	n	0.31	0.31-low	0.31-low	0.31-low	
1832395	n	1.58	1.58-low	1.58-low	1.58-low	
1832396	y	0.89	0.89-low	0.89-low	0.89-low	
1832397	y	2.79	2.79-low	2.79-low	2.79-low	
1832403	n	0.44	0.44-low	0.44-low	0.44-low	
1832407	n	0.56	0.56-low	0.56-low	0.56-low	
1832408	n	0.13	0.13-low	0.13-low	0.13-low	
1832414	n	0.20	0.20-low	0.20-low	0.20-low	
1832418	n	0.55	0.55-low	0.55-low	0.55-low	
1832843	n	0.33	0.33-low	0.33-low	0.33-low	
1833	n	0.59	n/a	0.59-low	0.59-low	
1833260	n	1.27	n/a	1.27-low	1.27-low	
1832260	n	1.23	n/a	1.23-low	1.23-low	
1834	n	0.88	n/a	0.88-low	0.88-low	
1834387	n	0.38	n/a	0.38-low	0.38-low	
1834390	n	1.37	n/a	0.10-moderate 1.27-low	0.10-moderate 1.27-low	live stream replacement @ 0.98
1834390	n	1.36	n/a	1.36-low	1.36-low	

Table D2 - Stream Culvert Installation or Replacement

Road Number		Existing Culvert Diameter	Streamflow ¹
	MP	Inches	Class
1800	9.20	18	DR
1800	9.98	24	I
1800	10.03	18	DR
1800	10.75	18	I
1800	11.49	18	DR
1800	11.94	18	DR
1800	12.06	36	I
1800	12.32	12	DR
1800	12.91	18	DR
1800	15.07	48	P
1800	15.57	18	DR
1800	15.79	18	DR
1800	15.94	24	I
1800	16.29	48	P
1800	16.68	18	DR
1800	17.00	30	I
1800	17.57	18	DR
1800	18.02	18	DR
1800	18.41	18	DR
1800	19.70	24	I
1800	20.03	18	DR
1800	20.20	36	I
1800	20.24	18	DR
1800	20.79	18	DR
1800	20.86	24	I
1828	21.11	18"	DR
1828	0.60	24"	I
1828	0.92	18"	DR
1828	1.21	18"	DR
1828	1.28	18"	DR
1828402	0.39	18"	DR

Road Number		Existing Culvert Diameter	Streamflow ¹
	MP	Inches	Class
1828402	0.76	18"	DR
1830	0.15	30"	I
1830	0.42	18"	DR
1830	0.53	18"	DR
1830	0.66	18"	I
1830	0.96	18"	DR
1830	1.68	18"	I
1830	1.91	18"	I
1830	2.39	24"	I
1830400	0.3	36"	I
1830400	0.70	36"	I
1831	0.01	18"	DR
1831	0.06	18"	I
1831	0.71	18"	I
1831	1.62	48"	P
1831	2.16	108" 2 pipes	P
1831	2.55	48"	P
1831	5.00	60"	P
1831383	1.55	42"	P
1832	0.15	18"	DR
1832	0.27	18"	DR
1832	0.33	18"	DR
1832	0.44	18"	DR
1832	0.56	18"	I
1832	0.65	18"	I
1832	0.78	18"	I
1832	0.90	18"	I
1832	1.05	18"	I
1832	1.31	18"	I
1832	1.38	18"	DR

Road Number		Existing Culvert Diameter	Streamflow ¹
	MP	Inches	Class
1832	1.47	18"	I
1832	1.68	18"	I
1832	1.82	18"	DR
1832	1.93	18"	I
1832	2.12	18"	DR
1832	2.41	18"	DR
1832	2.45	18"	I
1832	2.52	18"	I
1832	2.63	18"	I
1832	3.01	18"	I
1832	3.78	18"	I
1832397	0.25	18"	DR
1832397	0.47	18"	DR
1832397	0.55	18"	I
1832397	0.88	18"	I
1832404	0.53	18"	DR
1833	0.18	18"	DR
1833	0.26	18"	DR
1833	0.31	18"	I
1833	0.48	36"	I
1833	0.57	18"	DR
1833260	0.21	42"	I
1833260	0.37	18"	DR
1833260	0.42	18"	DR
1833260	0.60	18"	DR
1833260	0.90	18"	I
1833260	1.26	18"	DR
1833260	1.51	18"	DR
1833260	1.80	18"	DR
1834	0.11	18"	DR
1834	0.57	30"	I

Road Number		Existing Culvert Diameter	Streamflow ¹
	MP	Inches	Class
1834	0.69	30"	I
1834390	0.19	30"	I
1834390	0.33	24"	I
1834390	0.98	30"	P
1834390	1.29	18"	I
1834390	1.32	18"	I
1834390	1.45	18"	DR

Streamflow 1 I-Intermittent DR-Ditch relief P-Perennial

Table D3 - Temporary road summary

Surface Type	Alternative 1 (No Action)	Alternative 2	Alternative 3 (Proposed Action)	Alternative 4
Existing Native	0.00	0.4	1.2	1.1
Existing Aggregate	0.00	0.4	0.6	0.7
New Native	0.00	2.7	2.8	3.6
New Aggregate	0.00	1.1	1.0	1.2
Total Miles	0.00	4.6	5.6	6.6

Table D4 – Alternative New Closure Level Summary

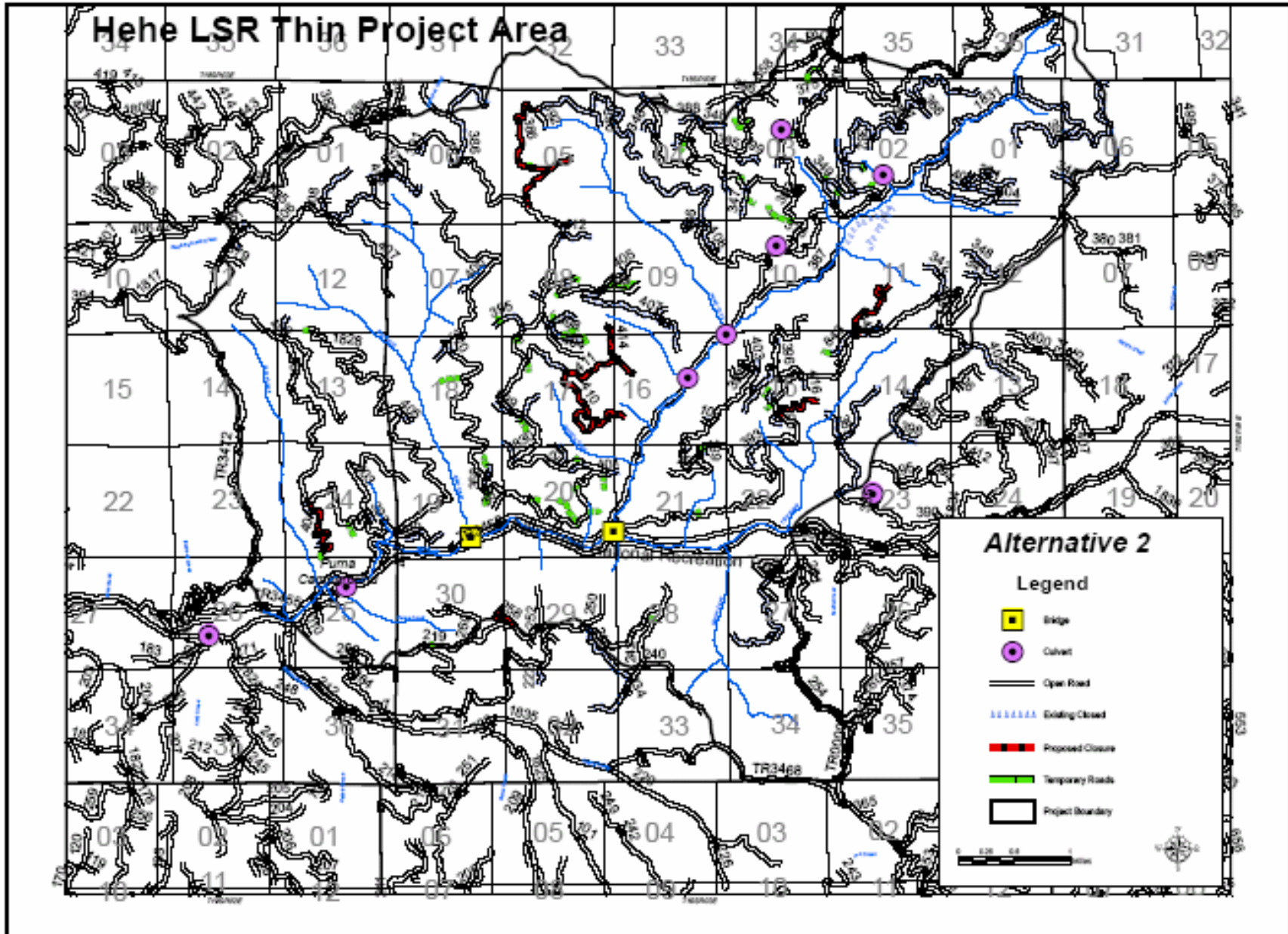
Closure level	Alternative 1 (No Action)	Alternative 2	Alternative 3 (Proposed Action)	Alternative 4
Low	0.0	4.0	20.3	7.2
Moderate	0.0	0.4	17.7	29.2
High - Decommission	0.0	0.0	0.0	1.7
Totals	0.0	4.4	38.0	38.1
Existing Closed Road to be Decommissioned	0	0.5	5.3	11.7

Table D5 – Proposed Road Closures

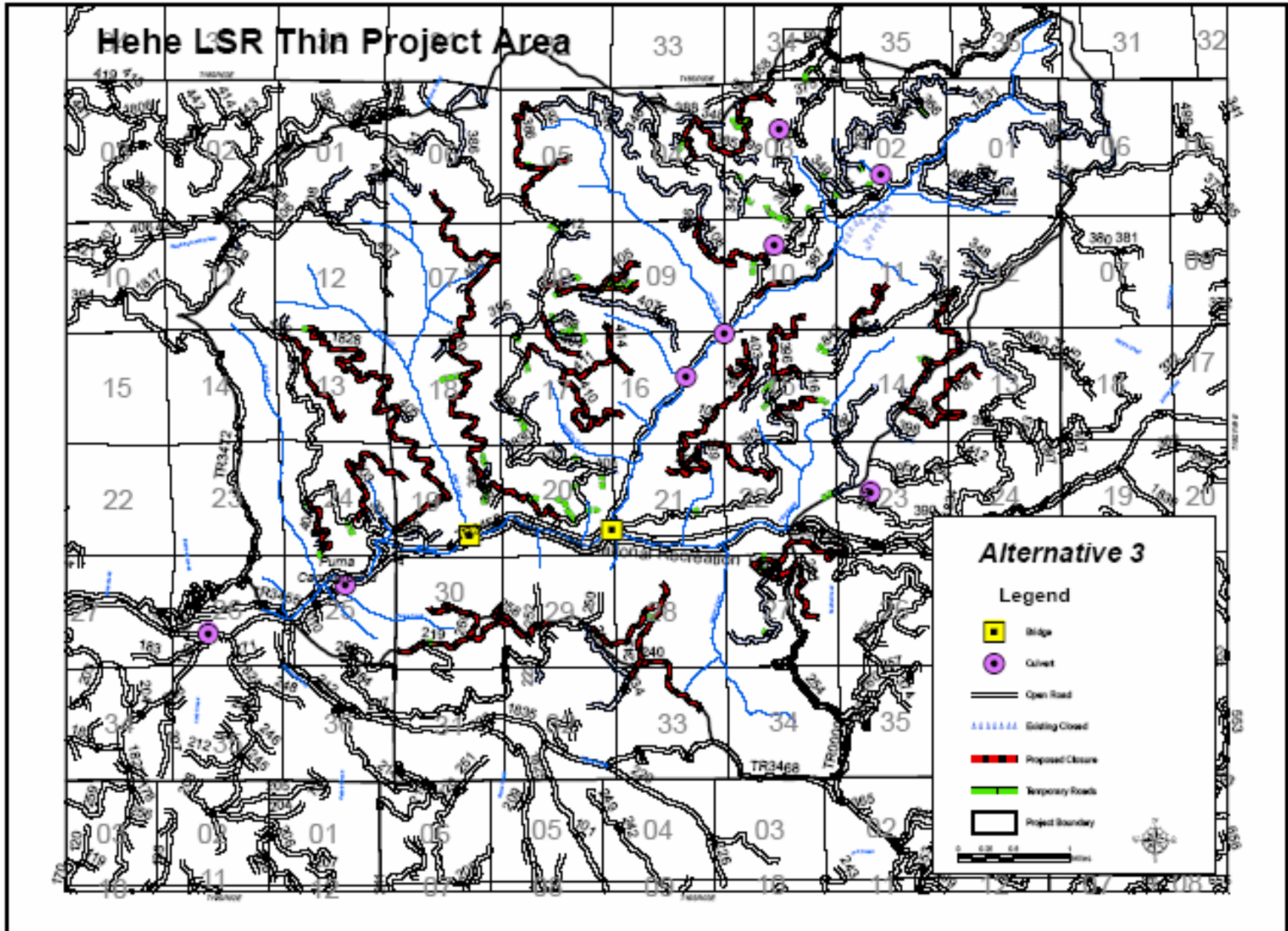
Road Number	Miles	Current Status	Proposed Closure Level-Alt 2	Proposed Closure Level-Alt 3	Proposed Closure Level-Alt 4
1817361	0.16	closed	n/a	n/a	low
1817362	0.09	closed	low	low	low
1817381	0.09	closed	n/a	n/a	low
1817391	0.15	closed	low	low	low
1825217	0.83	open	n/a	low	low
1825218	1.17	closed	n/a	low	low
1825219	1.65	open	n/a	low	low
1825240	0.95	open	n/a	low	low
1825242	0.82	open	n/a	low	low
1825258	0.30	closed	n/a	low	low
1825260	0.79	open	n/a	low	low
1828	4.18	open	n/a	moderate	moderate
1828400	0.08	closed	low	low	low
1828403	1.43	open	n/a	moderate	moderate
1828404	0.89	open	low	low	moderate
1828405	0.17	open	low	low	low
1828407	1.15	open	n/a	low	moderate
1828408	0.20	closed	low	low	low
1828412	0.14	closed	low	low	low
1830368	0.27	closed	low	low	low
1830369	0.06	closed	low	low	low
1830370	0.35	closed	low	moderate	moderate
1830372	0.11	closed	low	low	low
1830381	0.12	closed	low	low	low
1830382	0.08	closed	low	low	low
1830386	1.47	open	low	low	moderate
1830394	0.27	open	low	low	low
1830395	0.33	closed	low	low	low
1830397	0.31	closed	low	low	low
1830398	0.33	closed	low	low	low
1830400	5.44	open	n/a	moderate	moderate
1830402	0.19	closed	low	low	low
1830403	0.26	closed	low	low	low
1830404	0.58	open	n/a	low	moderate
1830405	0.46	open	n/a	moderate	moderate
1830406	0.12	closed	low	low	low
1830407	2.07	open	n/a	low	moderate
1830408	0.13	open	n/a	low	moderate
1830409	0.36	closed	low	low	moderate
1830410	1.97	open	n/a	moderate	moderate
1830411	0.76	open	n/a	low	low
1830412	0.31	open	n/a	low	low
1830413	0.09	closed	low	low	low
1830414	0.41	open	moderate	moderate	moderate
1830415	0.11	open	n/a	low	low
1830423	0.07	closed	low	low	low

Road Number	Miles	Current Status	Proposed Closure Level-Alt 2	Proposed Closure Level-Alt 3	Proposed Closure Level-Alt 4
1831	3.43	closed	n/a	decommission	decommission
1831338	0.09	closed	low	low	low
1831341	0.21	closed	low	low	low
1831345	0.09	closed	low	low	low
1831346	0.24	closed	low	low	low
1831347	0.28	closed	low	low	low
1831348	0.24	closed	low	low	low
1831349	0.28	closed	low	low	low
1831365	0.19	closed	n/a	low	low
1831366	0.13	closed	n/a	low	low
1831367	0.27	closed	n/a	low	low
1831368	0.12	closed	n/a	low	low
1831369	0.24	closed	n/a	moderate	moderate
1831370	0.19	closed	n/a	low	low
1831371	0.37	closed	low	low	low
1831381	2.14	closed	low	moderate	decommission
1831382	3.16	open/closed	low	moderate	decommission
1831385	2.05	open	n/a	low	moderate
1831386	1.13	open	n/a	low	moderate
1831387	0.90	open/closed	n/a	decommission	decommission
1831388	0.19	closed	low	low	low
1831390	0.27	closed	low	low	low
1831395	0.13	closed	low	low	low
1831396	0.35	open	n/a	low	moderate
1831399	0.30	closed	low	low	low
1831401	0.20	closed	low	low	low
1831402	0.08	closed	low	low	low
1831403	0.23	closed	low	low	low
1831404	0.24	closed	low	low	low
1831408	0.41	closed	low	low	low
1832102	0.05	closed	low	low	low
1832103	0.04	closed	low	low	low
1832104	0.08	closed	low	low	low
1832342	0.45	closed	decommission	decommission	decommission
1832345	0.82	open	low	moderate	moderate
1832387	0.26	closed	low	moderate	decommission
1832393	0.31	closed	low	low	low
1832395	3.28	open	n/a	3.00 low/ 0.28 moderate	moderate
1832396	1.30	open	n/a	0.89 low/ 0.41 moderate	moderate
1832397	2.79	open	n/a	low	moderate
1832403	0.44	open	n/a	low	low
1832404	0.68	open	n/a	low	low
1832407	0.56	closed	low	low	low
1832408	0.13	closed	low	low	low
1832414	0.20	closed	low	low	low
1832418	0.55	open	low	moderate	decommission
1832843	0.33	closed	low	low	low
1833260	0.64	open	n/a	moderate	moderate

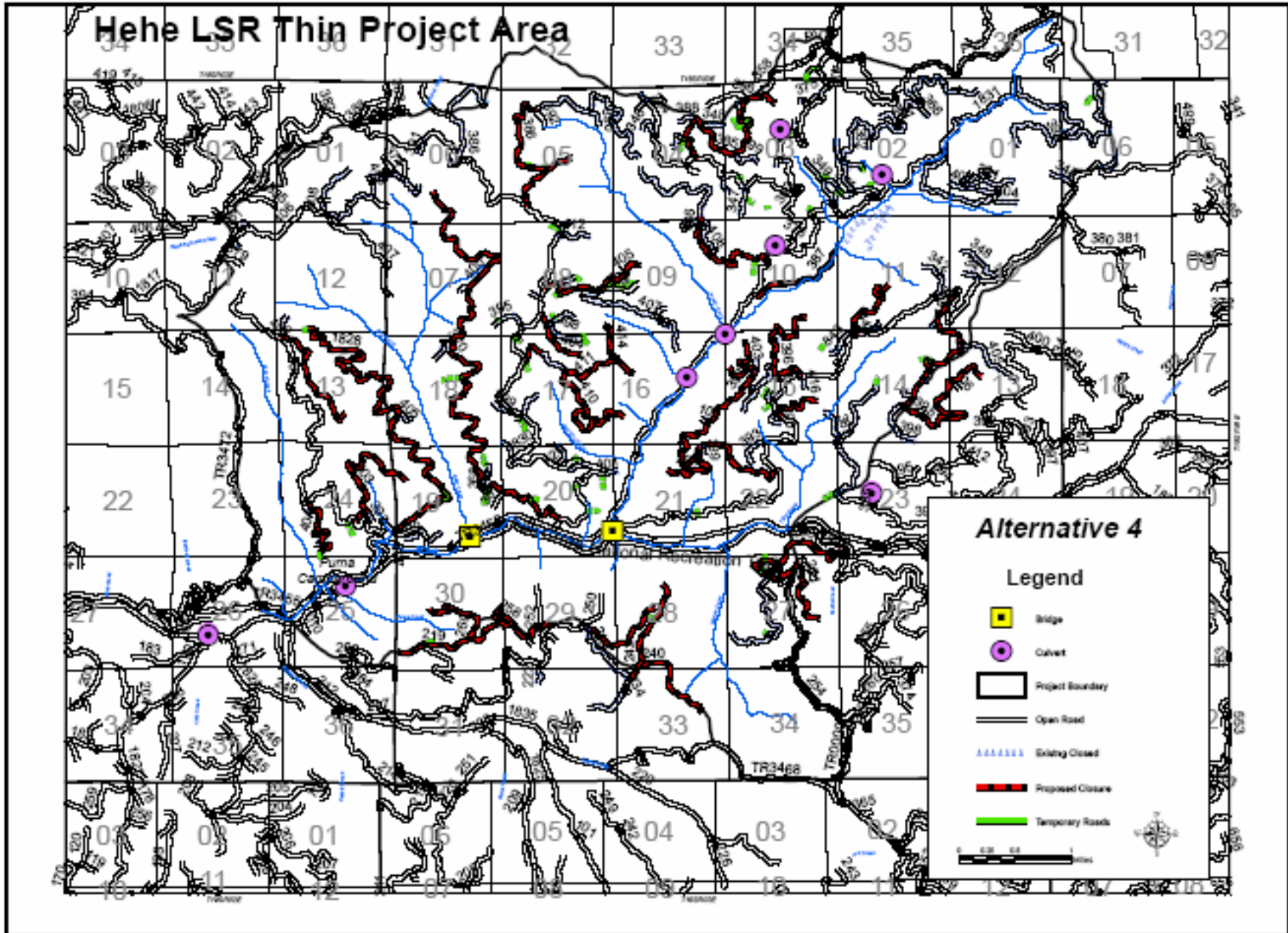
Road Number	Miles	Current Status	Proposed Closure Level-Alt 2	Proposed Closure Level-Alt 3	Proposed Closure Level-Alt 4
1833251	1.03	open	n/a	low	low
1834387	0.38	closed	n/a	moderate	decommission
1834390	2.73	open/closed	n/a	1.36 mi. low/ 1.37 mi. decom.	1.36 mi. low/ 1.37 mi. decom.



Map D1 – Alternative 2 Road Closures



Map D2 – Alternative 3 Road Closures



Map D3 – Alternative 4 Road Closures

Appendix E – Pre and Post Thin Stand Conditions

Table E1 – Pre and Post Thin Stand Conditions

Unit#	Age	TPA		BA		RD		CC		QMD	
		Pre '09	Post Thin	Pre '09	Post Thin	Pre '09	Post Thin	Pre '09	Post Thin	Pre '09	Post Thin
10A	53	305	75	205	125	60	23	75	45	10.1	14.7
10B	53	340	75	180	90	51	25	75	45	8.2	14.7
10F	53	240	75	175	70	53	26	75	45	7.8	14.7
10G	53	260	60	175	75	53	20	75	35	7.8	14.7
10I	53	260	60	180	85	54	25	75	35	8.8	14.7
10K	53	510	75	200	95	52	27	75	45	7.6	14.7
10M	53	260	75	170	93	51	24	75	45	8.8	14.7
12	45	289	75	205	82	61	22	75	36	8.8	14.2
74	54	198	100	225	113	59	30	67	44	11.7	14.4
102	45	290	75	260	100	60	25	75	45	10.8	13.0
120	46	273	60	185	70	55	23	73	25	9.8	12.5
123	44	170	75	180	75	45	28	65	35	12.2	14.5
148	45	180	100	195	120	55	30	68	35	12.0	14.7
155	41	181	75	127	74	38	20	57	35	9.6	13.5
164	55	210	75	208	111	57	27	70	40	12.8	16.4
164A	55	210	75	208	111	57	27	70	40	12.8	16.4
206	53	198	100	225	113	59	30	67	44	11.7	14.4
209	46	273	60	175	60	53	23	71	22	9.5	12.5
212	55	217	75	220	115	60	28	66	37	12.2	16.5
214	51	213	75	197	108	55	25	73	42	9.5	16.2
214A	51	213	75	197	108	55	25	73	42	9.5	16.2
214C	51	213	75	197	108	55	25	73	42	9.5	16.2
214D	51	213	75	197	108	55	25	73	42	9.5	16.2
214E	51	213	75	197	108	55	25	73	42	9.5	16.2
252	56	210	75	208	111	57	27	70	40	12.8	16.4
281	39	302	75	243	78	70	25	78	30	10.3	11.7
289	55	210	75	208	111	57	27	70	40	12.8	16.4
296	55	210	75	208	111	57	27	70	40	12.8	16.4
298	39	257	100	232	101	65	28	75	44	11.9	13.2
299	54	210	75	208	111	57	27	70	40	12.8	16.4
306	56	252	74	227	70	63	20	71	31	11.2	12.3
310	40	302	75	243	59	70	25	78	30	10.3	11.7
332	54	210	75	208	111	57	27	70	40	12.8	16.4
335	40	270	55	254	60	70	25	77	30	11.9	13.2
341	40	302	75	243	80	70	25	78	30	10.3	11.7

Unit#	Age	TPA		BA		RD		CC		QMD	
		Pre '09	Post Thin	Pre '09	Post Thin	Pre '09	Post Thin	Pre '09	Post Thin	Pre '09	Post Thin
358	39	257	100	232	101	65	28	75	44	11.9	13.2
361	41	181	75	127	74	38	20	57	35	9.6	13.5
370	55	217	75	220	115	60	28	66	37	12.2	16.5
384	55	217	75	220	115	60	28	66	37	12.2	16.5
396	39	257	100	232	101	65	28	75	44	11.9	13.2
405	43	177	95	182	117	60	30	63	45	11.5	14.7
408	44	289	75	205	82	61	22	75	36	8.8	14.2
414	48	213	75	197	108	55	25	73	42	9.5	16.2
419	40	270	55	254	75	70	25	77	30	11.9	13.2
420	44	270	55	254	75	70	25	77	30	11.9	13.2
432	54	177	95	182	117	60	30	63	45	11.5	14.7
433	41	270	55	254	83	70	25	77	30	11.9	13.2
442	55	170	75	271	142	66	33	70	45	16.3	18.6
447	41	203	105	200	134	55	35	67	60	11.9	15.3
449	43	203	105	200	134	55	35	67	60	11.9	15.3
471	48	213	75	197	108	55	25	73	42	9.5	16.2
474	42	270	55	254	80	70	25	77	30	11.9	13.2
476	42	203	105	200	134	55	35	67	60	11.9	15.3
478	44	270	55	254	80	70	25	77	30	11.9	13.2
485	44	270	55	254	85	70	25	77	30	11.9	13.2
494	57	252	74	227	70	63	20	71	31	11.2	12.3
604	39	257	100	232	101	65	28	75	44	11.9	13.2
514	44	177	95	182	117	60	30	63	45	11.5	14.7
520	44	203	105	200	134	55	35	67	60	11.9	15.3
522	56	217	75	220	115	60	28	66	37	12.2	16.5
528	56	193	54	277	105	69	24	73	35	15.3	18.9
545	41	203	105	200	134	55	35	67	60	11.9	15.3
554	44	270	55	254	80	70	25	77	30	11.9	13.2
569	57	252	74	227	70	63	20	71	31	11.2	12.3
594	39	257	100	232	101	65	28	75	44	11.9	13.2
606	57	287	100	212	81	67	23	70	35	9.2	12.2
607	47	289	75	205	82	61	22	75	36	8.8	14.2
616	44	289	75	205	82	61	22	75	36	8.8	14.2
620	57	252	74	227	70	63	20	71	31	11.2	12.3
622	40	203	105	200	134	55	35	67	60	11.9	15.3
626	57	287	100	212	81	67	23	70	35	9.2	12.2
629	57	252	74	227	70	63	20	71	31	11.2	12.3
632	43	203	105	200	134	55	35	67	60	11.9	15.3
634	40	302	75	243	80	70	25	78	30	10.3	11.7
636	57	253	75	276	114	74	28	77	41	14.1	16.7

Unit#	Age	TPA		BA		RD		CC		QMD	
		Pre '09	Post Thin	Pre '09	Post Thin	Pre '09	Post Thin	Pre '09	Post Thin	Pre '09	Post Thin
640	46	289	75	205	82	61	22	75	36	8.8	14.2
672	38	257	100	232	101	65	28	75	44	11.9	13.2
694	44	177	95	182	117	60	30	63	45	11.5	14.7
765	42	203	105	200	134	55	35	67	60	11.9	15.3
773	45	289	75	205	82	61	22	75	36	8.8	14.2
780	42	270	55	254	80	70	25	77	30	11.9	13.2
799	41	302	75	243	85	70	25	78	30	10.3	11.7
813	46	289	75	205	82	61	22	75	36	8.8	14.2
3602	39	302	75	243	75	70	25	78	30	10.3	11.7
3607	40	302	75	243	80	70	25	78	30	10.3	11.7
3512	45	270	55	254	85	70	25	77	30	11.9	13.2
3556	45	289	75	205	82	61	22	75	36	8.8	14.2
3557	54	260	60	180	85	54	25	75	35	8.8	14.7
3558	54	177	95	182	117	60	30	63	45	11.5	14.7
3564	54	254	75	249	125	68	30	75	42	11.5	17.5
3565	40	302	75	243	70	70	25	78	30	10.3	11.7
3608	39	302	75	243	80	70	25	78	30	10.3	11.7
3613	53	260	60	180	85	54	25	75	35	8.8	14.7
3613A	53	210	75	208	111	57	27	70	40	12.8	16.4
3613B	53	260	60	180	85	54	25	75	35	8.8	14.7
3613C	53	210	75	208	111	57	27	70	40	12.8	16.4
3613D	53	210	75	208	111	57	27	70	40	12.8	16.4
3613E	53	210	75	208	111	57	27	70	40	12.8	16.4
3613F	53	260	60	180	85	54	25	75	35	8.8	14.7
3643	41	270	55	254	75	70	25	77	30	11.9	13.2
3671	41	177	95	182	117	60	30	63	45	11.5	14.7
3786	53	287	100	212	81	67	23	75	35	9.2	12.2

Note: Pre and post conditions only consider merchantable trees (>7" dbh).

Appendix F – Aquatic Conservation Strategy Objectives

An integral part of the NW Forest Plan, the goal of the Aquatic Conservation Strategy (ACS) is: to maintain and restore the ecological health of watersheds and the aquatic ecosystems within them. The four major components of the ACS (as noted below) provide the basis for protection of watershed health.

1. Riparian Reserves were established to buffer streams and other water bodies. Riparian Reserves are portions of watersheds where riparian-dependent resources receive primary emphasis and where special standards and guidelines apply. Standards and guidelines prohibit and regulate activities in Riparian Reserves that retard or prevent attainment of the Aquatic Conservation Strategy objectives. Riparian Reserves include those portions of a watershed directly coupled to streams and rivers, that is, the portions of a watershed required for maintaining hydrologic, geomorphic, and ecologic processes that directly affect standing and flowing waterbodies such as lakes and ponds, wetlands, streams, stream processes, and fish habitats. Under the Aquatic Conservation Strategy, Riparian Reserves are used to maintain and restore riparian structures and functions of intermittent streams, confer benefits to riparian-dependent and associated species other than fish, enhance habitat conservation for organisms that are dependent on the transition zone between upslope and riparian areas, improve travel and dispersal corridors for many terrestrial animals and plants, and provide for greater connectivity of the watershed.
2. Key Watersheds were identified across the NWFP area to serve as the cornerstones of aquatic species recovery.
3. Watershed Analysis: Procedures for conducting analysis that evaluates geomorphic and ecologic processes operating in specific watersheds. This analysis should enable watershed planning that achieves Aquatic Conservation Strategy objectives. Watershed Analysis provides the basis for monitoring and restoration programs and the foundation from which Riparian Reserves can be delineated. Watershed Analysis must be completed prior to management in Key Watersheds, and Riparian Reserves.
4. Watershed Restoration. A comprehensive, long-term program of watershed restoration to restore watershed health and aquatic ecosystems, including the habitats supporting fish and other aquatic and riparian-dependent organisms.

Projects that will include management within a Riparian Reserve must:

1. Describe the existing condition, including the important physical and biological components of the fifth-field watershed(s) in which the project area lies,
2. Describe the effect of the project on the existing condition; and
3. Demonstrate that in designing and assessing the project the decision maker considered and used, as appropriate, any relevant information from applicable watershed analysis.

This work will address these items at a level of detail in proportion to the risk associated with the project.

Determination of Project Consistency

ACS Components: All action alternatives prescribe management within the riparian reserves. This management was designed to improve the long term function of the reserves in regard to providing high quality water and fish habitat conditions. This may involve some short term negative effects that would be offset by long term improvements. The project area is not in a key watershed. Watershed analysis was completed for the Fall Creek fifth field watershed in 1995. General recommendations from that analysis regarding riparian management were incorporated into project design. Other watershed restoration is planned, with the addition of woody material into streams, road decommissioning, and road drainage improvements.

ACS Consistency: The existing condition of the Fall Creek fifth field watershed is described in the Fall Creek watershed analysis (USDA, 1995). Additionally, watershed disturbance levels for the Fall Creek watershed are described in water quality cumulative effects section in the EA. More detail is also provided for the Hehe Creek sub-watershed in Integrated Aquatics Team Special Report located in the Project File. The project effects on existing condition are disclosed throughout the Integrated Aquatics Team Special Report. Negative short-term effects were identified, with numerous long term beneficial effects. Watershed analysis recommendations were incorporated into the project design for all alternatives.

An integral part of the NW Forest Plan, the goal of the ACS is: to maintain and restore the ecological health of watersheds and the aquatic ecosystems within them. This project is consistent with the ACS because it is designed to contribute to maintaining or restoring the project area and watershed condition over the long term, with only minor short-term negative effects.

The Project addresses these recommendations directly by the scale, scope, and methods chosen for harvest, road decommissioning, soil remediation, culvert replacement, and low-impact fuels treatments. The result of any of action alternatives would be stable fish populations on an upward trend as the size of trees that are naturally supplied to stream channels increases, increased habitat connectivity as a barrier culvert is replaced, decreased road-generated fine sediments as roads are maintained or closed, and reduced risk of wildfire as fuels are removed or consumed by fuels treatments. The end result would be the project area and watershed that is on a trajectory towards greater functionality through increased resilience to local disturbances and resistance to large scale, catastrophic instability.

The ACS Objectives state Forest Service and BLM-administered lands within the range of the northern spotted owl would be managed to:

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

All action alternatives and no action would maintain the recommended riparian reserve widths outlined in the Northwest Forest Plan. Fall Creek Watershed Analysis (page X) recommends thinning as a useful tool to meet Aquatic Conservation Strategy Objectives. The thinning project's focus is to maintain through time and restore diversity and complexity of the watershed and the aquatic systems to which species, populations, and communities have adapted. Structural diversity would be maintained and enhanced by the proposed thinning treatments in riparian reserves. Thinning in the 40-60 year-old densely populated stands would accelerate diversity and the complexity of these areas that are currently in a homogeneous state. Removal of trees in riparian reserves would be limited to areas outside of the stream influence zone (170 feet) on listed fish streams, outside of secondary shade zone (100 feet) on all perennial streams, and outside of primary shade zone (60 feet) on intermittent streams. There would be a no-harvest buffers in thinning units of 60 to 170-feet to protect the stability of the stream channel and floodplain. Thinning the riparian reserves would help restore species composition, growth, and stand level diversity desirable in healthy riparian ecosystems.

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

All action alternatives and no action maintain existing riparian connections between watersheds. No early successional conditions would be created in riparian areas. Spatial and temporal connectivity would be maintained through the implementation of no harvest buffers along streams. All fish bearing streams would have 100-170 feet no-harvest buffers on either side of the stream. Non-fish bearing perennial streams would have 100-foot no-harvest buffer placed on either side of the stream. Intermittent streams would have 60-foot no-harvest buffers placed on either side of the stream. These areas allow for connectivity between ridge tops and valley bottoms. In addition, none of the alternatives proposes to build roads across stream channels. An overall reduction in the drainage network related to roads is expected as a result of the proposed action. Several roads will be decommissioned and drainage structures and road fill will be removed. Road closures

where perennial stream crossings exist will be removed and non-drivable waterbars added to create additional disconnect between remaining road surfaces between culvert removals and stream channels. Cross drain culverts will be added to roads that will remain open; this will also result in a reduction of hydrologic connectivity of ditch flow and stream channels.

Treated acres within riparian reserves would retain an average 35-60 percent canopy closure after harvest. Chemically and physically unobstructed routes critical to life history requirements would remain intact because of these prescriptions. Spatial connectivity may be restored for some plants and animal species that cannot survive under dense canopy. An increase in insects and arthropods is expected from the development of the understory.

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

There would be no change for the no action alternative. For all action alternatives, the physical integrity of the aquatic system is anticipated to be maintained and preserved by adhering to the recommended riparian reserve widths outlined in the Northwest Forest Plan and by using Best Management Practices (BMPs) (USDA, 1988). Specific BMPs are T-2 (harvest unit design); T-7 (Streamside Management Unit Designation); T-8 (Stream Course Protection); and T-12 (Suspended Log Yarding in Timber Harvest). These practices maintain the physical integrity of the aquatic system by designating prescriptions (i.e., maintenance of root strength, shade canopy, and large woody material). Retention of riparian reserves widths would maintain channel stability.

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

For all action alternatives, full riparian reserve widths on all stream channels and wetlands would maintain temperature, chemistry, and suspended loads at current levels. Maintaining current canopy cover within riparian reserves is expected to provide shading and maintain stream temperatures. Biological, physical and chemical integrity of water quality would be maintained using BMPs and by applying riparian reserve widths. There would be no change for the no action alternative.

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

All action alternatives would maintain the sediment regime under which these systems evolved. The input of sediments to these streams has typically been through debris torrents, the incidence of which would be little changed by these alternatives. The action alternatives would begin to restore the sediment regime to more natural, episodic levels through road closure where appropriate and road maintenance/repair of the roads that will remain open in order to reduce the likelihood of chronic, road related sediment directly entering the stream channel. The no action alternative would likely continue with some impact to the sediment regime as existing system roads would not have the benefit of maintenance. Road maintenance would generally fix localized sediment problem areas as well as repair and reshape the road surface improving the water flow and reducing the fine sediment movement often associated with older roads needing maintenance and repair.

Road maintenance as well as yarding and timber hauling have the potential to cause an increase in the sediment to the streams within this planning area. However, due to the implementation of BMPs any increase in sedimentation would be short-term.

By maintaining a no-harvest zone adjacent to stream channels, additional introduction of sediments would not significantly increase over current sediments levels. Stand density management would accelerate conversion of the riparian reserves to late successional forest characteristics, resulting in long term improvements to bank stability and sediment storage capacity provided by increases in in-stream large woody material. Water quality would remain the same and improve as larger trees fall into the riparian area.

Accelerated growth in the riparian area would help restore the natural sediment regimes that the aquatic system evolved.

6. Maintain and restore instream flows sufficient to create and sustain riparian, aquatic, and wetland habitat and to retain patterns of sediment, nutrient, and wood routing.

No action or the action alternatives would not affect base flow conditions. Midpoint ARP values for this planning area would remain above recommended values. The timing, magnitude, duration, and spatial distribution of flows would be maintained. All wet areas (less than 1/4 ac.) are associated with stream courses and would be protected through the implementation of riparian reserves. There are no meadows in or around any of the proposed units.

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

The no action alternative would not affect the current duration of floodplain inundation and water table elevation in meadows and wetlands. All the action alternatives are expected to have minimal effects on low flow conditions. Thinning treatments in riparian reserves are not expected to have any effect on floodplains or water table elevations. Midpoint ARP values for this planning area would remain above recommended values.

Instream flows are addressed in the Willamette National Forest Plan standards and guidelines (USDA, 1990) FW-113, FW11, FW-093, and FW-089. These forest-wide standard and guidelines are required in the plan. With the implementation of these standards, it is anticipated that in stream flows would be maintained and restored sufficiently to create and sustain riparian, aquatic and wetland habitats, and to retain patterns of sediment, nutrient, and wood routing.

There are a number of small wetlands within this project area. Some of these wetlands are close enough to proposed harvest units that their water level may fluctuate up or down for short periods of time. The water table adjacent to wet areas has always varied due to changes in climate or localized changes in water routing. This short-term variation is thought to be negligible in both size and duration.

8. Maintain and restore the species composition and structure diversity of plant communities in riparian zones and wetlands to provide adequate summer and winter thermal regulation, nutrient, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of large wood sufficient to sustain physical complexity and stability.

The existing species composition would be maintained or enhanced by proposed thinning activities. All action alternatives begin the restoration of riparian vegetation diversity by prescribed riparian reserve thinning which would increase the diameter of overstory trees to generally increase structural diversity and provide for a more rapid development of future sources of large woody material into the stream channel. Biological, physical, and chemical integrity of water quality would remain intact by maintaining current canopy cover and streamside shade within riparian reserves.

Implementation of riparian reserves as recommended in the Northwest Forest Plan would maintain current species composition and structure, and provide adequate summer and winter thermal regulation, protect the channels stability, and supply and distribute large wood sufficient to sustain physical complexity.

No action would maintain the current riparian species composition and there would be no benefit from riparian thinning. The no action riparian areas would develop on a slower time path for restoring large wood to the system.

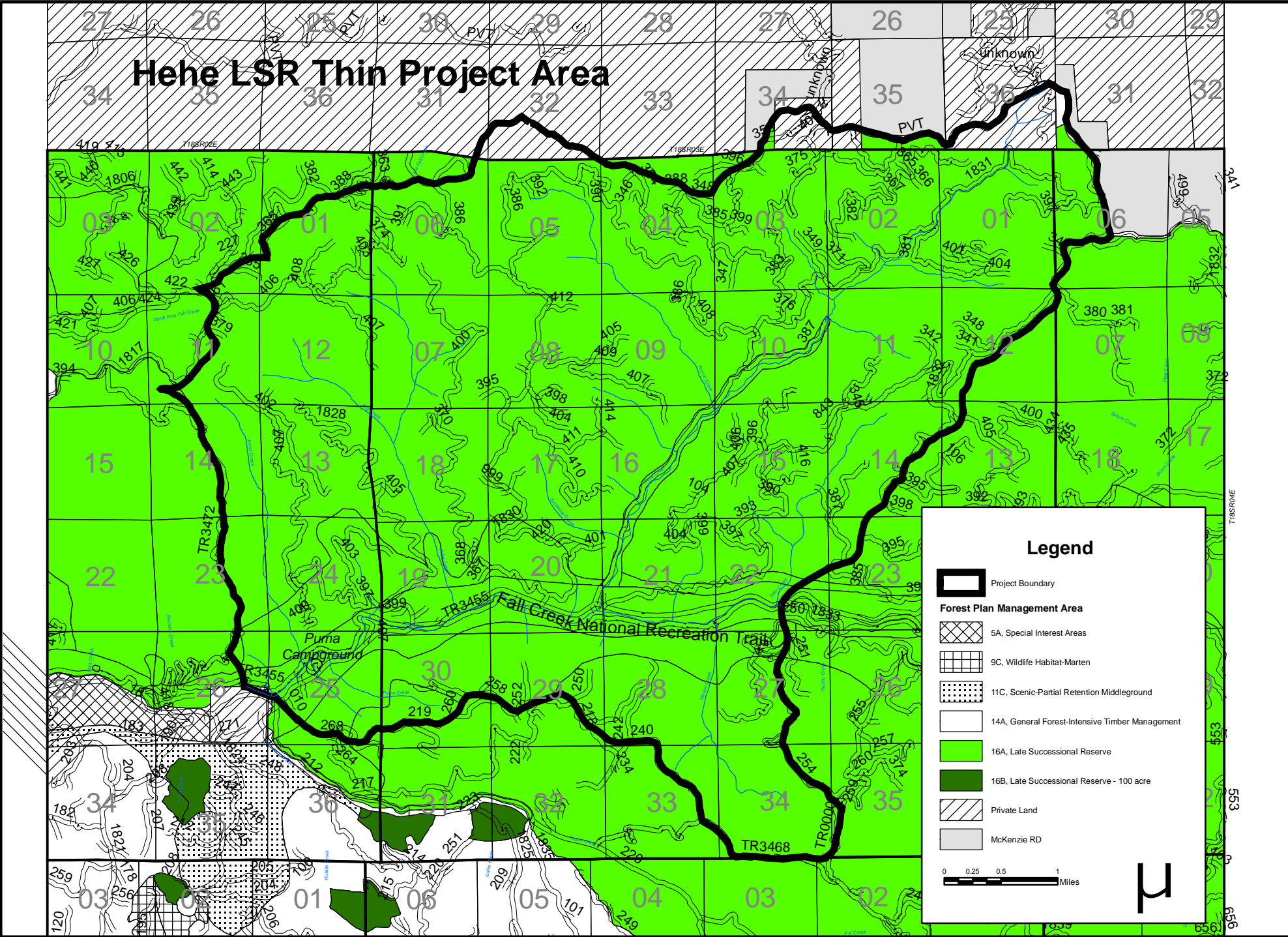
9. Maintain and restore habitat to support well distributions of vertebrate's riparian dependent species.

No action would maintain consistency with this objective in the short term. There may be long term detrimental effects from stand stagnation due to lack of thinning treatment. The four action alternatives are very similar in consistency with this objective. Alt. 2, because it thins less acres than 3 and 4, may be more detrimental in the longer term due to the untreated acres eventually displaying reduced growth and stand development. The no-thin buffers of 100 feet along perennial and 60 feet along ephemeral streams would protect the aquatic environment. There would be a slight short term negative effect from thinning by opening up the tree canopies to the 40%-60% range. This may alter the micro-habitat conditions to a slight degree, thus influencing habitat suitability in the short term.

The Project activities would be in accordance with the ACS objectives since maintenance of the existing aquatic habitat would be insured through the no-treatment buffers. Road maintenance and road decommissioning would lead to a reduction in fine sediment delivered to fish habitat. Road maintenance would include the addition of necessary cross drain culverts to establish disconnect of ditch flow from stream channels. This would allow ditch flow to filter out in vegetation on the hillslope, rather than travel in the ditches and directly deliver at stream crossings. Road decommissioning is planned to remove impact of valley bottom roads. Riparian habitat would endure a short term moderate degradation due to the thinning; but this same activity would, within several decades, produce a substantially enhanced riparian condition as the remaining trees respond with increased growth rates and a more diverse understory develops beneath these trees. Habitat connectivity would be enhanced through the replacement of a culvert that is currently a migratory barrier. Flow regime would remain largely unchanged given the present and estimated future ARP values for the Project area.

Map of Land Management Plan Areas

Hehe LSR Thin Project Area



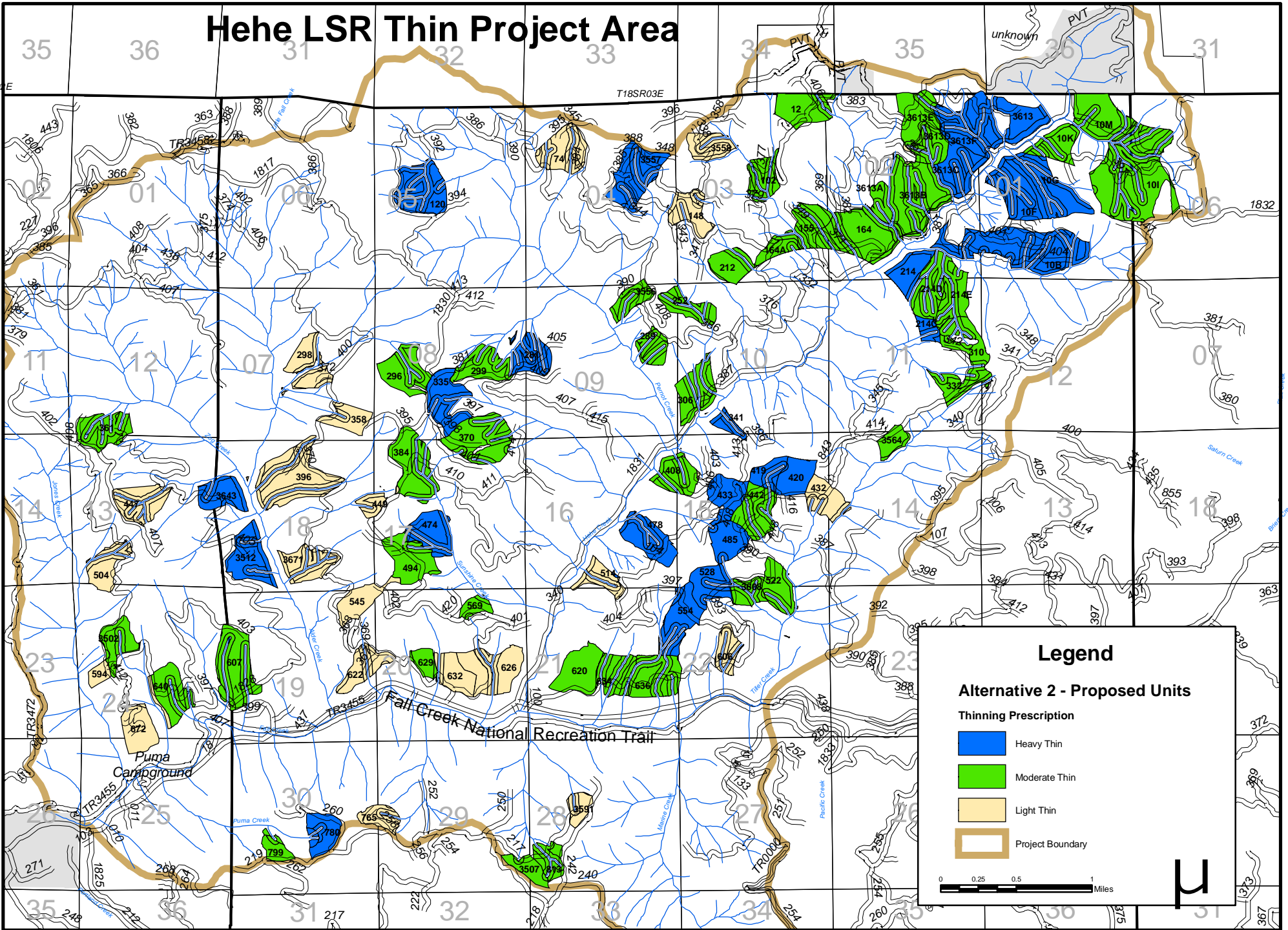
Legend

- Project Boundary
- Forest Plan Management Area**
 - 5A, Special Interest Areas
 - 9C, Wildlife Habitat-Martens
 - 11C, Scenic-Partial Retention Middleground
 - 14A, General Forest-Intensive Timber Management
 - 16A, Late Successional Reserve
 - 16B, Late Successional Reserve - 100 acre
- Private Land
- McKenzie RD

0 0.25 0.5 1 Miles

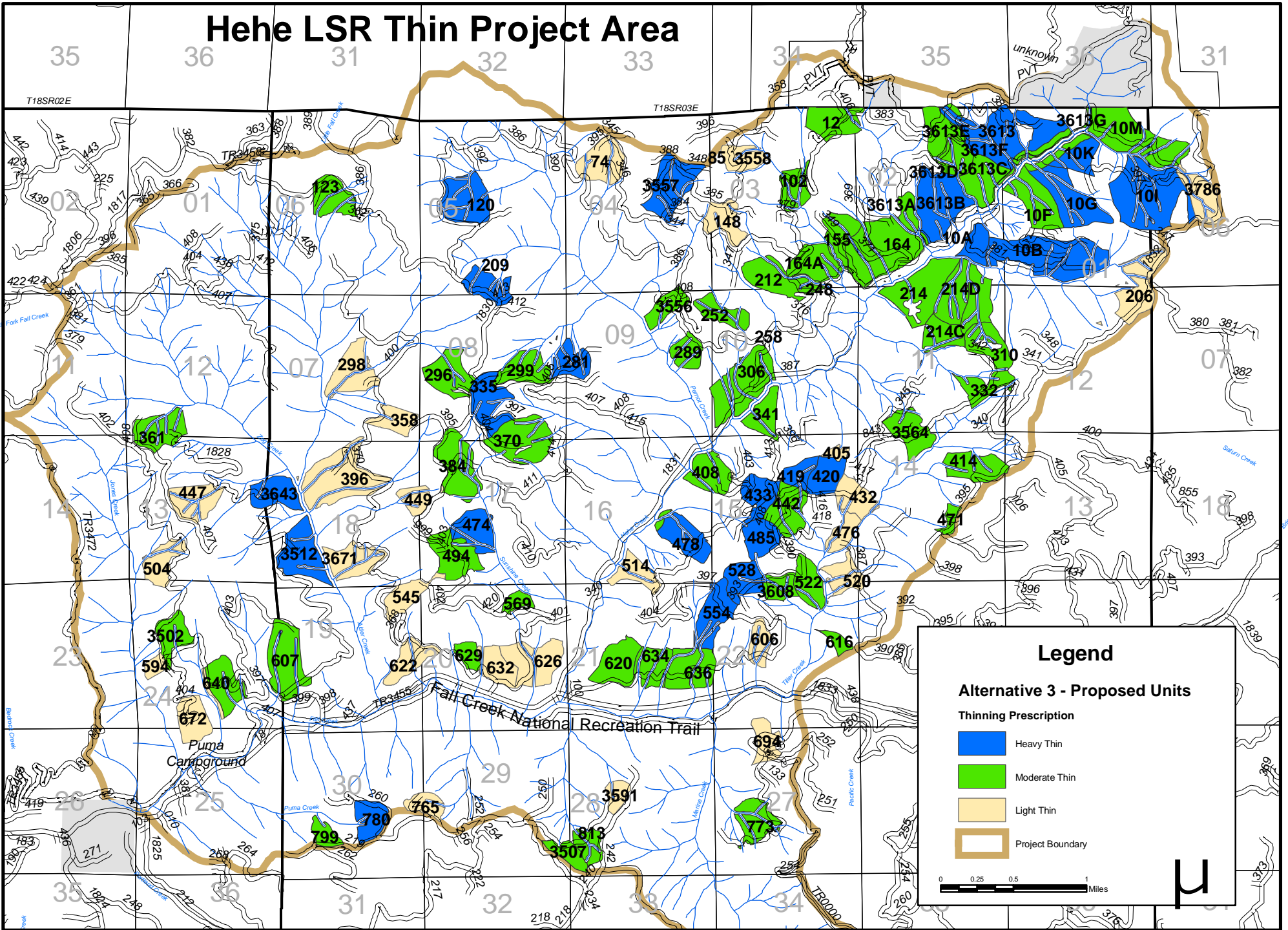
Map of Alternative 2 ~ Proposed Units

Hehe LSR Thin Project Area



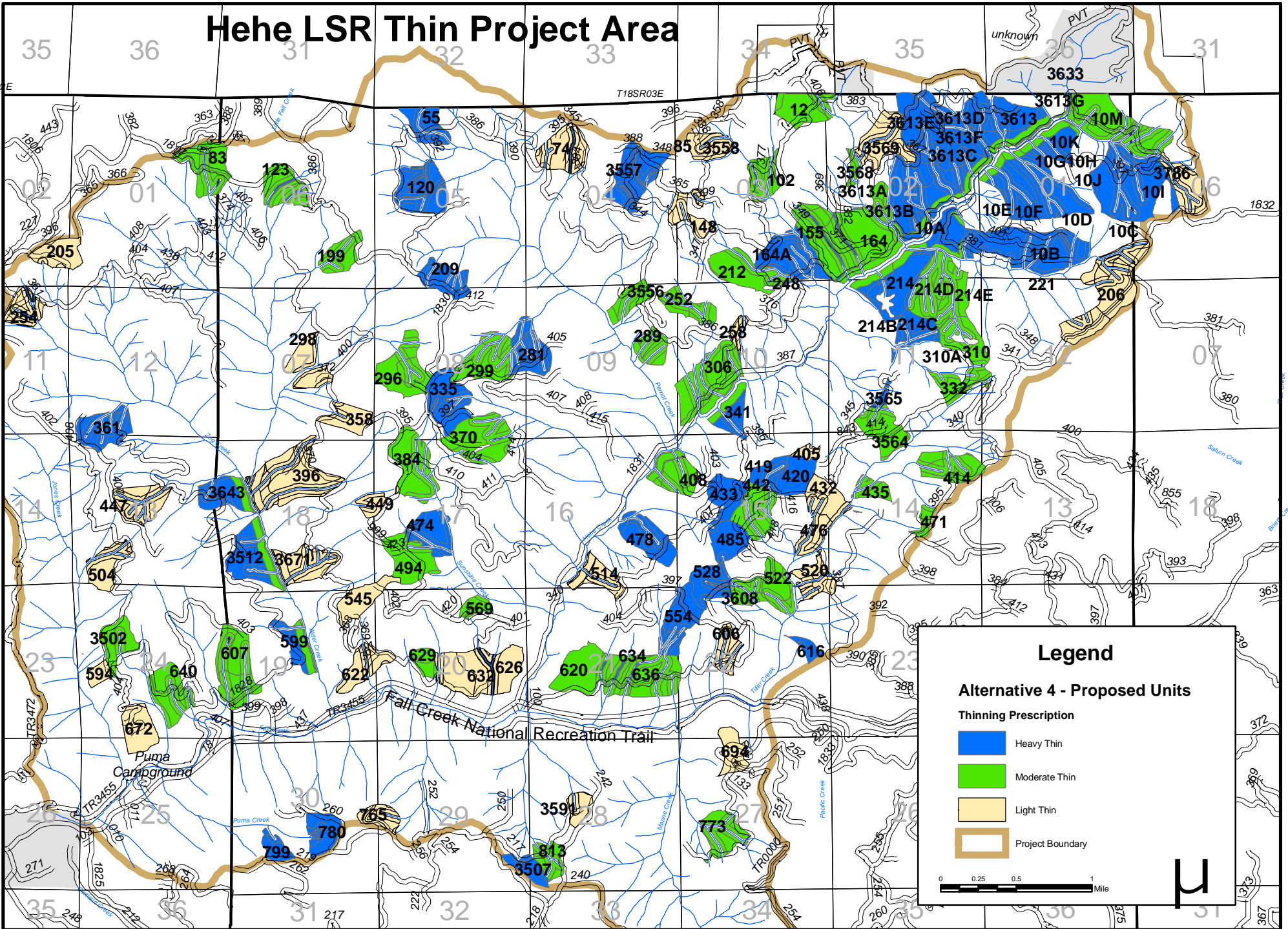
Map of Alternative 3 ~ Proposed Units

Hehe LSR Thin Project Area



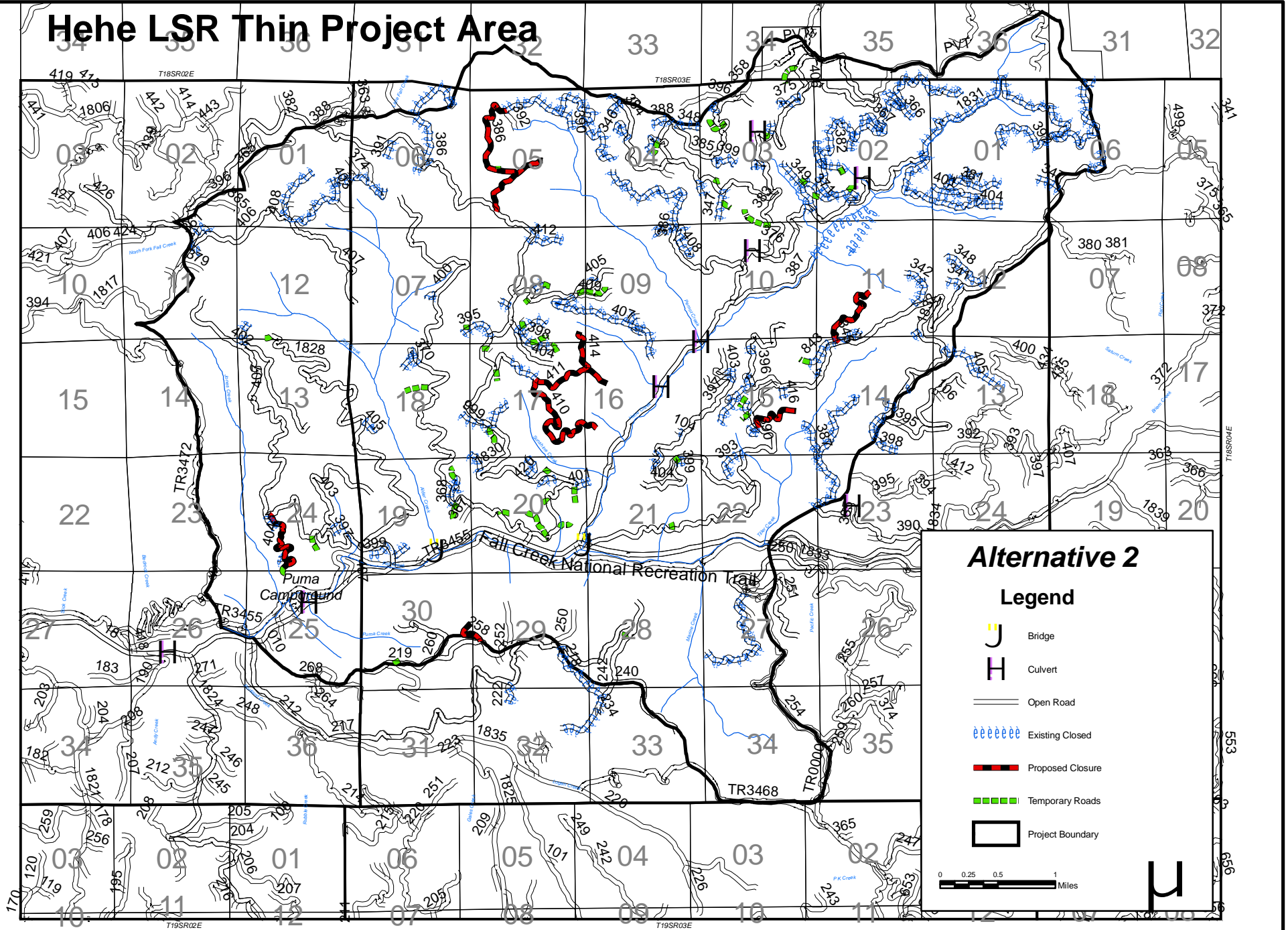
Map of Alternative 4 ~ Proposed Units

Hehe LSR Thin Project Area



Map of Alternative 2 ~ Road Closures

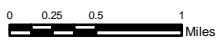
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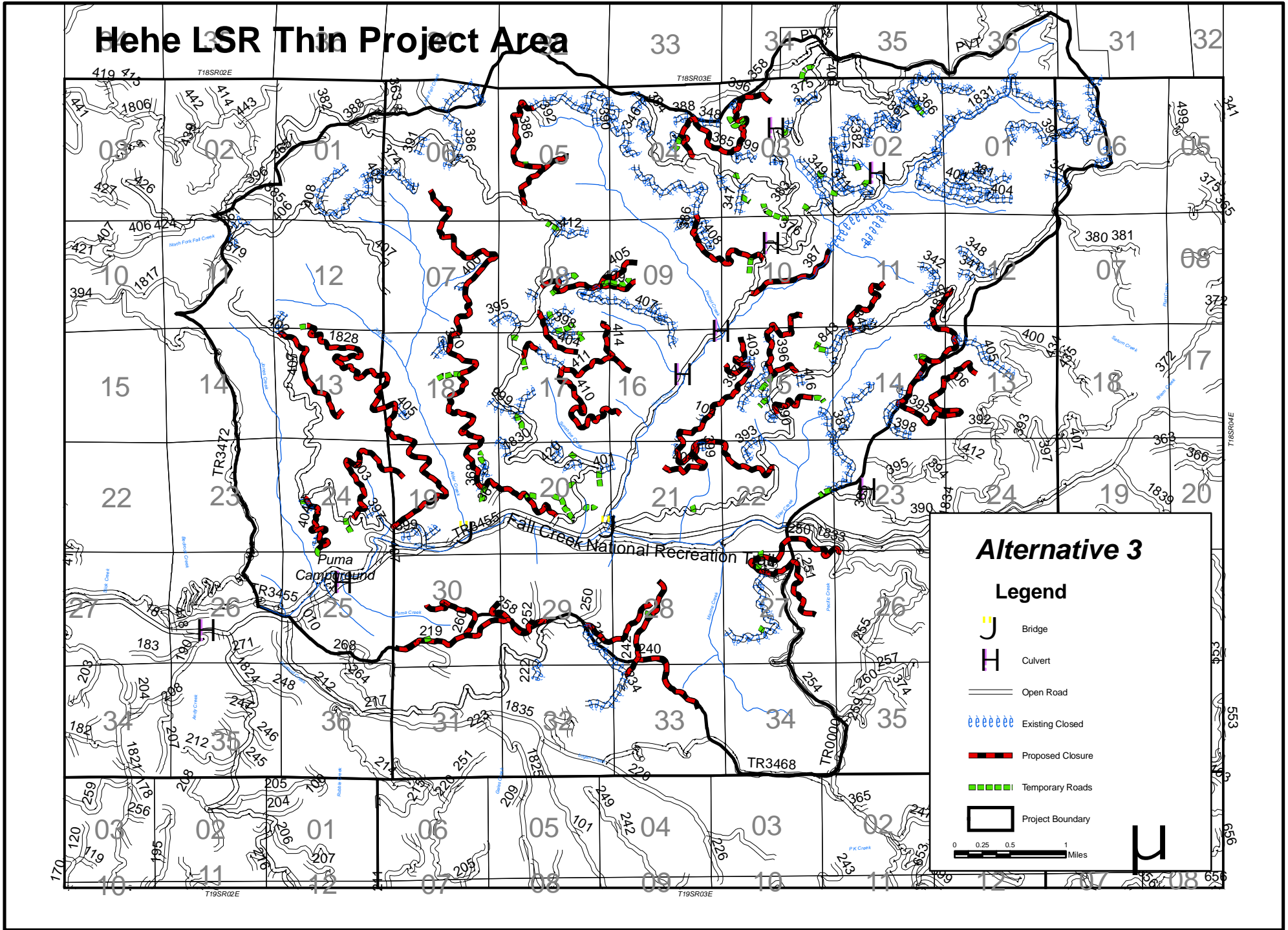
Alternative 2

Legend

- Bridge
- Culvert
- Open Road
- Existing Closed
- Proposed Closure
- Temporary Roads
- Project Boundary



Map of Alternative 3 ~ Road Closures



Map of Alternative 4 ~ Road Closures

