United States
Department of
Agriculture

Forest Service

April 2006

Environmental Assessment

Quartzville LSR Thin Timber Sale

Sweet Home Ranger District
Willamette National Forest
Linn County, Oregon

For Information Contact: Mike Rassbach, District Ranger
3225 Highway 20 Sweet Home, OR 97386
(541) 367-5168
[*http://www.fs.fed.us/r6/Willamette/manage/nepa/index.html*](http://www.fs.fed.us/r6/Willamette/manage/nepa/index.html)

Errata Sheet

The following changes occurred in the Quartzville Environmental Assessment between the draft and the final document:

Page 9 – remove bullet in front of Introduction section.

Page 13 – delete first full paragraph beginning “The map above (Figure 4) shows……”

Page 22 – all citations under the bullets should be changed to (USDA and USDI. 1998b…).

Page 27 – citation in third paragraph should say (USDA. 2002, p. 3)

Page 28 – first sentence in the 4th paragraph – change the word “were” to “was” so it reads: “A second management allocation within the analysis area, Riparian Reserves, was designated…”

Page 39 - second sentence 4th paragraph – date in citation is 2002 so it should read, “(USDA and USDI. 2002, Ch. 7, p.12).

Page 39 – first paragraph under Roadless Area subtitle – (citation at end of paragraph should say (see Figure 6, page 25)

Page 83 – first paragraph- citation should say (USDA and USDI. 1998b. Ch. VI pp. 160-164).

Page 89 – fifth paragraph- citation should say (see Appendix H: Wildlife Biological Evaluation).

Page 95 – last citation on page should say (USDA and USDI. 1998b, Ch. IV, p. 131).

Table of Contents

List of Tables

List of Figures

Summary

Purpose and Need

The Sweet Home Ranger District of the Willamette National Forest proposes to use a combination of silvicultural harvest prescriptions and other stand treatments to accelerate the development of late-successional stand characteristics in overstocked, young, even-aged, managed stands within the *Quartzville Late Successional Reserve* (LSR). These treatments are intended to improve habitat conditions, habitat function and connectivity for late-successional and old-growth related species there.

The action is needed because these stands were established to produce high yields of timber for commodity production rather than late-successional habitat characteristics described in the NW Forest Plan for LSR's (*USDA and USDA, 1994 B-1).* For many decades management objectives here were to maximize tree growth to provide a sustained yield of timber commodities over time, while also meeting other multiple use objectives. With the development of the NW Forest Plan in 1994, the objectives for management of these stands changed when they became part of the Quartzville Late-Successional Reserve (LSR). The goal here now is to provide large, contiguous blocks of complex, late-successional forest habitat for species dependent on this type of habitat for their survival.

When the LSR network was designated, the drafters of the *NW Forest Plan* knew there were not enough large intact blocks of late-successional habitat to meet the objectives of the LSR's so they included a variety of seral stages in these management allocations. In young seral stands (*less than 80 years old*) included in the LSR's, they encouraged the use of silvicultural treatments to accelerate the development of habitat conditions for species dependent on late-successional/old growth habitat (*USDA and USDI 1994, C-12*). They reasoned that the sooner inclusions of young seral habitat within the LSR became late-successional habitat, the better for the recovery of late-successionally dependent species, especially those in decline like the northern spotted owl. The 35-45 year-old, managed stands proposed for treatment with this project are part of the young seral stage inclusions within the LSR. Recent research indicates that "if the plantations in …LSRs are treated with the proper types of thinning and some other management actions, the actions may accelerate the development of some old-growth characteristics by decades. Some benefits in biological diversity could occur within the next two or three decades" *(USDA 2002, 3).*

Alternatives including the Proposed Action

Proposed Action*:* Based on management direction and recommendations included in the *NW Forest Plan, Mid-Willamette LSR Assessment* and *Quartzville Watershed Analysis* and various research findings to accelerate development of late-successional stand characteristics in young stands in LSR's, the following proposal was developed to accomplish the above stated project objectives. 828 acres of 35-45 year-old, even-aged managed stands in the *Quartzville LSR* would be commercially thinned to various stand densities. Occasional, small openings would be scattered among thinned areas in the uplands to simulate gaps that naturally occur in late-successional stands. Some areas in each harvest unit would be left intact.

Riparian Prescriptions for Proposed Action: None of scattered, small openings would occur in the first site tree (*172 feet*) from any stream. Portions of Riparian Reserves within proposed harvest units, which are not contributing to primary stream shade or channel bank stability, would be thinned to enhance stand growth and diversity. Variable-width, no-harvest buffers would be maintained in the primary shade zones along all perennial streams to provide the shading necessary to maintain water temperatures and to create filter zones necessary to reduce sediment delivery to streams. The minimum riparian buffer widths would be 25 feet on intermittent streams, 66 feet on perennial non-fish-bearing streams and 100 feet on fish-bearing streams.

These stand treatments would be accomplished using a combination of helicopter, skyline and ground-based yarding systems to harvest a total of 26 units yielding about 8.28 MMBF of timber.

To access the proposed harvest units approximately 100 feet of new, native-surface, temporary spur road would be constructed and approximately 1.4 miles of closed logging spur roads, constructed during the first entry, would be re-opened. These spur roads would be decommissioned (or put into storage for later use) through closures with berms and the addition of water bars following timber harvest. In addition, three system roads totaling 5.28 miles would require reconstruction to access harvest units because they have previously been closed and water barred. These roads would be decommissioned similarly to the roads above. They would be closed and water barred again following harvest activities. In addition, road maintenance would be done on about 25 miles of existing haul routes.

Alternatives to the Proposed Action*:* An alternative way to achieve the desired stand characteristics, without accelerating their development, is to take No Action. In this alternative no silvicultural stand treatments would be done in young, even-aged stands within the Quartzville LSR. These previously-managed stands would be allowed to mature over time, on their own.

Another option for accelerating the development of desired stand characteristics on these young, managed stands is achieved with similar treatments to the proposed action, but on fewer acres because harvest would be more limited in the Riparian Reserves contained within proposed harvest units.

Riparian Prescriptions for another option: As with the Proposed Action, none of the small, scattered openings would occur in the first site tree (*172 feet*) from any stream. Instead of the variable-width, no-harvest buffers used in the Proposed Action, this alternative would utilize 'one-standard-tree-height' (*172 foot*) width, no-harvest buffers on all perennial streams to provide shading to maintain water temperatures and to create filter zones necessary to reduce sediment delivery to stream. Variable-width, no-harvest buffers of at least 25 feet would be used on intermittent streams. These buffers would include trees contributing to stream bank stability. Outside of no-harvest buffers, thinning would be done to enhance stand growth and diversity. This Riparian Reserve thinning, in proposed harvest units would occur in the following locations:

- In the portion of the Riparian Reserves along intermittent streams (*which do not flow water most of the year but do show channel scour*) which is outside of the no-harvest buffer area to the outer edge of the Riparian Reserve (*172 feet from the stream*) .
- In the portion of the Riparian Reserves along fish-bearing streams which is outside of the 172-foot no-harvest buffer to the outer edge of the Riparian Reserve (*344 feet from the stream*). The exceptions are that no harvest would occur within 344 feet of McQuade Creek and the thinning area on Canal Creek would be outside of the 132-foot no-harvest buffer to the outer edge of the Riparian Reserve (*344 feet from the stream*).
- No thinning would occur in the Riparian Reserves on non-fish-bearing perennial streams.

Road access to harvest units is treated similarly to the proposed action in all respects except that this alternative would reopen 0.46 fewer miles of closed logging spur roads (constructed during the first entry), would not construct 100 feet of native-surface temporary spur road, and would not open up one closed, system road. This is because roads are not planned in no-harvest buffers and the stream buffers are wider in this alternative than in the Proposed Action. In the Proposed Action, buffers only include the primary shade zone. In this alternative they are one site tree (172 feet) wide and may include both primary and secondary shade zones. There are also some variations in yarding methods between the two action alternatives because of availability of road access and unit configurations resulting from elimination of harvest in portions of Riparian Reserves.

Issues

A significant issue for this project is Riparian Reserve management. The Riparian Reserve allocation overlays the Late-Successional Reserve allocation and is designed not only to address Aquatic Conservation Strategy Objectives but also to address travel and dispersal corridors for many terrestrial animals and plants, and to provide for greater connectivity within and between LSR's. The young, even-aged, managed stands within the Riparian Reserves do not currently meet the desired stand characteristics for this allocation (*USDA and USDA 1994, B-11 and B-31*) but accelerating development of desired stand characteristics here is potentially in conflict with the need to retain shade on Quartzville Creek and its tributaries. Quartzville Creek is on the State of Oregon Department of Environmental Quality's 303(d) list of water-quality impaired water bodies because temperatures exceed state water quality standards during a portion of the summer months. Retaining shade in the Riparian Reserves is important to meet water quality temperature standards.

Other issues include: (1) high road densities and their potential impacts on habitat usability; (2) harvest-related activities, especially road construction within an inventoried roadless area; (3) potential impacts of stand treatments on special habitats and (4) protection of Outstandingly Remarkable Values within the Quartzville Creek corridor so as not to compromise it's eligibility for designation as a Wild and Scenic River.

Environmental Consequences

Introduction: The alternatives use both active and passive methods of attaining desired stand characteristics in the LSR. The No Action alternative uses passive management to attain project objectives on both the uplands and Riparian Reserves within the LSR. The Proposed Action uses active stand treatments on both the uplands and in the secondary-shades zones within Riparian Reserves. A second action alternative actively treats only upland areas of the LSR and limited areas within the Riparian Reserves. It uses passive management in the remainder of the Riparian Reserves. Both action alternatives necessitate the use of various yarding, loading and hauling equipment which require road access to treatment areas. All alternatives use passive management in the primary shade zones within Riparian Reserves.

Consequences: Late-successional habitat is in short supply in the Pacific Northwest and some species dependent on this habitat are in decline, so active or passive methods of attaining desired stand characteristics affect the **timing of habitat** development in the *Quartzville LSR*, one of many in a network of LSR's in the Pacific Northwest. Alternatives Two and Three actively treat stands to attain desired stand characteristics while Alternative 1 passively addresses these stand objectives. It is estimated that attainment of desired stand characteristics would be perhaps decades faster with active treatment than with passive treatment (*USDA 2002, 3*). There is some risk with passive management in these dense plantations. Disturbance events that would likely occur here can either put these plantations on a "path that leads to complexity" or can begin to unravel the stands depending on a variety of factors (*USDA 2002, 5).* Both active and passive management can have different effects on dependent species or individuals within this LSR. With active treatments, there may be some short-term (*5 to 10 years*) impacts to the species that would ultimately benefit from treatments because thinning would open up the canopy on these stands for several years.

Between alternatives there are differences in the **amount of habitat treated** which affects the timing of attainment of desired habitat conditions in the *Quartzville LSR* as a whole. Alternative 1 does not actively treat any acres. This results in a tradeoff between the time it takes to develop late-successional habitat in the LSR and the potential effect of extending the recovery time for species that use this habitat, which is currently in short supply in the Pacific Northwest. According to forest ecologist Jerry Franklin, the structure of young, managed stands differs appreciably from young, natural stands that developed following wildfire; so young managed stands are "likely to develop on different and, perhaps slower trajectories than those followed by existing late-successional forests..." *(Franklin, 2001).* Alternative 2 actively treats 828 acres and Alternative 3 actively treats 557 acres which would contribute to accelerated development of desired habitat conditions within the *Quartzville LSR* as a whole. In addition, development of more late-successional habitat in this LSR and projects that accomplish similar objectives in other LSRs in the network would cumulatively contribute toward improved habitat conditions which would eventually aid in the recovery of populations that are in decline.

Differences in access and the types of yarding systems used in the two action alternatives can affect logging costs and such things as acres of ground disturbance which can affect soil compaction, soil displacement and the potential for noxious weed establishment, etc. Alternative 2 utilizes skyline yarding on 584 acres, helicopter on 133 acres and ground-based yarding on 111 acres. Alternative 3 utilizes skyline yarding on 371 acres, helicopter on 119 acres and ground-based yarding on 67 acres. The cost/benefit ratio for Alternative 2 is 2.1 and for Alternative 3 is 1.8.

There are virtually no differences in the amount of shade affected adjacent to streams in all alternatives because primary shade zones are kept intact except for some yarding corridors in the action alternatives. According to the *Sufficiency Analysis* done for this project, stream temperature increases are not expected with any alternative although there is slightly more risk in the Proposed Action than in the other alternatives, because it treats stands in the secondary shade zones of Riparian Reserves (*see Hydrology effects, pages 126-150 and Sufficiency Analysis files for this project which are available for review at Detroit Ranger District).*

The tradeoff of not taking any risk in order to protect stream temperatures in the primary shade zones along streams is that development of desired stand characteristics, as defined by the NW Forest Plan, could be delayed, by perhaps decades. For example, the young, even-aged, overstocked, managed stands here would take longer to develop: large trees desired for habitat and quality stream shade in the Riparian Reserves and large woody component desirable in stream channels to hold sediments and pool water for aquatic habitat. In addition, snow breakage potential is higher in dense stands and in riparian areas, also putting these stands at risk (*personal communication, district silviculturist Detroit Ranger District*)

Tree growth expected from thinning in the secondary shade zones areas in the Proposed Action would contribute to improved habitat conditions in the Riparian Reserves and the development of travel and dispersal corridors which would contribute to improved connectivity within the LSR, perhaps decades sooner than with passive management here.

Project Location

The project is located in the Canal, Upper Quartzville and Galena subwatersheds within the Quartzville Creek Watershed in T11S, R4E, Sections 10-15, 24, 25, 28, and 33-36; T11S, R5E, Sections 21, 26-31, and 35; and T12S, R4E, Section 1 in Oregon (*See vicinity map, Figure 1).*

Figure 1: Vicinity Map

Figure 2 below shows an enlarged map of the subwatersheds in which the project is located.

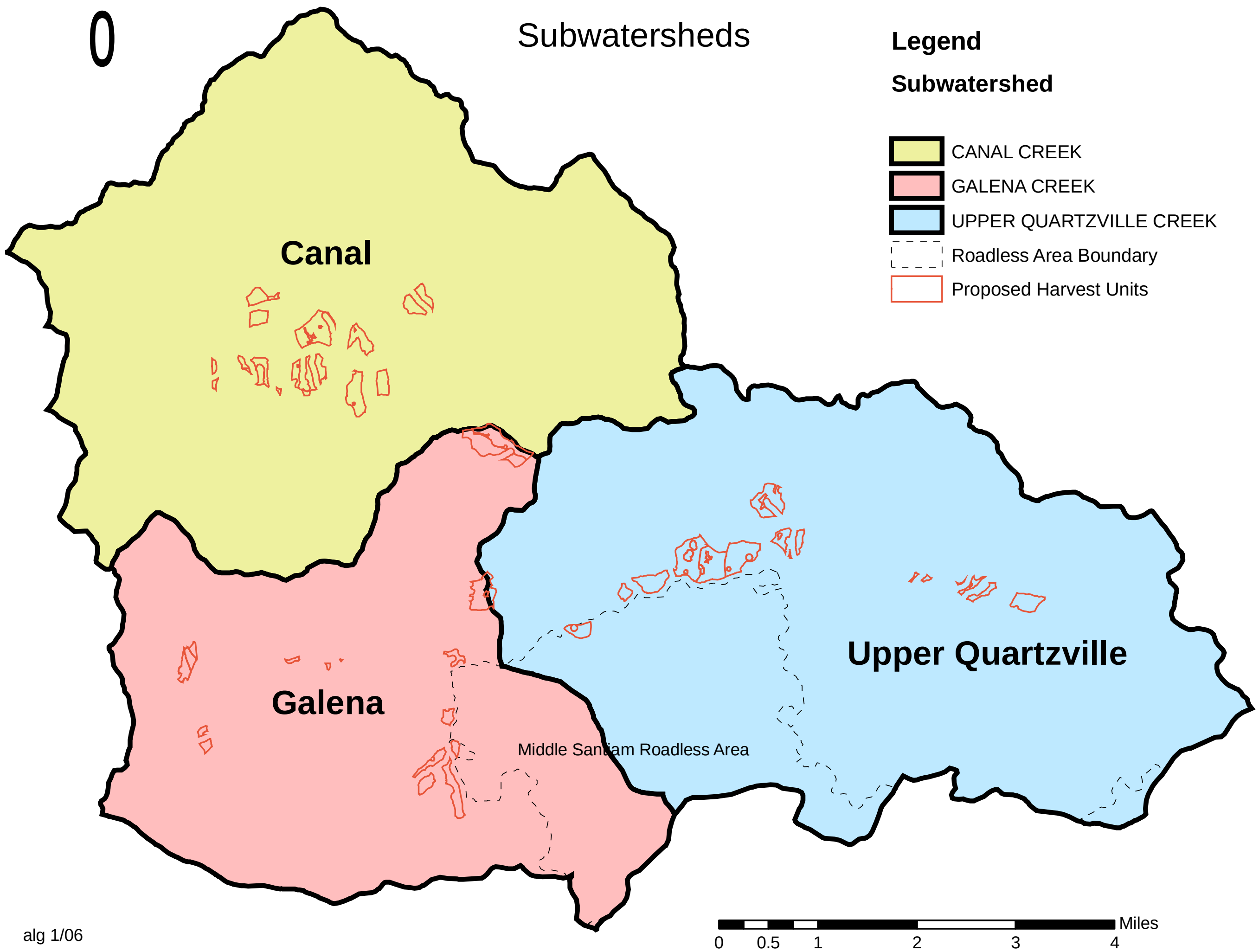


Figure 2: Subwatersheds

Decision

Based upon the effects of the alternatives, **the responsible official would decide:**

- Which alternative best meets the project purpose of accelerating development of late-successional stand characteristics in young stands within the *Quartzville LSR*.
- Whether the long-term benefits of accelerating development of large trees in portions of stands within riparian areas, that are not contributing to primary stream shade or channelbank stability, outweighs the potential short-term risks to stream temperatures by thinning in the secondary shade zone on Quartzville Creek *(a 303 (d) listed stream for summer temperatures)* and its tributaries
- Whether it is better to actively treat young stands to accelerate the development of late-successional stand characteristics or let those young stands develop desired characteristics on their own, over a much longer period of time.

This decision affects the length of time it would take for young stands to develop desired stand characteristics within the Quartzville LSR as well as the number of acres treated. For some species dependent on this habitat for their survival, the timing issue is very important.

Implementation monitoring would be required to evaluate whether stands developed the desired late-successional stand characteristics over the long term, whether species benefited by the habitat treatments, and whether stream temperatures in Quartzville Creek and its tributaries changed, either improved or declined, as a result of project activities.

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:

- **Introduction:** The section 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 section also details how the Forest Service informed the public of the proposal, how the public responded, and what issues were addressed.

Comparison of Alternatives, including the Proposed Action: This section provides a more detailed description of the agency's proposed action as well as alternative methods for achieving the stated purpose. These alternatives were developed based on significant issues raised by the public and other agencies. This discussion also includes possible mitigation measures. Finally, this section provides a summary table of the environmental consequences associated with each alternative.

Environmental Consequences: This section describes the environmental effects of implementing the proposed action and other alternatives. This analysis is organized by resource area. Within each section, the affected environment is described first, followed by the effects of the No Action Alternative that provides a baseline for evaluation and comparison of the other alternatives that follow.

Agencies and Persons Consulted: This section 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 Sweet Home Ranger District Office in Sweet Home, Oregon.

Introduction

This section includes information on the background leading up to the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal, how the public responded, and identifies the issues addressed in the analysis.

Background

Existing Conditions

The young, even-aged, managed stands being considered for treatment in this project are 35-45 year old stands with diameters of 10 to 14 inches and heights of 60 to78 feet. The stands were clearcut between 1961 and 1972, broadcast burned and densely seeded or planted (*see Appendix I for summary of stand histories*). They contain little or no legacy downed wood or snags because of past harvest practices. Currently they are densely stocked at 200 to 340 trees per acre and are beginning to see effects of overcrowding such as reduced stand vigor, mortality, etc.

These stands were established to produce high yields of timber for commodity production, not to provide old-growth forest habitat. These dense, second-growth stands offer little in the way of structural diversity desired in late-successional habitat.

When these stands were initially harvested and reforested they were planted densely with the idea that they would have been pre-commercially and commercially thinned as they grew and started to crowd each other and compete for light and nutrients. Thinning the stands was done to keep them healthy and productive. When they reached about 85+ years of age, they would have been scheduled for harvest, probably by clearcutting and then replanted to begin the cycle again. In this management scenario, the objectives for these stands were aimed at maximizing tree growth to provide a sustained yield of timber commodities over time, while also meeting various multiple use objectives. This management resulted in a landscape with a mosaic of timber stands in various seral stages.

In order to accomplish commodity-based management objectives in an economically efficient manner, about 155 miles of roads were constructed to access various harvest units in the analysis area. This resulted in the following open road densities within the analysis area: Canal Creek - 2.4 miles per square mile; Upper Quartzville Creek – 2.6 miles per square mile and Galena Creek – 1.9 miles per square mile. These three subwatersheds are only a portion of the larger Quartzville Late-Successional Reserve which has overall road densities of 3.3 miles per square mile.

The map on the following page (*Figure 3*) illustrates the harvest pattern on Forest System lands in the *Quartzville LSR* which created this mosaic as well as the road system developed to access harvest units. The harvest units are color-coded by the decade in which harvest occurred and units in the proposed action are outlined in red. The darker colored units were harvested earlier than the lighter colored units. The map shows about 10,500 acres of harvest since the 1950's, or about 1/3 or the analysis area.

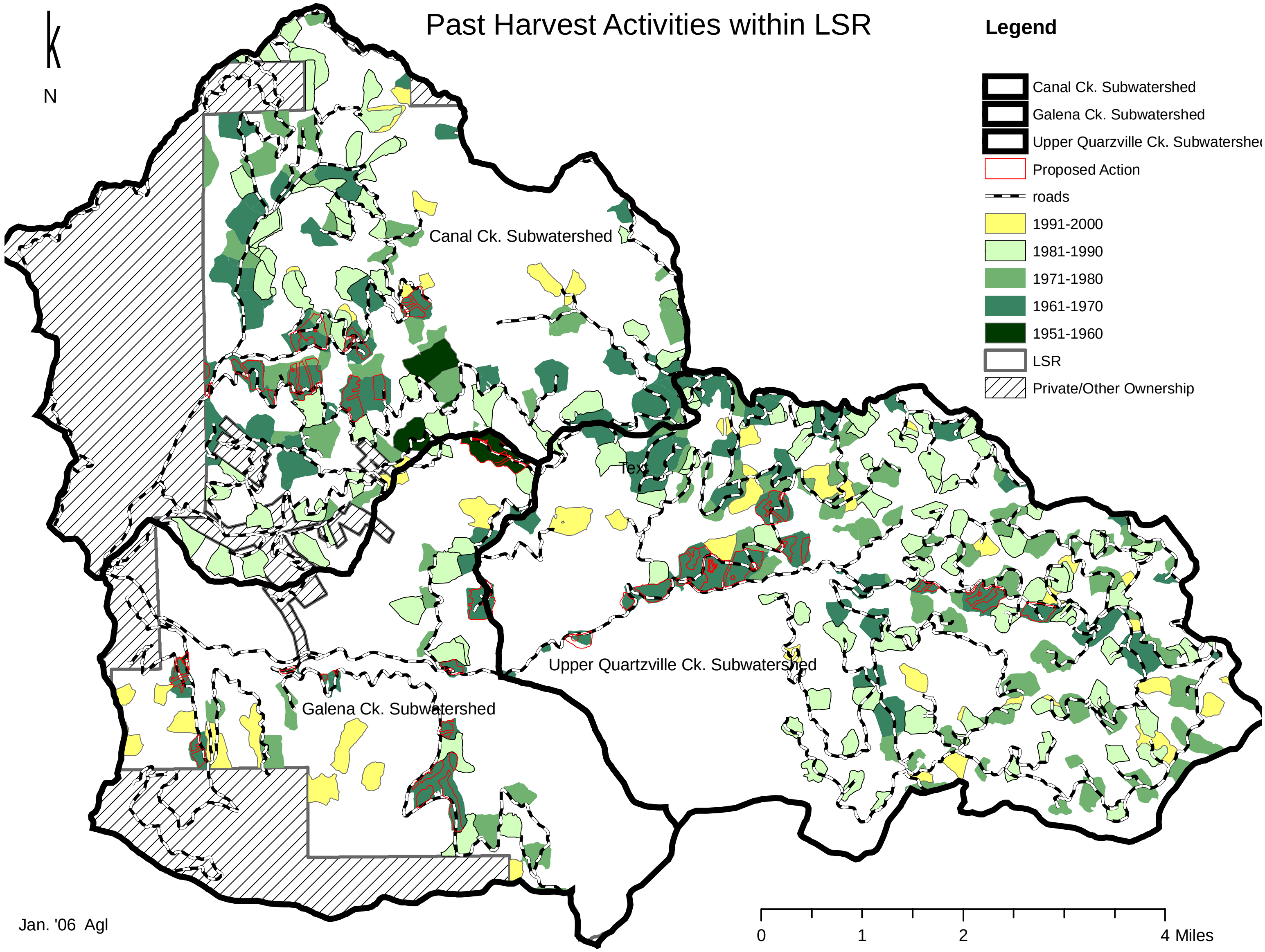


Figure 3: Past Harvest Activities

Listing of the northern spotted owl: In 1990, the U.S. Fish and Wildlife Service listed the northern spotted owl under the Endangered Species Act. They determined that the spotted owl was threatened throughout its range by the loss of suitable habitat as a result of timber harvesting and catastrophic events such as fire. In 1992 they designated critical habitat (*CHU's*) for the owls on federal lands and later prepared a Draft Recovery Plan for the birds. The Late Successional Reserve is shown in green and the CHU boundary is shown by hatched lines on the map below (*Figure 4*).

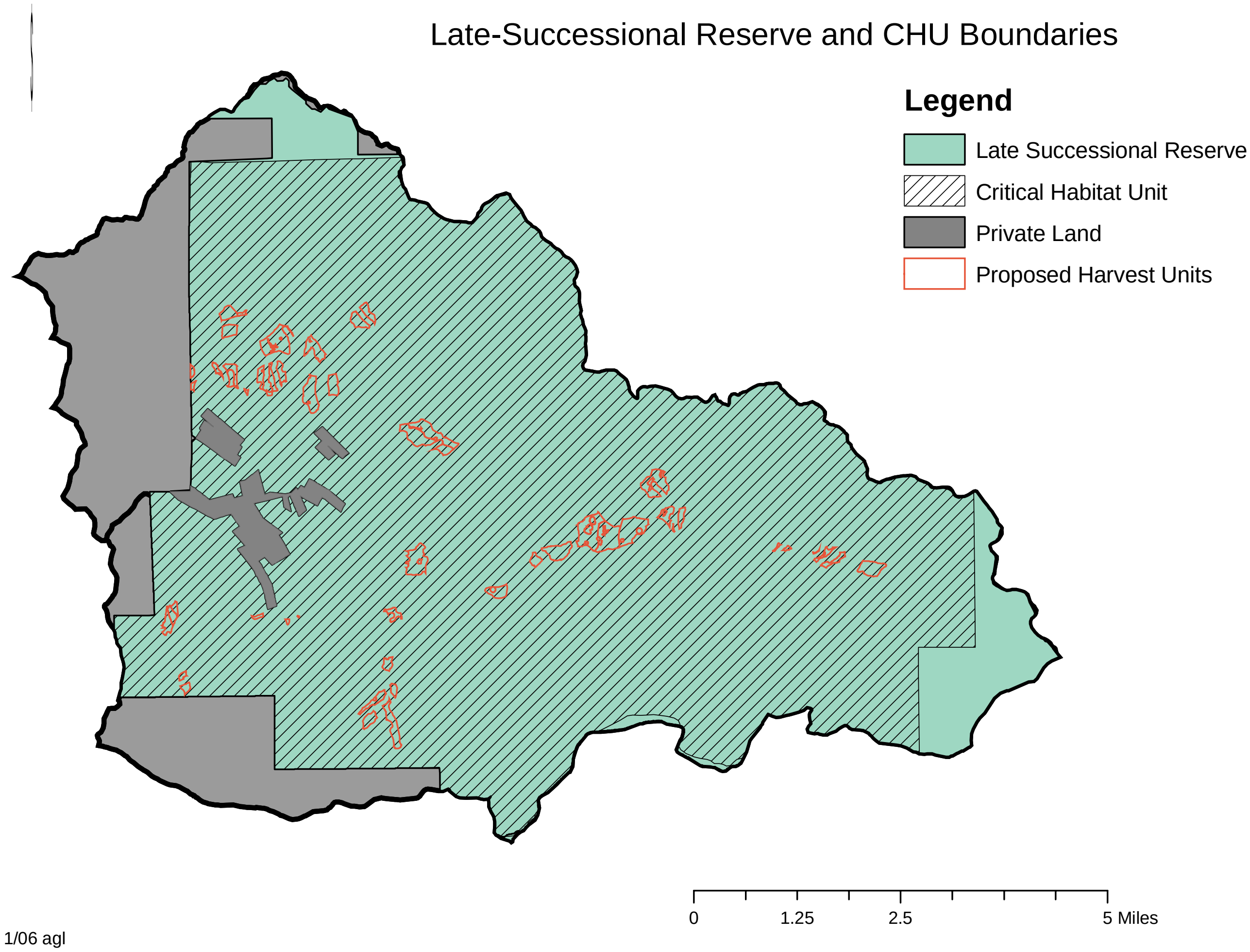


Figure 4: Late-Successional Reserve (LSR) and Critical Habitat Unit (CHU)

Changes brought about by the NW Forest Plan

According to forest ecologist Jerry Franklin, scientists realized that recovery of threatened populations of old-growth related species, including the northern spotted owl, would be limited if ample late-successional habitat was not available to them. They knew that this type of habitat was in short supply in the Pacific Northwest, so in 1994 the *NW Forest Plan* allocated a network of large blocks of land called Late-Successional Reserves (*LSR's*) designed to "meet legal requirements to maintain viable populations of native wildlife throughout the region" and to serve as habitat for species dependent on this habitat (*USDA 2002, 3)*.

The map above (*Figure 4*) shows not only CHU boundaries but also shows the portion of the Quartzville Late-Successional Reserve boundaries that fall within the analysis (the green area on the map).

When LSR's were designated, "intact blocks of late-successional forests no longer existed at the desired scale so … LSR's…actually incorporated fragmented landscapes, portions of which had been logged and planted" *(Franklin, 2001).* The map below show the "logged and planted" areas included within the LSR (*Figure 5*)

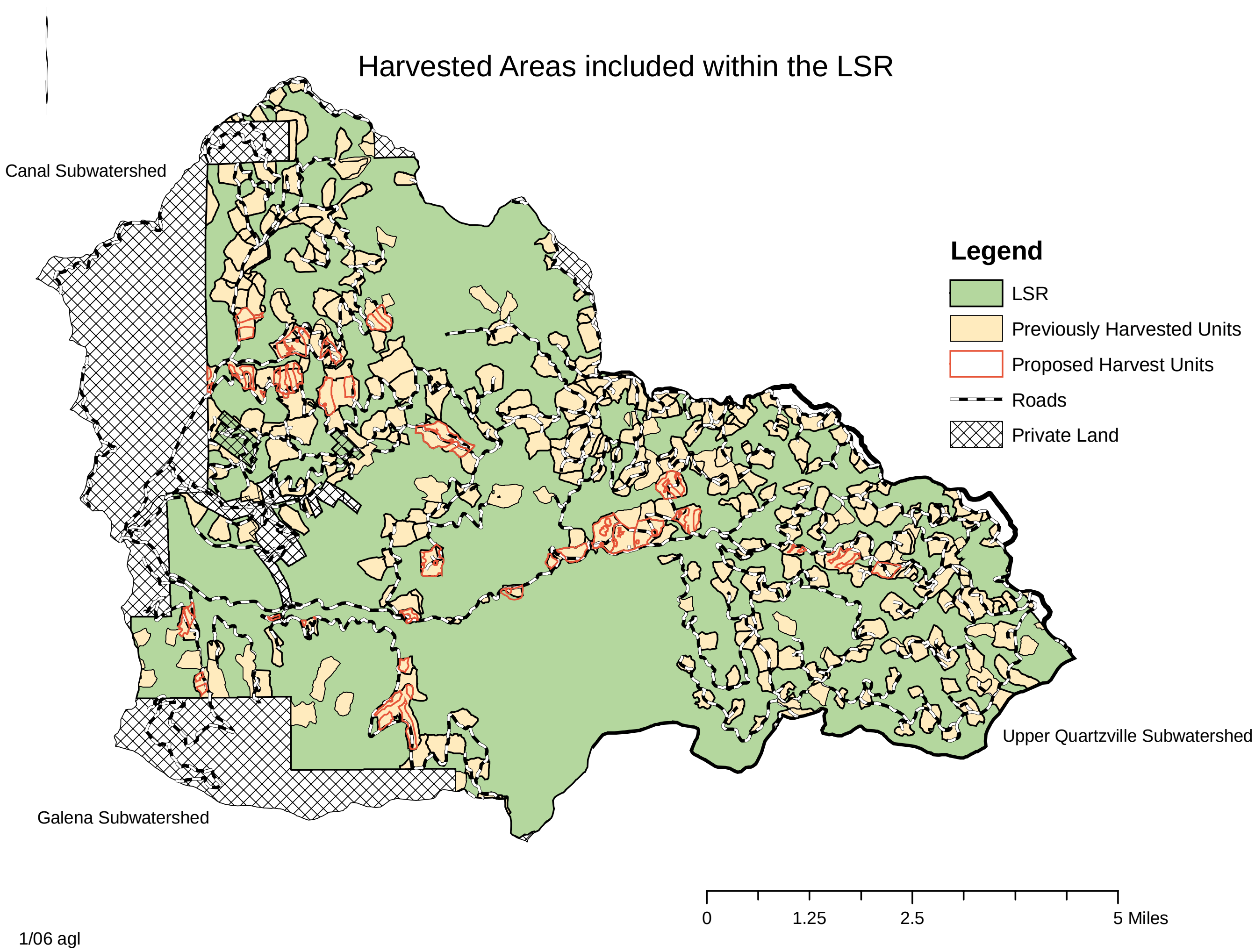


Figure 5: Harvest Areas within LSR

The stands being considered for treatment with this proposal were part of the "logged and planted" inclusions that were allocated to the *Quartzville Late-Successional Reserve (LSR)*.

After these stands became part of the LSR, the objective for their management changed from even-aged, high-yield commodity production to maintaining large, contiguous blocks of complex, late-successional forest habitat for species dependent on this type of habitat. Based on a variety of research, the *NW Forest Plan* described desired stand characteristics for late-successional habitat as including among other things: live old-growth trees, snags, down woody debris, logs in streams, multiple canopy layers, canopy gaps, a patchy understory, open tree crowns with heavy limbs, and a diversity of native plant species (*USDA and USDI. 1994, B-2 and B-3*). These are not the same characteristics that are desired for high-yield commodity production in even-aged timber stands.

When scientists designed the Late-Successional Reserve network they allowed for silvicultural treatments of included, managed stands less than 80 years of age, to accelerate the development of habitat conditions for species dependent on late-successional/old-growth habitat (*USDA and USDI. 1994, C-12*). In fact, the *NW Forest Plan* "encouraged the use of silvicultural practices to accelerate the development of overstocked young plantations into stands with late-successional and old-growth forest characteristics, and to reduce the risk to Late-Successional Reserves from severe impacts resulting from large-scale disturbances and unacceptable loss of habitat" (*USDA and USDI. 1994, B*-1). They reasoned that the sooner this habitat is made available to threatened species dependent upon it for their survival, the better their chances of recovery.

Not only does management direction encourage the use of silvicultural treatments in young, even-ages, managed stands in the LSR's but research supports this as well. This is illustrated by remarks made by Tom Mills, PNW Research Station Director who said, "…recent scientific research indicates that if the plantations in the LSRs are treated with the proper types of thinning and some other management actions, the actions may accelerate the development of some old-growth characteristics by decades. Some benefits in biological diversity could occur within the next two or three decades" *(USDA 2002, 4).*

About 34,629 acres of the 83,666 acre *Quartzville LSR* is on the Sweet Home Ranger District and is being considered in this analysis. Table 1 shows the current stand ages in the portion of Quartzville LSR being analyzed for this project. About one third of the stands here are less than 80 years of age and could potentially receive silvicultural treatments now and in the future. Most of these are managed stands.

Table 1: Age Distribution of Managed Stands in LSR

Stand age in Years	Acres	Percent of Area
0-29	5,166	15
30-49	3,513	10
50-80	2,557	7
Subtotal for stands less than 80 years of age	**11,236**	**32%**
80-99	171	<1
100-149	5,391	16
150+	17,831	51
Subtotal for stands more than 80 years of age	**23,393**	**68**
Total	**34,629**	**100**

Relationship of Project to Various Management Plans, Management Direction, Watershed Analysis, LSR Assessments, etc.

Willamette Forest Plan: This environmental assessment tiers to and relies upon the analysis in the 1990 Final Environmental Impact Statement for the *Willamette National Forest Land and Resource Management Plan* (Willamette Forest Plan*)* and the Final Supplemental Environmental Impact Statement on *Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl* (NW Forest Plan) which amended the Willamette Forest Plan and forest plans on 18 other National Forests and seven Bureau of Land Management districts in 1994.

The amended *Willamette Forest Plan* provides resource management direction, defines various management areas (MA's), describes desired conditions for these management areas and outlines standards and guidelines under which lands and resources administered by the Willamette National Forest are managed. The relevant management allocations for this project are Late-Successional Reserves (MA16) and Riparian Reserves (MA15). The Riparian Reserve allocation overlays the Late-Successional Reserve allocation. The following briefly discusses the goals of these management areas and direction for their management.

MA 16 - Late Successional Reserves were intended to maintain large, contiguous blocks of complex, late-successional forest habitat for species dependent on this type of habitat for their survival.

The following summary highlights the direction in the *NW Forest Plan* for LSR management allocations. *(Refer to the NW Forest Plan for more details and specific direction*). This direction was adhered to in the development of this project.

- "Silvicultural systems proposed for Late-Successional Reserves have two principal objectives: (1) development of old-growth forest characteristics…and (2) prevention of large-scale disturbances … that would destroy or limit the ability of the reserves to sustain viable forest species populations"(*USDA and USDI. 1994, B-5*). *These objectives are also the primary objectives of this proposal (see Purpose and Need, page 24).*
- "Stand management in Late-Successional Reserves should focus on stands that have been regenerated following timber harvest or … that have been thinned. (This includes) stands that would acquire late-successional characteristics more rapidly with treatment, or are prone to fire, insects, diseases, wind or other disturbances that would jeopardize the reserve. Depending on stand conditions, treatments could include, but should not be limited to: (1) thinning or managing the overstory to produce large trees; release advanced regeneration of conifers, hardwoods, or other plants; or reduce risk from fire, insects, disease or other environmental variables, etc. For clarification it was noted that "(thinning) prescriptions should encourage development of diverse stands with large trees and a variety of species in the overstory and understory. Prescriptions should vary within and among stands." (*USDA and USDI. 1994, B-6*). *The Proposed Action would treat managed stands with the goal of accelerating development of late-successional stand characteristics through variable density*

thinning which also encourages stand diversity. Treatment prescriptions also vary within and among stands.

- "A management assessment shall be prepared for each large Late-Successional Reserve (or group of smaller Late-Successional Reserves) before habitat manipulation activities are designated and implemented" *(USDA and USDI. 1994, C-11). This was accomplished in the Mid-Willamette LSR Assessment in 1998.*
- "Thinning or other silvicultural treatments inside reserves are subject to review by the Regional Ecosystem Office to ensure that the treatments are beneficial to the creation of late-successional forest conditions. The Regional Ecosystem Office may develop criteria that would exempt some activities from review" (*USDA and USDI. 1994, C-12). On July 9, 1996 the Regional Ecosystem Office (REO) issued a letter outlining the criteria that "exempted certain commercial thinning projects in Late-Successional Reserves"…from review by the REO and on May 9, 1995 they issued a letter outlining criteria to exempt certain timber stand improvement projects from review by the REO. Those criteria and evidence that this project meets those criteria is outlined later in this section of the environmental assessment.*
- For areas west of the Cascades, such as this project, allowances were made for silvicultural treatments such as thinning "…in stands up to 80 years old regardless of the origin of the stands …(for the purpose of benefiting) the creation and maintenance of late-successional forest conditions" (*USDA and USDI. 1994, C-12*). *All stands proposed for treatment are less than 80 years old and are being treated to accelerate the development of late-successional forest conditions (see summary of stand history of each unit in Appendix I).*
- Road construction in Late-Successional Reserves … is not recommended unless potential benefits exceed the costs of habitat impairment. If new roads are necessary to implement a practice that is otherwise in accordance with these guidelines, they would be kept to a minimum, be routed through non-late-successional habitat where possible, and be designed to minimize adverse impacts…" (*USDA and USDI. 1994, C-16*). *About 100 feet of new, native-surface temporary road construction would be necessary to accomplish stand treatment objectives for this area. Although not new construction, about 1.4 miles of existing, native-surface temporary roads and 5.28 miles of closed and water barred, system roads would have to be re-opened to access harvest unit in the Proposed Action. The accelerated development of habitat conditions within the LSR is thought to outweigh the affects of the short-term use of these roads during harvest operations. With the exception of the new construction, the roads occur on existing road beds and would be closed following harvest activities. In addition, all of the proposed roads are in non-late-successional habitat.*
- "In Late-Successional Reserves, a specific fire management plan would be prepared prior to any habitat manipulation activities. This plan … should specify how hazard reduction and other prescribed fire applications would meet the objectives of the Late-Successional Reserve" (*USDA and USDI. 1994, C-18*). *A fire management plan was included in the Mid-Willamette LSR Assessment, 1998.*
- "Evaluate impacts of non-native species (plant and animal) currently existing within reserves, and develop plans and recommendations for eliminating or controlling non-native species that

are inconsistent with Late-Successional Reserve objectives…" (*USDA and USDI. 1994, C-19*). *Mitigation measures would be implemented to minimize potential introduction of non-native plants into the LSR such as washing equipment working in the area, obtaining gravel for road work from weed-free sources, seeding disturbed areas with native species, surveying and removing individuals and populations of non-native plants in harvest units and along road systems, etc.*

MA -15 Riparian Reserves *are one of the components of the Aquatic Conservation Strategy outlined in the NW Forest Plan.* Riparian Reserves serve to: (1) restore and maintain the ecological health of watersheds and aquatic ecosystems on public lands at the watershed and landscape scales; (2) protect habitat for fish and other riparian-dependent species and (3) restore currently degraded habitats.

Riparian Reserves were intended to "provide an area along all streams, wetlands, ponds, lakes, and unstable and potentially unstable areas where riparian-dependent resources receive primary emphasis" *(NW Forest Plan, page A-5).* They also serve to "improve travel and dispersal corridors for many terrestrial animals and plants, provide for greater connectivity within the watershed," and serve as connectivity corridors among Late-Successional Reserves. (*USDA and USDI. 1994,A-5 and B-13*).

Riparian Reserve management areas usually include at least the water body, inner gorges, all riparian vegetation, 100-year floodplain, landslides, and landslide-prone areas. The widths of the reserves are based on some multiple of a site-potential tree, or a prescribed slope distance, whichever is greater.

The following summary highlights the direction in the *NW Forest Plan* for Riparian Reserve management allocations. *(Refer to the NW Forest Plan for more details and specific direction*). This direction was adhered to in the development of this project.

- Management activities must be consistent with Aquatic Conservation Strategy (*ACS*) Objectives (*USDA and USDI. 1994, 11*). *Proposed activities were designed to be consistent with ACS objectives as evidenced by the hydrology report in Appendix E.*
- The Aquatic Conservation Strategy in the *Northwest Forest Plan* included a requirement to prepare comprehensive watershed analyses for all fifth field watersheds. It also stated that watershed analysis should be completed prior to construction of new roads or landings in Riparian Reserves. *In the Proposed Action, 100 feet of new, native surface temporary spur roads would be constructed within a Riparian Reserve, but not in the primary shade zone. A watershed analysis was completed for the Quartzville Watershed in September 2002.*
- "Apply silvicultural practices for Riparian Reserves to control stocking, reestablish and manage stands, and acquire desired vegetation characteristics needs to attain Aquatic Conservation Strategy Objectives" (*USDA and USDI. 1994, C-32*). *The Proposed Action utilized silvicultural practices in Riparian Reserve Management Areas, but outside of primary shade zones, to acquire desired vegetation characteristics there.*
- Minimize road and landing locations in Riparian Reserves. During project planning efforts were made to minimize road and landing impacts on Riparian Reserves. *Yarding of harvest*

units is often dictated by topography when skyline and ground-based harvest systems are used. Every effort was made to minimize roads and landings in Riparian Reserves. In the Proposed Action there are three closed logging spur roads, constructed during the first entry, totaling 1.4 miles that would be reopened and 100 feet of new, native surface temporary spur that would be constructed within Riparian Reserves, but not in the primary shade zones. These roads would be used during harvest operations and closed with a berm and water barred following harvest activities. In addition the following occur in the Riparian Reserve allocation but occur outside of riparian non-harvest buffers: (1) five helicopter landings, all of which are existing landings but one landing needs to be expanded in size; (2) six skyline landings and (3) six ground-based yarding landings. Furthermore, there are two ground-based yarding stream crossings which would be designated perpendicular to the stream channel on intermittent streams, as per BMP standards, and two proposed harvest units where skyline yarding would occur across streams. Full suspension would be required across the streams and when yarding through Riparian Reserves. Trees felled for yarding corridors would be left in place. Where possible, they would be felled into stream channels to provide large wood.

- "Active silvicultural programs would be necessary to restore large conifers in Riparian Reserves. Appropriate practices may include …thinning densely-stocked young stands to encourage development of large conifers…These practices can be implemented along with silvicultural treatments in upland areas, although the practices would differ in objective and, consequently design." (*USDA and USDI. 1994, B-31*). *Alternative 2 proposes thinning to encourage development of large conifers within the secondary shade-zone in Riparian Reserves.*
- In a March 2004, the *Decision to Clarify Provisions Relating to the Aquatic Conservation Strategy*, established the following requirements for projects within Riparian Reserves: "a project record for a project within Riparian Reserves must: (1) describe the existing condition, including the important physical and biological components of the fifth field watersheds 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." *The proposed action in the Quartzville LSR Thin Planning Area includes thinning in Riparian Reserves. Descriptions and disclosure of effects can be found in Chapters 2 and 3, and in the Hydrology Report in Appendix E. Other documents such as the Sufficiency Analysis are kept on file with the District Hydrologist and are available for public review at the Detroit Ranger District office.*

Regional Ecosystem Office Letter RE: Criteria to Exempt Specific Silvicultural Activities in LSR's and MLSAs from REO Review: This letter is incorporated by reference into this document. A copy of the letter is included in Appendix J. On May 9, 1995 the Regional Ecosystem Office (REO) issued a letter outlining the criteria that exempt "certain pre-commercial thinning, release and reforestation activities within LSRs from REO review."

Table 2: Regional Ecosystem Office (REO) Criteria to Exempt Specific Silvicultural Activities in LSR's from REO Review

Criteria for Exemption of "certain pre-commercial thinning, release and reforestation activities within LSR's from REO Review	How Criteria is Addressed in this Proposal
Pre-commercial thinning where stand is overstocked and prescription should indicate that the development of late-successional conditions would be accelerated or enhanced, cut trees less than 8"dbh, skidders or harvesters not used, treatments promote species diversity including hardwoods and shrubs, treatments include varied spacing, treatments minimize need for future entries, and cutting is done with hand tools including chain saws	*Pre-commercial thinning/release is proposed in the LSR, see maps in Post-sale Activities Plan (Appendix B). Pre-commercial thinning prescriptions meet requirements in this letter.*
Release: competition from undesirable vegetation delays the development of late-successional conditions and modeling shows late-successional conditions would be enhanced with treatment, cut material is less than 8" dbh, no skidders or harvesters used, treatments promote natural diversity, and cutting is done with hand tools including chain saws	*Pre-commercial thinning/release is proposed in the LSR, see maps in Post-sale Activities Plan (Appendix B). Release prescriptions meet requirements in this letter.*
Reforestation and Revegetation: no site preparation is required other than hand scalping, reforestation is necessary to quickly reach late-successional conditions, etc., treatments promote natural species diversity, treatments result in varied spacing and treatments minimize the need for future entries.	*Planting would be done using post-sale funding, as available. It would occur in DTR areas where minor species would be planted to promote diversity. In addition, underplanting would occur in Riparian Reserves and some thinned stands to increase stand diversity and help develop a second canopy layer.*

Regional Ecosystem Office Letter RE: Commercial Thinning Projects in LSR's: This letter is incorporated by reference into this document. A copy of the letter is included in Appendix J. On July 9, 1996 the Regional Ecosystem Office (*REO*) issued a letter outlining the criteria that "exempt certain commercial thinning projects in Late-Successional Reserves"…from review by the REO. These projects were exempted because "such projects have a high likelihood of benefiting late-successional forest conditions" provided they meet the following criteria:

Table 3: Regional Ecosystem Office (REO) Criteria for Exemption from REO Review

Criteria for Exempting Thinning Projects from REO Review	Where Criteria is Addressed in this Proposal
The purpose of the treatment is to develop late-successional conditions. The treatment would result in long-term development of vertical and horizontal diversity, snags, coarse woody debris (logs), and other stand components benefiting late-successional forest-related species. Also, to the extent practicable, create components that would benefit these species in the short-term.	Summary Purpose and Need Proposed Action Alternative 2 Alternative 3
Negative short-term effects are outweighed by long-term benefits to species and won't lesson the short-term functionality of the LSR as a whole.	Environmental Consequences
Leave tree criteria provide for such things as culturing individual trees for large crowns and limbs and retention of characteristics that induce disease, damage and mortality or habitat consistent with LSR objectives.	Leave tree criteria, especially in DTR's and retention of existing snags, etc. would encourage these conditions.
Coarse Woody Debris (CWD) objectives should be based on research that shows optimum levels of habitat.	Based on Decayed Wood Advisor (2003) DecAid Model and Mid-Willamette LSR Assessment Recommendations
Stand is not currently a complex, diverse stand that would soon meet LSR characteristics without treatment.	Existing conditions Vegetation effects
Stand is less than 80 years old or exceeding 20 inches DBH.	Stands are 35 to 45 years old with diameters of 10 -14 inches dbh
Stand is overstocked	Stands are overstocked and contain 200 – 340 trees per acre
Treatments are designed to increase tree size, crowns and other desirable characteristics	Purpose and Need Proposed Action
Prescription is supported by information or modeling indicating achievement of LSR characteristics would be accelerated.	Vegetation effects
Treatment is primarily an intermediate thinning, and development of a second canopy layer is no more than an associated, limited objective as follows: 1. 10% or more would remain unthinned. 2. 3-10% would be in openings roughly ¼ to ½ acres in size 3. 3-10% would be heavily thinned	Alternative 2 Alternative 3
Treatment doesn't inappropriately simplify stands.	Vegetation Effects
Treatment includes falling green trees or leaving snags and existing debris to help meet coarse woody debris objectives.	Alternative 2 Alternative 3
Snag objectives are part of the desired future condition…make progress toward meeting overall snag objectives…Each treatment includes retention and creation of snags…	Proposed Action Alternative 2 Alternative 3
Habitat improvements outweigh habitat losses due to road construction	Alternative 2 Alternative 3 Environmental Consequences

2001 Amendment to Willamette Forest Plan: In January 2001, the Willamette Forest Plan was further amended by 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 and USDI, 2001*) which amended a portion of the Northwest Forest Plan, and thus the Willamette Forest Plan, by adopting new standards and guidelines for Survey and Manage and Protection Buffer species, and other mitigating measures.

Second 2004 Amendment to Willamette Forest Plan: In March 2004, another *Record of Decision Amending Resource Management Plans for Seven Bureau of Land Management Districts and Land and Resource Management Plans for Nineteen National Forests Within the Range of the Northern Spotted Owl*, amended a portion of the Northwest Forest Plan, and thus the Willamette Forest Plan, by clarifying the proper spatial and temporal scale for evaluating progress toward attainment of Aquatic Conservation Strategy (ACS) objectives and by providing clarification that no project level finding of consistency with ACS objectives is required.

The proposed action and all action alternatives detailed in this environmental assessment are designed to be consistent with direction provided throughout the amended Willamette Forest Plan.

Quartzville Watershed Analysis (Sept. 2002) is incorporated by reference and is available for public review at the Sweet Home Ranger District office. As recommended by the Aquatic Conservation Strategy in the *Northwest Forest Plan* a comprehensive watershed analyses was completed for the Quartzville watershed in September 2002. This project lies within the area studied in this watershed analysis.

Recommendations from this watershed analysis as they relate to this project include the following:

- "density management and thinnings … (which) emphasize enhancement and restoration opportunities that target stands in Riparian Reserves, (Late Successional Reserves) LSR, … lands in Critical Habitat that have been managed primarily for timber harvest in the past" (*USDA and USDI, 2002*).
- "implement density management prescriptions to develop and maintain late-seral forest stand characteristics…(Desirable) stand characteristics include larger trees for a large green tree component and recruitment of large standing dead/down coarse woody debris in future stands, multi-layered stands with well developed understories, and multiple species that include hardwoods and other minor species" (*USD and USDI, 2002*)
- "Density management would be prescribed primarily in mid-seral stands in the stem exclusion stage to encourage the development of late-seral forest conditions. Priorities for density management to accelerate the development of late-seral forest conditions would be high in Riparian Reserves, LSR, … lands in Critical Habitat." It also recommended development of late-seral forest stand characteristics, especially in managed stands in LSR's, Riparian Reserves, etc. (*USDA and USDI, 2002, Ch. 7 pg. 6*).

Mid-Willamette LSR Assessment (August 1998) is incorporated by reference and is available for public review at the Sweet Home Ranger District office. As required in the *NW Forest Plan*, the 83,666 acre Quartzville LSR was analyzed in the 1998 *Mid-Willamette LSR Assessment* which determined that since the mid-1900's the LSR has seen a 32% decrease in late-successional and interior forest habitat. This decrease was in a large part due to harvest activities. At the time of the assessment, about 41% of the LSR was in early, early-mid, and mid seral stages. Young stands in these early seral stages do not yet meet the late-successional or old-growth habitat characteristics desired within this LSR management allocation. Some tree growth has occurred since 1998 moving some of the youngest stands out of the earliest seral stages, but overall the percentage of stands not meeting late-successional stand characteristics is about the same now as it was in 1998. In its recommendations, the *Mid-Willamette LSR Assessment* suggested some urgency in promoting late-seral conditions within the *Quartzville LSR* by "treating a range of seral stages in plantations in as short of time as possible" *(USDA and USDI. 1998b, 163).*

Besides reductions in late-successional habitat, the assessment determined that this LSR exceeded desired road densities which can negatively impact the function and usability of LSR habitat. The LSR Assessment recommended reducing road densities to improve function and usability of LSR habitat.

Further, this assessment determined that the Quartzville LSR (RO213) has the following key issues: late-successional forest, road density and within and between LSR connectivity.

- ***Late successional forest*** – Many of these stands (early through mid seral stands) may benefit from density management within the next 30 years *(USDA and USDA. 1998, Chap IV, page 12).* Commercial thinning opportunities are predominately in the "dense uniform conifer stands" of the early mid seral stands" *(USDA and USDA. 1998, Chap IV, pg 121). This proposal would commercially thin dense uniform conifer stands in these seral stages.*
- ***Road density***- "Much restoration of late-successional forest conditions from past effects of roads may be needed in Quartzville …, due to their relatively large size and high overall road density" *(USDA and USDA. 1998, Chap II pg 63).* The assessment goes on to state that those portions of LSRs above 2 mi/mi^2 should receive attention for treatment so that they can meet long-term objectives, LSR-wide. This recommendation is especially pertinent to …Quartzville RO213)… *(USDA and USDA. 1998, Chap IV, pg 118). Road densities in the analysis area range from 1.9 to 2.6 open road miles per square mile. Opportunities to close roads were analyzed and many would be implemented as a result of the proposed action.*
- ***Within and between LSR connectivity***-"Connectivity within ….Quartzville is negatively impacted by the amount and juxtaposition of non-connected late-successional habitat on federal lands. … These conditions result in isolated blocks of habitat or blocks of habitat that are connected by relatively narrow causeways. Enhancing connectivity and avoiding further degradation of connectivity on federal lands within these LSRs is a priority in improving the function of these LSRs. *(USDA and USDA. 1998, Chap III pages 79-80).* …..Restoring and avoiding further degradation of connectivity within these areas should be a priority when developing treatments *(USDA and USDA. 1998, chap IV, page 117.). The proposed action addresses improving connectivity within the LSR by accelerating development of early seral stands, by designing harvest areas such that existing interior forest is maintained and*

aggregating treatments, where possible, to promote larger patches of developing late-seral forests.

Northwest Forest Plan Temperature TMDL Implementation Strategies (September 2005) is incorporated by reference and is available for public review at the Sweet Home Ranger District office. This document evaluated the Aquatic Conservation Strategy objectives outlined in the *NW Forest Plan* and developed a tool called the "*Sufficiency Analysis*" to ensure stream temperature water quality standards are met on 303 (d) listed water quality impaired streams. The document "provides a basis for analyzing stream shade, effects of shade on stream temperature, and management of riparian areas to meet water quality and broader objectives embodied in the NWFP Aquatic Conservation Strategy (ACS)" (Northwest Forest Plan Temperature TMDL Implementation Strategies, page 4). *The "Sufficiency Analysis" was used to analyze project impacts on stream temperatures for this project. This analysis is incorporated by reference into this document and is available for public review at the Detroit Ranger District office of the Willamette National Forest (see Environmental Consequences, pages 75 to 181 and Appendix J).*

The Willamette Forest Roads Analysis, 1998 as amended in 2003: This analysis is incorporated by reference and is available for public review at the Sweet Home Ranger District office. This analysis resulted in the identification of a network of Key Forest Roads "to provide sustainable access to National Forest System lands for administration, protection, and utilization in a manner consistent with Willamette Forest Plan guidance and within the limits of current and likely funding levels" (*USDA. 2003, p. 2*). This analysis identified five roads in the analysis area as being Key Forest Roads. They are: the first 2.6 miles of road 1131, the first 2.1 miles of road 1131 101, road 1100, road 1133, and road 1152.

The analysis goes on to say, "Roads that are not selected as Key Forest Roads will generally be candidates for some form of treatment that stabilizes their erosion potential and reduces that impact on the resources. These roads will be considered for closure, stabilization, or, if unneeded decommissioning. Their status will be determined with input from watershed, district or project planning, NEPA, or as travel management plans are developed in response to local resource and social issues. Declining road maintenance budgets will also be a factor. Non-Key Forest Roads that pose an immediate threat to resources may require a physical barrier to eliminate traffic or may be decommissioned" (USDA. 2003, p. 4)

The interdisciplinary team for this project analyzed non-key forest roads within the analysis area for closures. Planned future use, fire access, maintenance requirements and disturbance patterns were considered. In all about 29 miles of roads were recommended for closures.

Wild and Scenic Rivers Act, 1968: Quartzville Creek was recognized in the *Willamette Forest Plan* as a potential candidate for Wild and Scenic River (WSR) designation. It was determined eligible for a "Recreation" designation base on its scenic and recreation qualities. *Proposed actions have been designed to maintain the Outstandingly Remarkable Values for this steam, so as not to preclude potential Wild and Scenic River designation.*

Middle Santiam Inventoried Roadless Area was studied in RARE I and II. A portion of the original area was established as the Middle Santiam Wilderness in the Oregon Wilderness Act of 1984 (*this part is located just south of the current Roadless area*), part of the remainder was released for multiple use management and has been developed and the remaining portion is the current Middle Santiam Roadless Area. Direction for activities within Inventoried Roadless Areas is outlined in Forest Service Interim Directive 1920-2006-1 which became effective on January 16, 2006.

The policy under this interim direction states that: “Inventoried roadless areas contain important environmental values that warrant protection. Accordingly, until a forest-scale roads analysis (FSM 7712.13b) is completed and incorporated into a forest plan, inventoried roadless areas shall, as a general rule, be managed to preserve their roadless characteristics. However, where a line officer determines that an exception may be warranted, the decision to approve a road management activity or timber harvest in these areas is reserved to the Chief or the Regional Forester as provided in FSM 1925.04a and 1925.04b. On a project-specific basis, the Chief, for good cause, may grant exceptions to the reservations of authority set out in this interim directive, upon the written request of a Regional Forester or Forest Supervisor.”

The Regional Forester has been given the authority to review timber harvest projects in inventoried Roadless areas under specific circumstances outlined in the directive. One of those circumstances is where “the timber is generally small-diameter material and the removal of timber is needed to improve habitat for listed or proposed threatened and endangered species, or for sensitive species (FSM 2670).

The map on the next page (Figure 6) shows the arrangement of harvest units in the Proposed Action in relationship to the Middle Santiam Roadless Area. One of these young, previously-managed stands falls within the Middle Santiam Roadless area. This unit is proposed to be thinned using a helicopter so no roads or landings would be constructed in the Roadless area. The proposed harvest in the inventoried Roadless area has been sent to the Regional Forester for review.

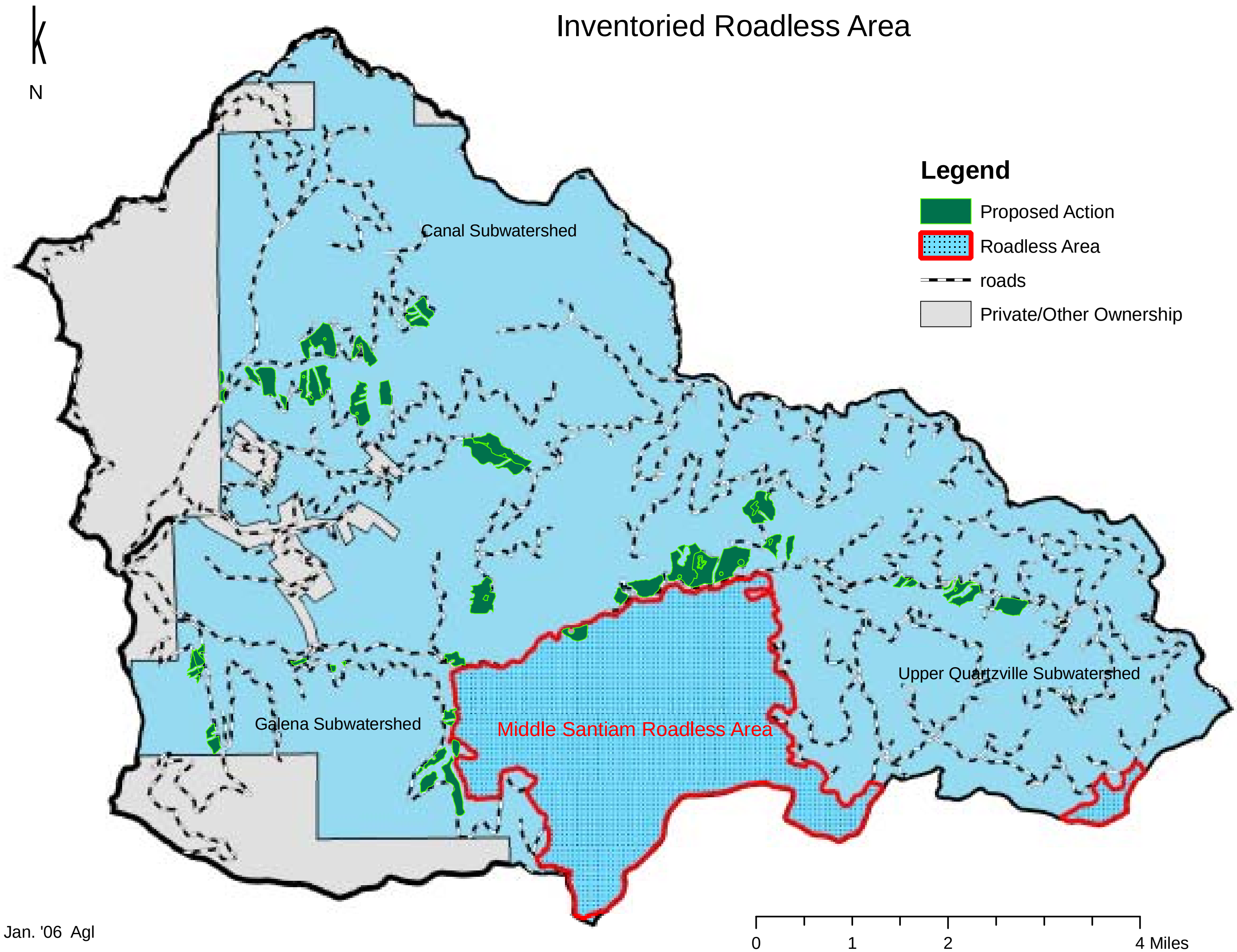


Figure 6: Middle Santiam Roadless Area

Purpose and Need for Action

The ***purpose of this proposal*** is to accelerate development of late-successional stand characteristics in young stands within the Quartzville Late Successional Reserve *(LSR #RO213)*. This would be done using a combination of silvicultural harvest prescriptions designed to hasten attainment of habitat conditions in overstocked, young, even-aged, managed stands within the LSR to improve habitat conditions and function for late-successional and old-growth related species. Additional reasons for the proposal are to encourage development of stand conditions within Riparian Reserves, in the LSR, that contribute to a healthy riparian ecosystem and improved habitat connectivity within the LSR.

There is not a complete understanding of what constitutes late-successional/old growth habitat but there is general agreement within the scientific community as to some basic desired stand characteristics including large live and dead trees, large downed logs, occasional gaps in the tree canopy, a variety of tree ages, sizes and species, "a deep, complex canopy, and patches of young trees, shrubs, and herbs on the forest floor" (*USDA. 2002, 2, USDA and USDA. 1998, 162; USDA and USDA. 1994, B-6;* and the *USDA and USDA, 2002, Ch. 7, pg. 6).*

Based on the current understanding of desired stand characteristics for late-successional habitat, and management direction and recommendation outlined above, ***project objectives*** for these young, structurally simplified stands include:

- Encouraging development of the following stand characteristics:
    1) an appropriate stand component of large diameter trees
    2) variations in stand densities that are occasionally interspersed with small openings
    3) multi-layered stands with well developed understories
    4) snags and down woody material of sufficient size and arrangement to meet habitat and ecological needs
    5) complex stand structure and diversity
    6) diverse, native species composition including hardwoods and other minor species
- Encouraging development of connectivity within the Quartzville LSR to aid in dispersal and genetic exchange that contributes to species viability (*USDA and USDI,1998b)*
- Reducing open road densities within the LSR to improve habitat function and usability while also providing adequate access for forest management and recreational activities (*USDA and USDA, 1998b)*

- Contributing to long-term forest health in the LSR including:
    1) Minimizing the spread of existing non-native plants/noxious weeds and avoiding introduction of any additional species or populations of non-native plants/noxious weeds into the LSR for the long-term.
    2) Increasing resistance of the LSR to disturbances such as fire, insects, diseases, etc.
- Meeting state water quality standards, especially stream temperatures, on Quartzville Creek (*a 303 (d) listed stream because summer stream temperatures exceed standards*) and its tributaries.

This action is needed because these second-growth stands offer little in the way of structural diversity desired in Late-Successional Reserves. These stands were established to produce high yields of timber for commodity production, not to provide late-successional forest habitat.

The stands being considered for treatment in this project are even-aged, 35 to 45 years old, managed stands with diameters of 10 to14 inches and heights of 60-78 feet. They have few biological legacies such as snags and downed wood. Currently they are densely stocked at 200 to 340 trees per acre and are beginning to see the effects of overcrowding such as reduced stand vigor and mortality. Prior to 1994, management objectives for stands in the analysis area were generally aimed at maximizing tree growth to provide a sustained yield of timber commodities over time, while also meeting various multiple use objectives. This management resulted in a landscape with a mosaic of timber stands in various seral stages.

In 1994, the *NW Forest Plan* designated a network of Late-Successional Reserves (*LSR)* designed to “meet legal requirements to maintain viable populations of native wildlife throughout the region” (*USDA 200,3)*. The designation of this LSR network changed the management direction for these stands when they were allocated to the *Quartzville Late Successional Reserve*. Now the objective for their management is to maintain large, contiguous blocks of complex, late-successional forest habitat for species dependent on this type of habitat.

When the LSR’s were designated, the drafters of the *NW Forest Plan* understood that they contained a variety of seral stages and allowed for silvicultural treatments in stands less than 80 years of age to accelerate the development of habitat conditions for species dependent on late-successional/old growth habitat (*USDA and USDI. 1994, C-12*). The plan states that “silvicultural systems proposed for Late-Successional Reserves (should) have two principal objectives: (1) development of old-growth forest characteristics 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 diseases that would destroy or limit the ability of the reserves to sustain viable forest species populations.” *(USDA and USDI. 1994, B-5)*. It further states that thinning prescriptions should encourage development of diverse stands with large trees and a variety of species in the overstory and understory (*and that*) prescriptions should vary within and among stands." *(USDA and USDI. 1994,B-6)*.

Studies have shown that uniform age and spacing of plantations makes them particularly subject to poor differentiation and even stagnation *(Oliver and Larson 1990*). Repeated, heavy thinning in these stands can allow them to develop structure similar to natural, old forests in a much shorter time period than would occur if high densities were maintained *(Barbour et al. 1997, Busing and Garman 2002, Carey et al. 1999, Garman et al. 2003, Latta and Montgomery 2004, McComb et al. 1993, Poage and Tappeiner 2002, Tappeiner et al. 1997).* It is estimated that attainment of desired stand characteristics would be perhaps decades faster with active treatment than with passive management. According to forest ecologist Jerry Franklin, the structure of young, managed stands differs appreciably from young, natural stands that developed following wildfire; so young managed stands are "likely to develop on different and, perhaps slower trajectories than those followed by existing late-successional forests..." *(Franklin,2001).* Also, there is some risk with passive management in these dense plantations since disturbance events that would likely occur here can either put these plantations on a "path that leads to complexity" or can begin to unravel the stands depending on a variety of factors (*USDA. ,2002, 5).*

Managing these young, dense stands through variable density thinning, introduction of small gaps in the stands, snag and coarse woody debris creation, etc. are useful tools in accelerating attainment of desired stand characteristics in the LSR (*USDA and USDI. 1994, B-1, B-6*).

As required in the *NW Forest Plan*, the 83,666 acre Quartzville LSR was analyzed in the 1998 *Mid-Willamette LSR Assessment* which in its recommendations suggested some urgency in promoting late-seral conditions within this LSR by "treating a range of seral stages in plantations in as short of time as possible" *(USDA and USDI. 1998b, 163).* This recommendation showed a need for treating managed stands, such as those proposed in this project.

A second management allocation within the analysis area, Riparian Reserves, were designated in the NW Forest Plan as part of the Aquatic Conservation Strategy (*ACS*) not only to protect water bodies and aquatic resources but also to improve travel and dispersal corridors for many terrestrial animals and plants, provide for greater connectivity within the watershed, and serve as connectivity corridors within and between Late-Successional Reserves. This connectivity aids in dispersal and genetic exchange which contributes to species viability. In order to achieve these objectives the ACS allowed for silvicultural practices in Riparian Reserves to control stocking, reestablish and manage stands and acquire desired vegetation characteristics needed to attain stand characteristics necessary for riparian-dependent species. In the young, dense, overstocked stands proposed for treatment, the goal is to accelerate growth and development of larger trees needed to attain these objectives, while also retaining adequate shade along stream channels to maintain desired stream temperatures on these 303 (d) listed streams

***Why is this action needed now*?**: This proposal should be undertaken now, rather than later in the life cycle of the stands because the young stands are more apt to respond to treatments and because the *Mid-Willamette Late Successional Reserve Assessment* suggested some urgency in promoting late-seral conditions within the LSR by their recommendation of "treating a range of seral stages in plantations in as short of time as possible" *(page 163)*. Also, these stands were planted at densities that assumed that thinning would take place during stand development to maintain healthy trees.

The northern spotted owl, listed as a threatened species, and many other plant and animal species are dependent on late-successional habitat for their survival. The supply of this type of habitat is limited and takes a long time to develop, so the sooner we develop these stand conditions within the LSR network the better for these species. Forest ecologist, Jerry Franklin, describes why young stand treatments in LSR's should be undertaken now, rather than later in the life cycle of the stands.

"So, if nature would eventually do most of the job anyway – why should we proceed with young stand treatments in LSRs? Because, by carrying out appropriate young-stand treatments we can contribute greatly to the restoration of old-growth structure. In my view, (we) should do so for the good of both the forest and society. We really do not want to wait several centuries for nature to do the job alone, assuming that she would. Good-quality old-growth forests are in short supply in our region—we need to expand the extent of structurally-complex forests as quickly as possible to achieve our goals, including reducing the risks to late-successional forest species. We need to reestablish the integrity and capability of the LSRs as quickly as possible." *(Franklin, 2001)*

Also, if this action is delayed for a long time the opportunity would be lost because the *NW Forest Plan* states that in LSR's "there is no harvest allowed in stands over 80 years old (*USDA and USDI. 1994,C-12*).

This action responds to the goals and objectives outlined in the *Willamette Forest Plan* (*1990*) as amended by the *NW Forest Plan (April 1994)*, and helps move the project area towards desired conditions described in that plan. The *NW Forest Plan* designated the Quartzville LSR land allocation and defined its purpose 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." The plan also identified thinning of young managed stands within LSR's as a useful tool for accelerating the development of late-successional habitat features *(USDA and USDI. 1994, B-6)*.

Late Successional Reserves, as designated, contain a mixture of seral stages so the *NW Forest Plan* acknowledged the potential need for active management in the LSR's to achieve desired objectives within the land allocation. The plan allowed for silvicultural treatments in stands less than 80 years old to accelerate the development of late-successional forest structural characteristics to improve habitat conditions for species dependent on these habitats.

Streams and their associated Riparian Reserves form an intricate network throughout the LSR. The dominant management focus for Riparian Reserves is to meet the Aquatic Conservation Strategy (ACS) objectives which are generally compatible with LSR objectives. Silvicultural treatments can be used in riparian areas to acquire desired vegetation characteristics there *(USDA and USDI. 1994, C-32)*.

In addition, the *Quartzville Watershed Analysis* recommends development and maintenance of late-seral forest stand characteristics using density management prescriptions. The analysis states that "density management and thinnings should emphasize enhancement and restoration opportunities that target stands in Riparian Reserves, LSR's… (and) in Critical Habitat that have been managed primarily for timber in the past." (*USDA and USDI. 2002, Ch.7 Pg. 6).*

Also, the *Mid-Willamette Late-Successional Reserve Assessment* has Objectives and Treatment Recommendations for different Landscape Blocks within the LSR *(VI 160-164).* The proposed thinning stands fall within a mix of three Landscape Blocks A, B1, and B2 *(see map of Landscape Blocks - Figure 7)*. The objectives and treatment recommendations within each block are as follows *(USDA and USDI. 1998b, 162):*

Landscape Block A represents the best late-successional habitat in these LSRs. Treatments, when needed, within block A should be scheduled in a group to minimize the number of entries and disturbance *(USDA and USDA. 1998b, Chap IV page 117).*

- Landscape Block A – Maximize the long-term functioning of the late-successional habitat, realizing some localized short-term impacts are acceptable on a small scale. Treat range of seral stages in plantations in as short a time as possible. Use minimum entries on those stands where site-specific factors show that they would benefit from treatment. Close any roads not needed for other concerns.

Landscape blocks B1 and B2 are the highest priority for treating densely stocked early and early-mid seral stands. These landscape blocks have the potential to develop a significantly greater number of stands with late-successional structure over the next 20 to 50 years (*USDA and USDA, 1998b Chap IV, pg 117*).

- Landscape Block B1 – Maintain existing connectivity and interior forest. Aggregate treatments to promote large patches of developing late-seral forest. A mix of treatment options should be used in the block. Multiple entries may be necessary to maintain canopy coverage in early to mid-seral stands. Buffer interior forest when doing commercial thinning treatments.
- Landscape Block B2 – The priority for this area is accelerating succession in early stands. Multiple entries may be necessary to treat early seral stands. Buffer interior forest when doing commercial thinning treatments.
- Landscape Block C2 is to protect existing interior habitat, promote large patches of developing late-successional forest and protect mid-seral stands that are currently functioning and transitioning.

The map below (*Figure 7*) shows the proposed harvest units in each landscape block described above.

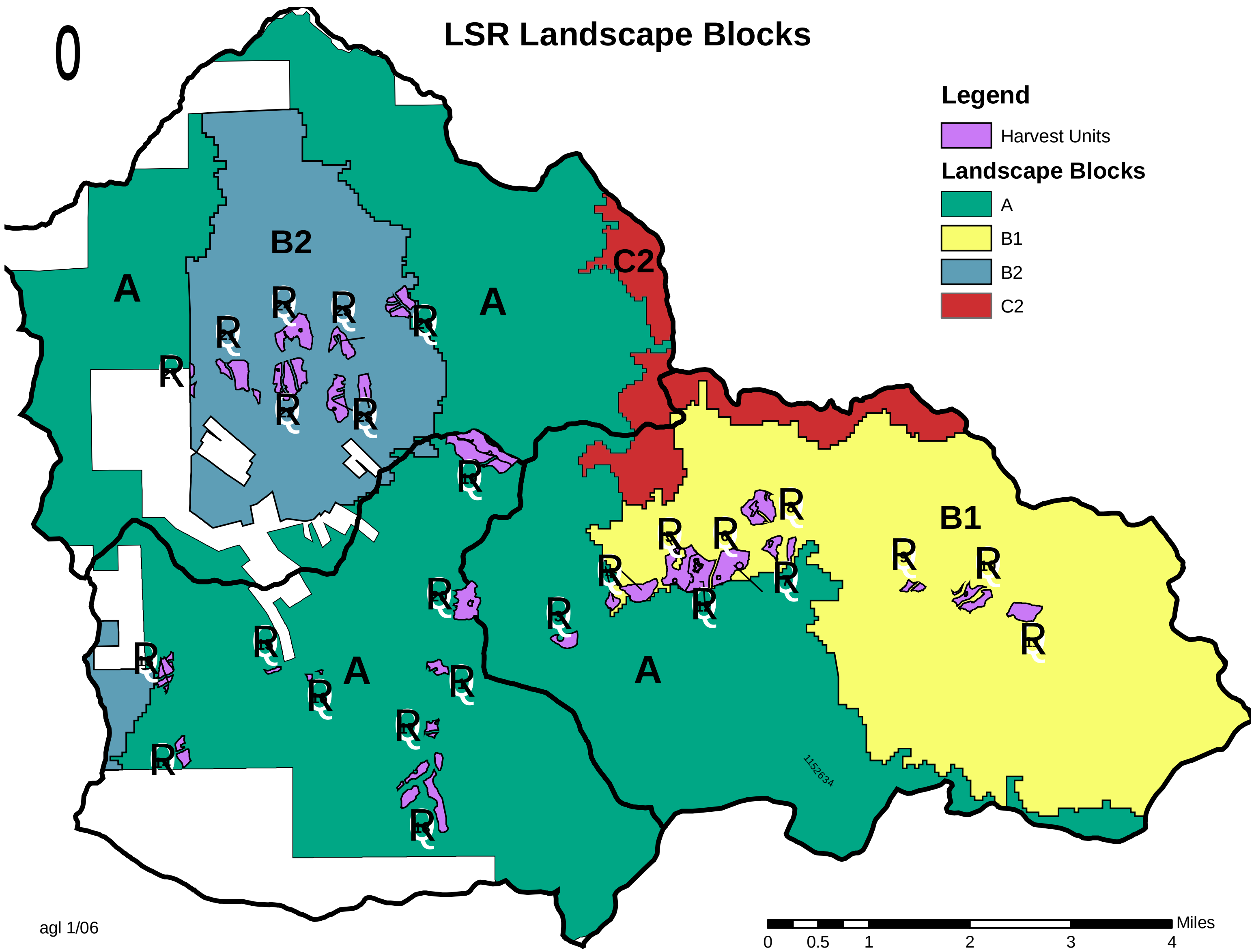


Figure 7: Landscape Blocks

Table 4: Harvest Unit Distribution within Landscape Block

Unit Number	Acres in Landscape Block A	Acres in Landscape Block B1	Acres in Landscape Block B2
1	12		
3	17		
4		40	
5		48	
6		49	
7		22	
8		43	
9		9	
10		31	
11		29	
12		38	
13	22		
14	15		
15	3		
16	3		
17	8		
18	65		
19	87		
20	43		
21			38
22			49
23			54
24			47
25			22
26			28
27			6

Finally, the Region 6 leadership team developed seven priorities to focus on key commitments for the next year and beyond. The seven priorities in order of importance are: restoring fire dependent ecosystems, NW Forest Plan, fire restoration, invasive species, aquatics, range and access. This project addresses the NW Forest Plan, invasive species, aquatics and access.

Proposed Action

Proposed Action: The Sweet Home District Ranger of the Willamette National Forest proposes to use a combination of silvicultural harvest prescriptions and other stand treatments to accelerate the development of late-successional stand conditions within young, overstocked, even-aged, managed stands in the Quartzville Late Successional Reserve (LSR) to improve habitat conditions, habitat function and connectivity for late-successional and old-growth related species there. The desired stand characteristics resulting from proposed stand treatments include: 1) development of large diameter trees, 2) creation of a mosaic of varying stand densities interspersed with occasional, small openings to improve stand structure and diversity, 3) establishment of multi-layered stands with well developed understories, 4) promotion of stand conditions which encourage diverse, native species composition including hardwoods and other minor species, and 5) creation of snags and down wood of sufficient size and arrangement to meet habitat and ecological needs , 6) promotion of complex stand structure and diversity and 7) increased resistance of the LSR to disturbances such as fire and disease.

To achieve the desired stand conditions, 828 acres of 35-45 year-old, managed stands within the *Quartzville LSR* would be commercially thinned to various stand densities. This type of thinning is being done to encourage development of large diameter trees and to introduce variations in stand density into these relatively evenly-spaced stands (*as per research by Beggs et al 2005, Poage and Tappeiner 2002, Zenner 2004*).

Ten percent of each stand would be retained intact as required in the July 9, 1996 Regional Ecosystem Office Letter *RE: Commercial Thinning Projects in LSR's.* Included in these retention areas are buffers for: sensitive species; interior forest; and streams.

Scattered among most of these thinned areas in the uplands, occasional, small openings would be created to simulate gaps that naturally occur in late-successional stands. These openings would occur in approximately 3 to 10% of the treated areas within proposed harvest units as required in the July 9, 1996 Regional Ecosystem Office Letter RE: *Commercial Thinning Projects in LSR's.* These openings would be created using a Dominant Tree Release (*DTR*) prescription where a large tree is left and the remaining trees within a 1/8 to ¼ acre circle surrounding that tree are removed, with the exception of any western white pine, western redcedar, hardwoods other than alder and trees less than six inches in diameter which would be left to contribute to species diversity. These interspersed openings and variations in stand densities would affect light conditions and other stand environmental conditions thereby encouraging diversity in plant species composition and development of multiple canopy layers which are desired in the LSR *(Barbour et al. 1997, Bradeis et al 2001, DeBel et al. 1997, Thysell and Carey 2000).* Snag and down wood habitat would be created in stands where it is lacking *(USDA and USDI. 1994, B-6, USDA. 1990, Chap IV, pg. 65-66, Barbour et al. 1997, Curtis et al. 1998, DeBell et al 1997, Franklin et al. 2002, Garman et al. 2003*). Finally slash would be treated in high-risk areas to minimize fire starts which could potentially jeopardize the functioning of the LSR (*USDA and USDI, 1998b, 145 and 152*).

Riparian Reserve Treatments: Since Riparian Reserves were established to: (1) assure protection of riparian and aquatic functions, (2) "improve travel and dispersal corridors for many terrestrial animals and plants, and (3) provide for greater connectivity of the watershed…." (*USDA and USDI. 1994, B-13*) and since Quartzville Creek is on the Oregon Department of Environmental Quality's *303(d) List of Water Quality Limited Water Bodies* for temperature, prescriptions in Riparian Reserves would have a different focus and function than those in the uplands.

Portions of Riparian Reserves within proposed harvest units which are contributing to primary stream shade or channel bank stability would not be treated in order to protect water quality, especially stream temperatures. These areas were determined from field review and completion of a "Sufficiency Analysis" which is the basis for analyzing stream shade, effects of shade on stream temperature and management of riparian areas to meet water quality and Aquatic Conservation Strategy (ACS) objectives as required in the 2005 *Northwest Forest Plan Temperature TMDL Implementation Strategies*. These unthinned areas would also serve to add variations in stand density within proposed harvest units. The portions of the Riparian Reserves within proposed harvest units which are not contributing to primary stream shade or channel bank stability would be thinned to encourage development of stand conditions that contribute to late-successional habitat, improved connectivity in the LSR, and a healthy riparian ecosystem. Gaps would not be introduced into thinned stands within the Riparian Reserves, if they are closer than one site tree (*172 feet*) from a stream.

How it would be accomplished: Careful consideration was given to appropriate logging systems to accomplish treatment objectives. Depending on topography, soil conditions, accessibility, suspension requirements to meet ecological needs, cost-benefit ratio, etc. a combination of helicopter, skyline, and ground-based yarding equipment would be used to harvest a total of 26 units on 828 acres and yielding about 8.28 MMBF of timber.

Connected Actions: In order to accomplish project objectives approximately 100 feet of new native-surface, temporary spur road would be constructed and approximately 1.4 miles of closed logging spurs, constructed during the first entry, would be re-opened to access harvest units. These roads are necessary to get logging equipment to the sites to implement the proposed silvicultural treatments. Following this harvest entry, these spur roads would be decommissioned (or stored for later use) by blocking them with berms and installing water bars to eliminate potential for storm damage and need for maintenance. All of these roads are in the LSR but are located in stands that do not currently meet late-successional stand characteristics. It was determined that the tradeoff of constructing and re-opening these spur roads, temporarily during harvest operations, was outweighed by the benefits of improving habitat quality in the LSR. These spur roads access approximately 309 acres of stands proposed for thinning.

In addition, three system roads, totaling 5.28 miles would require reconstruction because they have previously been closed and water barred. The road prism is in place, but in order to haul out these roads they would require the following reconstruction: reconditioning the roadbeds by smoothing out water bars, resurfacing the roads with rock, and reestablishing drainage ditches. The ditch-relief culverts will be removed and replaced by drain dips on road 1131-202. These roads would be closed and waterbarred following harvest activities.

Also, about 25 miles of road maintenance, consisting of spot rocking, brush cutback to provide a safe site distance, road blading, ditch cleanout, and ditch-relief culvert replacement would be required on existing access roads. Ditch-relief culverts that have exceeded their design life would be replaced on road 1131 between mile posts 3 and 6, road 1100 805 between mile posts 0.7 and 2, road 1142 between mile posts 0 and 6, and road 1145 between mile posts 1 and 1.5. These system roads allow access to 238 acres of stands proposed for thinning.

Mitigation measures would be implemented to minimize anticipated effects of the proposed action. These include restricting harvest operations during times of the year when it would be detrimental to species' reproductive success, buffering sensitive species and habitats from disturbance during harvest activities, buffering interior late-successional forest habitat especially in Landscapes Blocks B1 and B2 through unit design (*as recommended in the Mid-Willamette LSR Assessment*), road closures to ensure better habitat function and usability, dispersed campsite relocation to compensate for dispersed sites lost due to road closures, noxious weed control and monitoring to minimize introduction or spread of these plants into the LSR, trailhead rehabilitation following harvest activities in the vicinity, tree planting and release in riparian areas to improve stand structure and to diversify stand age and species composition, subsoiling portions of units where ground-based logging systems were used, and seeding disturbed areas with native seed to minimize erosion and potential seedbeds for establishment of noxious weeds.

Similar actions would be implemented as funding is available for post-harvest activities from this project. These actions include: existing harvest landing rehabilitation, restoration of old debris torrent tracks identified in some of the proposed harvest units, riparian area restoration near a mine site and a proposed harvest unit, rock pit restoration, introduction of structure into designated stream channels to reduce stream velocities during high water flow events, existing spur road closures, fertilization to increase plant growth, recreation sign replacement, making firewood available for public use in areas permitted within LSR's as described in the *NW Forest Plan*, planting minor species such as western redcedar and western white pine in openings created in Dominant Tree Release areas, underplanting minor species in some thinned areas, and pre-commercial thinning to enhance species diversity and increase growth rates of trees in young, managed stands near proposed harvest units *(see Appendix B for details on the above proposed activities*).

Proposed Implementation Date: This project, called *Quartzville LSR Thin* is proposed for implementation in Fiscal Year 2006.

Decision Framework

The Sweet Home District Ranger, who is the deciding official for this project, would review the information presented in this Environmental Assessment including its analysis of the environmental consequences of the various alternatives, proposed mitigation to minimize anticipated effects and other supporting documentation as a basis for making the following decisions regarding this project:

- Which alternative best meets the project purpose of accelerating development of late-successional stand characteristics in young stands within the Quartzville LSR to hasten the development of habitat conditions for late-successional and old-growth related species and to improve habitat connectivity and function.
- Whether the long-term benefits of accelerating development of large trees in portions of stands within riparian areas, that are not contributing to primary stream shade or channelbank stability, outweighs the potential short-term risks to stream temperatures by thinning in the secondary shade zone on Quartzville Creek *(a 303 (d) listed stream for summer temperatures)* and its tributaries
- Whether it is better to actively treat young stands to accelerate the development of late-successional stand characteristics or let those young stands develop desired characteristics on their own, over a much longer period of time.
- What monitoring would be required to evaluate whether stands developed the desired late—successional stand characteristics over the long term, whether species benefited by the habitat treatments, and whether stream temperatures in Quartzville Creek and its tributaries changed, either improved or declined, as a result of project activities.

Information regarding heritage resources would be included in the supporting documentation made available to the decision-maker although this information is exempt from public disclosure under the Freedom of Information Act (*FSM6271.2*).

The decision being made affects the amount of area potentially treated to achieve project objectives as well as the length of time it would take for young stands to develop desired stand characteristics within the Quartzville LSR. For some species dependent on this habitat for their survival, the timing issue is very important.

Public Involvement

Consultation: Government-to-government consultation regarding this project was conducted with the Confederated Tribes of Grand Ronde Community on March 10, 2005 and with the Confederated Tribes of Siletz Indians on March 16, 2005. No comments were received regarding this project at either one of these meetings. In addition, during the scoping of issues and concerns, as part of the public participation process, letters were mailed to tribal governments on February 9, 2004. No issues were raised regarding the proposed project as a result of that mailing.

Formal consultation with the U.S. Fish and Wildlife Service, on this project, was completed and a Biological Opinion received (*USDI March 2005 and February 2003*). Their determination was that this project may affect but is not likely to adversely affect spotted owls.

Consultation with US Fish and Wildlife Service for fisheries was not required since no bull trout habitat exists in the analysis area. In addition, consultation with NOAA Fisheries was not necessary due to a “no effect” determination for listed anadromous fish species.

Scoping: The proposal was listed in the Schedule of Proposed Actions (SOPA) starting in August 2003. The purpose of the SOPA is to provide an early and informal notice of proposed projects on the Forest. This is done so that the public is aware of upcoming activities, can indicate their interest in specific projects, and become involved early in the environmental analysis process. To spread the word about upcoming projects, the Willamette National Forest sends its quarterly mailer “Forest Focus” containing the SOPA to over 100 individuals, groups and/or industry representatives. The SOPA is also available on the Forest website.

Agencies and individuals who have expressed interest in this project, and similar projects on the Sweet Home District in the past, were provided opportunities to comment on the proposed Quartzville LSR Thin project during scoping, which began in February, 2004. To begin the scoping process a Project Initiation Letter dated February 9, 2004 was mailed to over 90 people, agencies and organizations including: Santiam Wilderness Committee, Oregon Natural Resources Council, Oregon Department of Fish and Wildlife and the City Manager of Sweet Home among others. This letter contained detailed information about the project proposal and preliminary issues.

In response to the scoping efforts, a comment letter was received from Oregon Natural Resources Council dated December 8, 2003. In their letter, they also referred to a previous comment letter dated 2/16/00. They were generally supportive of thinning in young stands provided that there is no road construction and no yarding corridors or other activities impacting water quality or aquatic habitat. They also were opposed to new or temporary roads in roadless areas, including uninventoried roadless areas.

All correspondence and full text of the letters are available in the analysis file for Quartzville LSR Thin at the Sweet Home Ranger District office.

Issues

To help focus planning efforts, the interdisciplinary team *(IDT)* used comments from the public and other agencies and information they gained from field reconnaissance to identify issues for this project.

The Forest Service separated the issues into two groups: significant and non-significant issues. Significant issues were defined as those directly or indirectly caused by implementing the proposed action. Non-significant issues were identified as those: 1) outside the scope of the proposed action; 2) already decided by law, 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. The Council on Environmental Quality (CEQ) NEPA regulations require this delineation in Sec. 1501.7, "…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)…" A list of non-significant issues and reasons regarding their categorization as non-significant may be found in the discussion that follows.

Significant issues

Riparian Reserve Management: Nearly 50 percent of the acreage in stands proposed for treatment falls within Riparian Reserves. Proposed treatments in Riparian Reserves, designed to meet project objectives of accelerating development of late-successional stand characteristics in the LSR and development of stand conditions within Riparian Reserve to meet Aquatic Conservation Strategy objectives, may be in conflict with the need to retain shade on Quartzville Creek and it's tributaries to maintain summer time stream temperatures at or below state water quality standards.

Currently Quartzville Creek is listed under section 303 (d) of the Clean Water Act, for the State of Oregon. The reason for this listing is because stream temperatures are outside of existing water quality requirements during part of the summer months. Since the mainstem was listed all streams tributary to the listed stream are also affected and that includes all streams in this analysis area.

Actively thinning in Riparian Reserves could result in short-term reductions in canopy closure. That could affect stream shade and potentially have minor affects on stream temperatures, in order to achieve long-term riparian benefits such as development of larger trees more quickly than under natural conditions to provide additional stream shade, large wood recruitment potential for both riparian areas and stream channels, increased stand structural diversity and improvement in the overall condition of the Riparian Reserves.

Indicators for measuring or interpreting conditions: Percent of canopy closure retained in primary shade zone and retention of at least 50% canopy closure in secondary shade zone within the Riparian Reserve management allocation

Non-significant issues*:* The following issues were identified as being non-significant for the purposes of this project. Generally, these issues are mitigated by standards and guidelines provided by the *Willamette National Forest Land and Resource Management Plan*, addressed through resource prescriptions, or decided upon by laws and regulations.

***Road Densities*:** The Quartzville LSR, which includes more than the three subwatersheds being considered in this analysis, has a high overall road density of 3.3 miles of road per square mile. This road density translates to a significant number of acres that were once forested but no longer support conifers or other trees. The total number of road miles in the Quartzville LSR is 431 *(USDA and USDI. 1998b, 62*). Assuming the average road is 20 feet wide, the total acreage of forestland lost to roads in this LSR is 1,045 acres or about 1.25% of the entire 83,666-acre LSR.

The road densities for the three subwatersheds considered for this project are: Canal Creek = 2.4 miles per square mile; Upper Quartzville Creek = 2.6 miles per square mile and Galena Creek = 1.9 miles per square mile.

Additionally roads increase disturbance to wildlife and contribute to increased peak flows as they often intercept groundwater flow and overland flow and concentrate this collected flow into small channels during periods of high rain. In addition roads serve as conduits for the spread of noxious weeds.

From comments received during public scoping for the *Quartzville Watershed Analysis*, many members of the public prefer that roads remain open for motorized recreation such as ORV riding and general access by motor vehicles. *(USDA and USDI. 2002, pg. C-1).* Contrary to this concern, but in order to minimize disturbance to species dependent on late-successional/ old growth habitat for which this land allocation was established, a recommendation in the *Quartzville Watershed Analysis (USDA and USDI. 200,* Ch. 7, p. 12) was to "Reduce disturbance effects to wildlife by reclaiming/ decommissioning unnecessary roads to reduce road densities in the watershed. Where roads cannot be decommissioned, close and storm proof unnecessary roads." Additionally, the *Mid Willamette LSR Assessment (page 63)* states: "Much restoration of late-successional forest conditions from past effects of roads may be needed in Quartzville and Fall Creek, due to their relatively large size and high overall road density." *The road density issue is treated similarly in both action alternatives.*

Roadless Areas: The Middle Santiam Roadless Area was originally studied in RARE I and II. Part of this area became the Middle Santiam Wilderness in the Oregon Wilderness Act of 1984 and another portion was released for multiple use management and has been developed. The remaining 6,783 acres are currently in the Middle Santiam Roadless Area (*see Figure 5, page 22)*.

One of the proposed harvest units, which was originally clearcut in 1960, is included in the boundary of the current Roadless Area. This unit is proposed for thinning with occasional ¼-acre gaps scattered among the thinning to accelerate development of habitat within the LSR. Through project design no roads or landings are proposed in the Roadless Area, as the unit is being yarded with a helicopter. The proposed treatments would maintain the roadless values here, would not have any long-term effects on visual quality and would not affect consideration of this inventoried

Roadless Area, in its entirety, from future wilderness consideration. This alternative was treated similarly in both action alternatives.

Special Habitats are non-forested areas including seeps, rock outcrops and gardens, caves, and meadows. These sites are important reservoirs of biodiversity, providing habitat for a variety of plants, fungi, and animals not often found in forested areas. In addition, many sensitive species are found in special habitats. Multiple special habitats were found in and adjacent to the proposed units. Many of these sites were impacted by the initial harvest of the stand. No buffers were left around the sites so they presumably experienced great change in solar radiation, humidity, and other microsite factors. *These special habitats would be evaluated and protected from disturbance, where necessary, in all alternatives for this project (Chapter 2 Mitigation Common to All Alternatives, Special Habitat section).*

***Wild and Scenic Rivers*:** Quartzville Creek has been recognized in the Forest Plan as a potential candidate for Wild and Scenic River (WSR) designation. It was determined eligible for a “Recreation” designation from its headwaters in T.11S., R. 5E., Section 35 down to the Forest boundary, which is a total of 12.3 miles. The Outstandingly Remarkable Values (ORV’s) that support WSR eligibility include its scenic and recreation qualities. Clear, rapidly-flowing water cascades over large boulders into deep pools. Quartzville Creek is stocked with rainbow trout and is thus a popular fishing destination. There are many well-used dispersed recreation sites along the creek. Dredging for gold on established mining claims is also a popular activity in the creek. Proposed thinning is allowed within the river corridor, but should not compromise the river’s “free-flowing” nature or degrade the Outstandingly Remarkable Values that helped determine its eligibility. *Proposed actions for this project treated this issue similarly. Proposed actions would not include new road construction within the river corridor that could degrade Outstandingly Remarkable Values. Skid trails within the river corridor would be ripped and seeded with native species where needed and closed to motorized use after the thinning is completed. Thinning prescriptions in all action alternatives are designed to maintain visual quality consistent with the Wild and Scenic River corridors.*

Alternatives, including the Proposed Action

This chapter describes and compares the alternatives considered for the Quartzville LSR Thin project. It includes a description and map of each alternative considered. This section also presents the alternatives in comparative form, sharply defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public. Some of the information used to compare the alternatives is based upon the design of the alternative (i.e., helicopter logging versus the use of skid trails) and some of the information is based upon the environmental, social and economic effects of implementing each alternative (i.e., the amount of erosion or cost of helicopter logging versus skidding).

Alternative 1 - No Action

Under the ***No Action*** alternative, current management plans would continue to guide management of the project area. These management plans include the 1994, *Record of Decision (ROD) for the "NW Forest Plan"* which amended the *Willamette National Forest Land and Resource Management Plan* to add, among other things, the **Quartzville Late-Successional Reserve** land allocation along with direction for management of the allocation. The main objective for management of the LSR is 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" *(USDA and USDI, 1994).*

Accomplishing the desired objectives for this land allocation under the *No Action* alternative means that desired late-successional stand characteristics would occur passively, without timber management intervention. It is expected that over time, many stands would advance through the natural growth cycle of early rapid growth, competition for growing space resulting in growth reductions and eventual mortality of some trees and then expression of further dominance by some trees and development of shade-tolerant canopy layer, and so on until eventually late-successional stand characteristics developed. On Federal land within the Sweet Home Ranger District, there are currently about 11,236 acres of stands less than 80 years old in the *Quartzville LSR* that don't meet late-successional stand characteristics. Alternative 2 would treat 828 acres and Alternative 3 would treat 557 acres of these stands.

The rate at which these stands develop desired stand characteristics is not only dependent on growth rates but also on the amount and frequency of disturbances such as fire. The LSR has a low to moderate frequency of stand replacing fires (80 to >200 years) and a moderate frequency (80-200 years) of partial burns. Overall, the current fire risk has been calculated at 49% of the area being low risk, 49% being moderate risk and 1% being high risk for fires. If a stand-replacing fire were to occur in the stands proposed for treatment, it would set back the development of late-successional stand characteristics even further on the time continuum.

The ***No Action*** alternative provides a basis for comparison to evaluate changes in the existing condition associated with the action alternatives. For the last decade, since the LSR was established, very few timber management activities have occurred here with the exception of a significant amount of salvage that occurred after a large windstorm in 1990. The salvage sales that were planned following the windstorm were still being implemented after the 1994 Late-Successional Reserve designation here. In addition, stand improvement activities such as variable-density pre-commercial thinning, etc. have been implemented here. Other significant events in the last decade include a large flood event in 1996 and logging and mining within the Lawler patented mining claim along the western boundary of the LSR. These events and the cumulative timber management activities that have occurred here for over 50 years, were taken into account in a 1998 assessment of the condition of this LSR and 10 others in the *Mid-Willamette Late-Successional Reserve Assessment.* With the exception of tree growth that has occurred since the assessment was written, it serves as a good baseline for habitat condition in the Quartzville LSR.

The following table displays the approximate seral stage distribution in this portion of the LSR by subwatershed.

Table 5: Distribution of Seral Stages by Subwatershed

Seral Stage	Canal Subwatershed		Upper Quartzville Subwatershed		Galena Subwatershed	
	Acres	Percent	Acres	Percent	Acres	Percent
Seral 1- Stand Initiation	1,571	15	2,228	14	856	10
Seral 2 -Stem Exclusion	2,359	23	2,890	18	792	10
Seral 3-Understory Reinitiation	2,154	21	1,830	12	1,403	17
Seral 4 -Late-Successional/Old-Growth	4,162	40	8,493	54	4,822	59
Non-Forested & Special Habitats	189	2	411	3	293	4
Total acres on Sweet Home RD	**10,435**	**100.0**	**15,852**	**100**	**8166**	**100.0**

In the time between the mid-1900's and 1998 however, the change in seral stage classes has changed dramatically. The *Mid-Willamette LSR Assessment* states that there has been a 32% decrease in late-successional forest in *Quartzville LSR* during this time period. This was mostly the result of timber harvest which is reflected in the percent of early-seral and early-mid seral stages today.

Currently, late-successional and interior forest patch numbers have increased while patch sizes have decreased. According to the LSR assessment, connectivity within the *Quartzville LSR* and between this LSR and adjacent LSR's is a concern because of the fragmentation as illustrated by change is patch numbers and sizes as discussed above. To illustrate this further, only 30% of the LSR is considered interior forest. Besides the need for large patch sizes of interior forest across the landscape to provide connectivity, part of the function of the Riparian Reserve allocations, that were also established under the *NW Forest Plan,* are to provide connectivity between adjacent LSR's and within the LSR's. Riparian Reserve connectivity in this LSR is variable.

Finally, the usability of LSR habitat can be negatively impacted by high road densities including such things as: limiting dispersal of some species, human disturbance, spread of non-native plants, erosion, etc. Nearly 80% of the entire Quartzville LSR had road densities greater than 2 mi/mi^2 *(USDA and USDI. 1998b,160)*. In the three subwatersheds being considered for this project, the road densities are: Canal Creek = 2.4 miles per square mile; Upper Quartzville Creek = 2.6 miles per square mile and Galena Creek = 1.9 miles per square mile. Road densities in excess of 2 miles per square mile are considered detrimental to habitat function and use.

Due to ownership patterns in the watershed, road densities in the *No Action* alternative would not change, except for roads that eventually grow closed due to a decline in funding sources for road maintenance.

To sum up the baseline description of this LSR, about 30% of late-successional habitat has been lost since the mid-1900's, fragmentation has occurred so connectivity within the LSR, and between adjacent LSR's, is a concern and finally, road densities are high enough to be affecting habitat usability in the LSR.

Alternative 2 - The Proposed Action

Alternative 2 would use a combination of silvicultural stand treatments to accelerate development of late-successional stand characteristics on 828 acres of 35-45 year-old, even-aged, overstocked, managed stands within the *Quartzville LSR* to improve habitat conditions, habitat function and connectivity for old-growth related species there.

The desired stand characteristics resulting from proposed stand treatments include: 1) development of large diameter trees, 2) creation of a mosaic of varying stand densities interspersed with occasional, small openings to improve stand structure and diversity, 3) establishment of multi-layered stands with well-developed understories, 4) promotion of stand conditions which encourage diverse, native species composition including hardwoods and other minor species, 5) creation of snags and down woody material of sufficient size and arrangement to meet habitat and ecological needs, 6) improved stand structure and diversity and 7) increased resistance of the LSR to disturbances such as fire and disease (*USDA and USDI. 1994, B-5).*

A variety of techniques would be implemented to attain late-successional stand characteristics including:

- **Variable density thinning –** This prescription is being utilized on 828 acres of overstocked, young, even-aged, managed stands to encourage development of large diameter trees and to introduce variations in stand density into these relatively evenly-spaced stands (*as per research by Beggs et al 2005, Poage and Tappeiner 2002, Zenner 2004*).

  Thinning prescriptions would be done to various canopy closures (40, 50, or 60 %) which equate to approximately 70, 90 and 110 trees per acre, respectively. A minimum of 40% canopy closure would be left in all thinning units to comply with requirements of the Critical Habitat Unit (*CHU*) for spotted owls which overlays most of the LSR in the analysis area.

  This treatment is designed to encourage development of improved habitat conditions in scattered, young, managed stands interspersed throughout the LSR. Variations in stand densities would be used to increase stand complexity and diversity. By varying light conditions to the forest floor, this treatment would encourage multiple canopy layers to develop and promote a diversity of native plant species, depending on their habitat requirements. Development of late-successional habitat conditions in these stands would contribute to better connectivity in the LSR and aid in dispersal and genetic exchange that leads to long-term species viability.
- **Dominant tree releases (DTR's) –** In this prescription a large tree is left and most of the remaining trees within a 1/8 to ¼ acre circle surrounding that tree are removed with the exception of the following species: western white pine, western redcedar, Pacific yew, all hardwoods except red alder, and any trees less than 6 inches in diameter. This provides occasional openings in the stands and variations in stand densities to mimic those in late-successional stands. These interspersed openings and variations in stand densities would affect light conditions and other stand environmental conditions thereby encouraging diversity in plant species composition and development of multiple canopy layers which are

desired in the LSR *(Barbour et al. 1997, Bradeis et al 2001, DeBel et al. 1997, Thysell and Carey 2000)*. Dominant Tree Releases are prescribed to varying densities in proposed treatment areas: 3%, 5%, and 10% of the area of the unit (a*s per July 9, 1996 Regional Ecosystem Office letter RE****: Commercial Thinning Projects in LSR's****)*. In units where 10% of the area is prescribed to be in a DTR there would be four ¼ acre openings per 10 acres of unit size. The remainder of the stand, outside the DTR's would be thinned to 40, 50 or 60% canopy closure as described above. No DTR's would occur closer than 172 feet from streams or in units thinned to 40% canopy closure. The openings in the eastern portion of Unit 13 would be created using 1/8 acre clearcuts interspersed throughout 10% of the area of this portion of the stand.

- **Retention areas would be left unharvested** in 10% of the original stand boundary that contains the proposed harvest units as required in the July 9, 1996 Regional Ecosystem Office Letter *RE: Commercial Thinning Projects in LSR's.* The retention areas may include, but are not limited to, buffers to protect sensitive plant species, interior late-successional forest habitat in Landscape Blocks B1 and B2, as well as stream retention buffers.
- **Species selection** in thinning prescriptions would be designed to promote diverse, native species composition including hardwoods and other minor species. In addition, cedar would be planted in 1/8-acre openings in Unit 13 to start a second age class and ensure species diversity. Natural seeding is expected in gaps and release of existing understory is expected in thinned areas.
- **Snags and Down Wood:** Five green trees, of average stand diameter, would be felled for down woody material during the current harvest operation. Five snags per acre would be created on harvest units after the timber sale to ensure an ample supply of snags. These would be in addition to existing coarse woody debris and snags.
- **Reduction of road densities** to improve late-successional forest habitat conditions for wildlife species and to minimize spread of non-native plants in the LSR. A total of about 14 miles of road would be closed. Roads 1131-120, 1131-202 and 1145-387 would be storm-proofed and closed with gates. Roads 1100-720, 1100-811, 1145, 1100-737 and 1100-743 would be closed by berms.
- **Commercial thinning** would occur **in Riparian Reserves**, outside of primary shade zones and in areas not contributing to channel bank stability, to encourage development of stand conditions that contribute to late-successional habitat and improved connectivity in the LSR and to accelerate development of shade in secondary shade zones in Riparian Reserve that would contribute to meeting water quality temperature standards.

- **Slash treatments:** All units in Alternative 2 would receive fuel treatments to reduce logging slash. These include such treatments as: yarding of trees with the top attached to the last log (YTA) (limbing would be done at the landing), burning of landing piles, and hand piling within 1 chain of roadsides. Handpiling would make roads more effective as fuel breaks for wildfire suppression. Alternative biomass utilization would occur if a market exists for wood fiber or firewood. Please refer to the Table 9: Alternative 2 Unit Prescriptions for individual unit treatment prescriptions.

  Prescribed fire would take place during the spring season, or when weather and fuels are in spring-like conditions. Spring conditions are: Fuels 3" and greater in diameter (*1,000 hour fuels*) would have fuels moistures of 25% or greater, soil moistures and duff moistures would be damp, at levels where duff consumption could be limited to less than 15% across the unit and mortality of overstory trees would be low.

- **Riparian Reserves:** A "*"Sufficiency Analysis for Stream Temperatures*" was conducted to evaluate the adequacy of Riparian Reserves, within proposed harvest units, to achieve and maintain, water quality standards for stream temperatures in Quartzville Creek and its tributaries. Areas within the Riparian Reserves that were directly contributing to primary stream shade and channel bank stability were eliminated from harvest units and left intact. The remaining portions of the Riparian Reserves, within proposed harvest units, were considered for thinning to accelerate the development of desired vegetation characteristics, such larger tree sizes to better meet *sufficiency analysis* objectives in the secondary shade zones in the Riparian Reserves, to enhance future large woody recruitment, and to contribute to habitat connectivity within the LSR. In this alternative, the areas to be thinned in the Riparian Reserves vary in width by harvest unit *(See Appendix A; Unit Prescriptions)* but in general the discussion below, and Table 6 which follows, outline the Prescriptions for fish-bearing streams, perennial non-fish-bearing streams and intermittent streams. Fish-bearing streams would have variable-width, no-harvest buffers at least 100 feet wide on either side of the stream and up to 344 feet wide either side of the stream, to protect the primary shade zones. These areas would be similar to the yellow area shown in the diagram above. Thinning along these streams would occur outside of the primary shade zones in the area that is at least 100 feet or more from the streams to the outer edge of the Riparian Reserves, which is 344 feet from the stream. This would be similar to the green area in the diagram above. This area includes the secondary shade zone and areas that do not provide stream shade. Streams that have 344 foot no-harvest buffers would not be thinned in the Riparian Reserves. Perennial non-fish-bearing streams would have variable-width, no-harvest buffers of at least 66 feet and up to 172 feet either side

Figure 8: Riparian Reserve

of the stream, to protect primary shade zones. Thinning along these streams would occur outside the primary shade zones in the area that is at least 66 feet or more from the streams to the outer edge of the Riparian Reserve which is 172 feet from the stream. This area includes the secondary shade zone. Streams that have 172 foot no-harvest buffers would not be thinned in the Riparian Reserves. Intermittent streams would have variable width buffers of at least 25 feet on either side of the stream and would include trees contributing to channel banks stability. Thinning along these streams would occur from the outer edge of the buffer (*at least 25 feet from the stream*) to the outer edge of the Riparian Reserve which is 172 feet from the stream.

Table 6: Riparian Reserve Prescriptions for Alternative 2

Stream Classification	NW Forest Plan Riparian Reserve Management Allocation Width	No-Harvest Buffers (in areas contributing to primary stream shade and channel bank stability)	Areas in Riparian Reserves, outside of stream buffers where Thinning is Proposed
Fish-bearing streams (Quartzville, McQuade, Galena, Minniece, Bruler, Butter, Gold and Little Meadows Creeks)	344 ft. either side of the stream channel	100 foot no-harvest buffer on either side of the stream channel would be the minimum buffer width and 344 feet no-harvest buffer on either side of the stream channel would be the maximum buffer width	Thinning would occur in the area between 100 and 344 feet from the stream channel, depending on the width of the no-harvest buffer. Channels with 344 feet no-harvest buffers would not be thinned.
Fish-bearing streams – (exception to above rule) The portion of **Canal Creek** within Unit 27	344 ft. either side of the stream channel	132 feet no-harvest buffer on the south side of the creek and 100 foot no-harvest buffer on north side of creek	On the south side of the creek, thinning would occur between 132 feet and 344 feet from the stream. On the north side of the creek, thinning would occur between 100 feet and 344 feet from the stream.
Perennial non-fish-bearing streams	172 ft. either side of the stream channel	Variable-width, no-harvest buffers ranging from a minimum of 66 feet to 172 feet on either side of the streams.	Thinning would occur from 66 feet to 172 feet from the stream depending on the width of the no-harvest buffer. Channels with 172 foot no-harvest buffers would not be thinned.
Intermittent streams	172 ft. either side of the stream channel	No-harvest buffers would be variable widths, with the minimum width being 25 feet either side of the stream and would include trees contributing to channel bank stability.	Thinning would occur from the outer edge of the variable-width, no-harvest buffer which is as least 25 feet from the stream to the outer edge of the riparian reserve which is 172 feet from the stream.

Note: all stream buffers are measured from the trees nearest the stream, not the water's edge, and occur on either side of the stream.

Connected actions

Roading: In order to implement the project approximately 100 feet of new native-surface, operator spur road would be constructed and approximately 1.4 miles of closed logging spurs, constructed during the first entry, would be re-opened. No roads would be re-opened within 172 feet of a perennial stream. These roads are necessary to get logging equipment to the sites to implement the proposed silvicultural treatments.

Three of these spurs occur within Riparian Reserves, but they lie outside of the no-harvest stream buffer areas. Following harvest activities, these spur roads would be closed with berms and water barred. They are in the LSR but are located in 35-45 year-old stands that do not currently meet late-successional stand characteristics. It was determined that the tradeoff of constructing and re-opening these spur roads was outweighed by the benefits of improving habitat quality in the LSR.

Table 7: Proposed Spur Road Construction and Reopening

Unit Number	Unit Acres	Feet of Temporary Spur Rd. Needed for this Entry	New Construction or Existing Temporary Spur Road
5	48	1200	100 = New 1100 = Existing
6	49	800	Existing
8	43	1900	Existing
19	87	1300	Existing
23	54	700	Existing
26	28	1800	Existing
Total new road construction		**100 ft = .02 mi**	**Accesses 48 acres**
Total reopen existing roads		**7600 ft = 1.4 mi**	**Accesses 309 acres**

Roads 1131-120 (*which accesses 69 acres in units 24 and 25*) and 1131-202 (*which accesses 141 acres in units 21, 22 and 23*) have been closed and water barred to protect them during storms. Road 1131-210 (*which access 28 acres in unit 26*) was closed by a large berm and stormproofed. The road prism is in place for all of these roads, but in order to haul on them they would need to be reconstructed. This involves reconditioning the roadbed by smoothing out water bars, resurfacing the roads with rock, and reestablishing drainage ditches on 5.28 miles of road. The ditch-relief culverts will be removed and replaced by drain dips on road 1131-202. These roads would be closed and water barred again following harvest activities

Also, about 25 miles of road maintenance, consisting of spot rocking, brush cutback to provide a safe site distance, road blading, ditch cleanout, and ditch-relief culvert replacement would be required on existing access roads. Ditch-relief culverts that have exceeded their design life would be replaced on road 1131 between mile posts 3 and 6, road 1100 805 between mile posts 0.7 and 2, road 1142 between mile posts 0 and 6, and road 1145 between mile posts 1 and 1.5. Ditch relief culverts do not intersect perennial streams.

Yarding: Careful consideration was given to appropriate **logging systems** to accomplish treatment objectives. Depending on topography, soil conditions, accessibility, suspension requirements to meet ecological needs, cost-benefit ratio, etc. a combination of helicopter *(133 acres)*, skyline *(584 acres)*, and ground-based equipment *(111 acr*es) was selected to harvest a total of 26 units, yielding about 8.28 MMBF of timber *(Refer to Table 9 and Appendix A for individual unit maps and prescriptions).*

There are five helicopter, six skyline, and six ground-based **landings** within Riparian Reserves that are outside of the no-harvest stream buffers. All of the helicopter landings are in existing openings, but one would need to be expanded for this alternative. In addition, there are two ground-based yarding system **stream crossings** on intermittent streams. Locations of these stream crossings would be designated, as per Best Management Practices and would be placed perpendicular to the stream channels.

In addition, there are two units in which skyline **yarding** would occur across streams. Logs would be fully suspended across stream channels and through Riparian Reserves. In addition, trees felled for yarding corridors within Riparian Reserves would be left in place to contribute to down woody material. These trees would be felled into stream channels whenever possible *(Refer to Appendix A Unit Prescriptions for specific locations).*

Similar actions

Similar actions would be implemented as funding is available for post-harvest activities from this project. These actions include: existing harvest landing rehabilitation, existing spur road closures, recreation sign replacement, making firewood available for public use in areas permitted within LSR's as described in the *NW Forest Plan*, planting minor species such as western redcedar and western white pine in openings created in Dominant Tree Release areas, and underplanting minor species in some thinned areas. The above actions will be evaluated in this analysis. Additional actions that will not be included in this analysis are: restoration of old debris torrent tracks identified in some of the proposed harvest units, riparian area restoration near a mine site and a proposed harvest unit, rock pit restoration, introduction of structure into designated stream channels to reduce stream velocities during high water flow events, fertilization to increase plant growth, and pre-commercial thinning to enhance species diversity and increase growth rates of trees in young, managed stands near proposed harvest units *(see Appendix B for details on the above proposed activities*).

Mitigation measures

Mitigation measures would be implemented to minimize anticipated effects of the proposed action. These include restricting harvest operations during times of the year when it would be detrimental to species' reproductive success, buffering sensitive species and habitats from disturbance during harvest activities, buffering interior late-successional forest habitat especially in Landscape Blocks B1 and B2, road closures to ensure better habitat function and usability, dispersed campsite relocation to compensate for dispersed sites lost due to road closures, noxious weed control and monitoring to minimize introduction or spread of these plants into the LSR, trailhead rehabilitation following harvest activities in the vicinity, tree planting and release in riparian areas to improve stand structure and to diversify stand age and species composition, subsoiling portions of units where ground-based logging systems were used, and seeding disturbed areas with native seed to minimize erosion and potential seedbeds for establishment of noxious weeds.

For the majority of mitigation measures see the section entitled Mitigation Common to All Alternatives, after the description of Alternative 3. In addition, see individual unit prescriptions in Appendix A

Mitigation specific to this alternative is as follows:

- *Leptogium rivale* is an aquatic lichen and a Survey and Manage Species which occurs along some streams in the project area. This lichen would have a 100-foot protection buffer on either side of the stream in stream reaches where it is found.

Funding would be collected from this timber sale to implement mitigation measures outlined in the upper portion of the table below. If additional funding is available, non-mitigation, post-sale activities listed on the bottom portion of the table below would be implemented as money allows. These non-mitigation, post-sale activities are listed in priority order for available funding. Both mitigation and non-mitigation activities are described in more detail in Appendix B.

Table 8: Mitigation and Post-Sale Activities for Alternative 2

Type of Project	Type of Action	Included in this Analysis
Mitigation Measures Funded by this Project		
1) Noxious Weed Monitoring and Control	Connected	Yes
2) Native Grass Seeding and Sub-soiling of Skid Roads	Connected	Yes
3) Planting and Release in Riparian Areas	Connected	Yes
4) Road Closures of roads re-opened for this sale	Connected	Yes
Dispersed Campsite Relocation and Reclamation	Connected	Yes
6) Trailhead Reconstruction	Connected	Yes
7) Snag Creation	Connected	Yes
Non-Mitigation, Post-Sale Activities to be Funded in Priority Order as Funding is Available From this Project		
8) Rehabilitate Existing Landings	Similar	Yes
9) Underplanting and DTR Planting	Similar	Yes
10) Debris Chute Restoration	Similar	Yes
11) McQuade Creek Restoration	Similar	Yes
12) Firewood	Similar	Yes
13) Pre-commercial Thinning of Other Managed Stands	Similar	Yes
14) Sensitive Species Monitoring	Similar	Yes
15) Fertilization of Commercially Thinned Managed Stands	Similar	Yes
16) Recreation Sign Replacement	Similar	Yes
17) Existing Spur Road obliteration	Similar	Yes
18) Rock Pit Restoration	Similar	Yes
19) Fertilization of Other Managed Stands	Similar	Yes

Table 9: Alternative 2 Summary

Unit #	Refor. #	Total Acres	Trees Per Acre	Canopy Cover in Thinned Areas	Dominant Tree Release (DTR)	Skyline Acres	Helicopter Acres	Ground-based Acres	Fuel Treatment HP = hand pile 1 chain along roads YTA = yard tops attached
1	Q1	12	110	60%	10% above rd. 720	5	7	0	HP 7ac along 1100 rd
3	Q4	17	90	50%	3%	0	17	0	HP 2ac along 1100 rd
4	Q5	40	110	60%	10%	10	30	0	Pullback 7 acres of slash along 11 rd, end haul to west side of unit & dump for soil stabilization
5	Q6	48	90	50%	3%	15	10	23	YTA 25ac., HP 8ac along 11 and 1155 rds
6	Q7	49	90	50%	10%	18	0	31	HP 8ac 11 and 1155 rds
7	Q8	22	110	60%	3%	22	0	0	YTA 200ft below landings and HP 4ac along 11 and 1155 rds
8	Q11	43	70	40%	No DTR	33	0	10	HP 6ac 1155 rd
9	Q12, Q12A	9	110	60%	3%	9	0	falling only	HP 2ac along1100 rd
10	Q13	31	110	60%	5%	31	0	falling only	HP 5ac along1100 rd
11	Q14, Q14A, Q14B	29	90	50%	10%	29	0	falling only	HP 2ac along 1100 rd.
12	Q41	38	110	60%	3%	0	0	38	HP 6ac along 1155 rd & around perimeter of dispersed site in NW corner
13	Q50, Q50A	22	90 ????	50% west 90% east	10% west, 1/8 ac. openings east	12	10	0	HP 4ac along spurs 805 & 808

Unit #	Refor. #	Total Acres	Trees Per Acre	Canopy Cover in Thinned Areas	Dominant Tree Release (DTR)	Skyline Acres	Helicopter Acres	Ground-based Acres	Fuel Treatment HP = hand pile 1 chain along roads YTA = yard tops attached
14	Q51	15	90	50%	3%	4	11	0	HP 3ac along spur rd 805 & around dispersed site
15	Q70	3	70	40%	No DTR	3	0	0	YTA 3ac
16	Q71	3	70	40%	No DTR	3	0	0	Burn landings only
17	Q72	8	110	60%	5 %	8	0	0	HP 1ac along 1142 rd
18	Q73	65	90	50%	10%	53	12	0	YTA 65ac, HP 8ac along 1142 rd
19	Q102	87	70 110	40% north of 1133 60% south of 1133	No DTR north 3% south	87	0	0	YTA 87ac, HP 11ac along 1133 rd
20	Q115	43	90	50%	3%	33	4	6	No treatment
21	Q201, Q201A	38	110 90	60% north 202 50% in helicopter	3%	28	10	0	Burn landings only
22	Q202	49	110	60%	10%	41	8	0	Burn landings only
23	Q203	54	70 110	40% east of stream 60% west of stream	No DTR east 10% DTR west	54	0	0	Burn landings only
24	Q206	47	90	50%	3%	39	8	0	HP 4ac along 1131 rd
25	Q207	22	90	50%	3%	16	6	0	HP 2ac along 1131 rd
26	Q209	28	90	50%	10%	28	0	0	HP 2ac along 1131 rd
27	Q240	6	110	60%	3%	3	0	3	YTA 3ac
Totals		**828**				**584**	**133**	**111**	

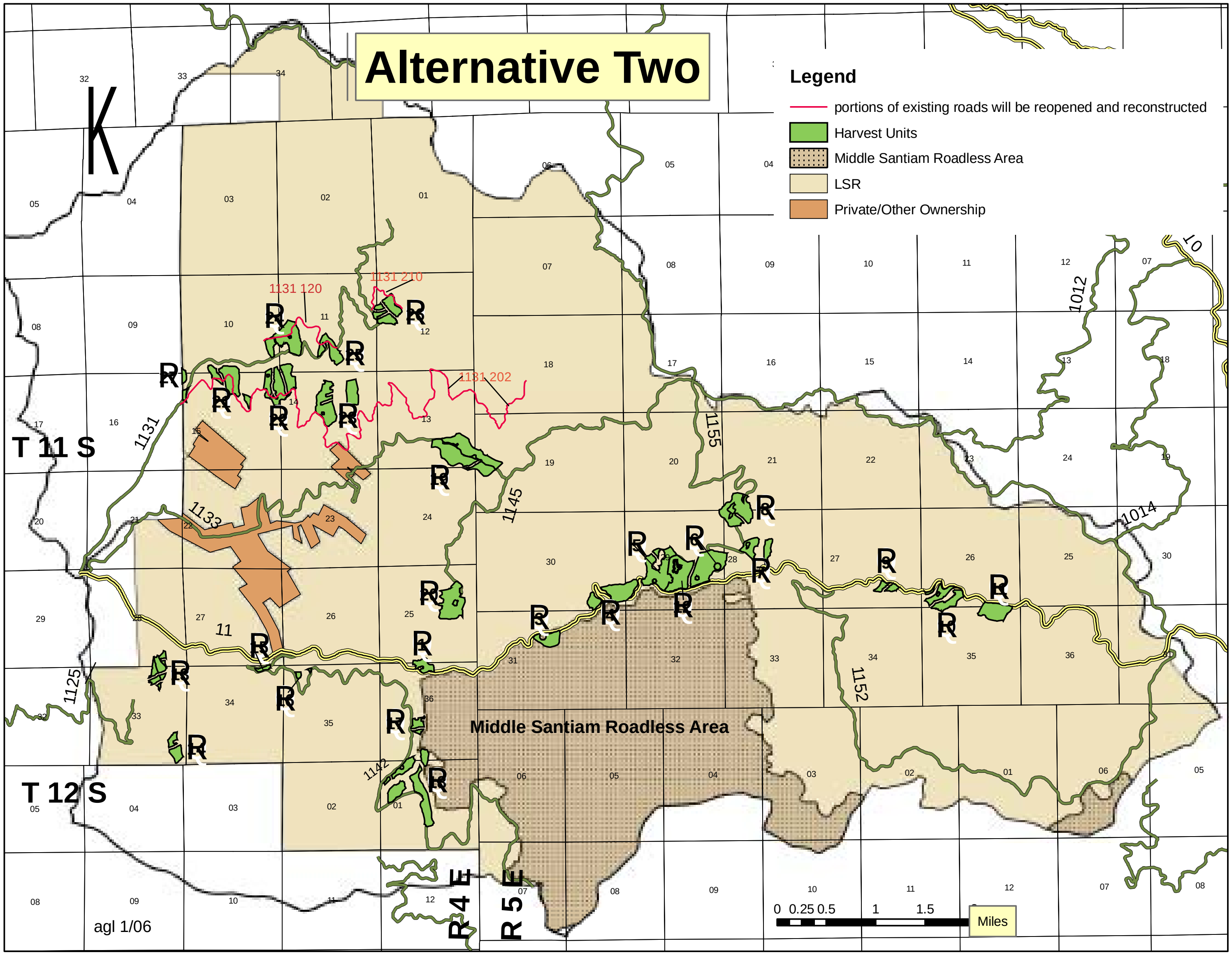


Figure 9: Alternative 2 Map

Alternative 3

Alternative 3, like Alternative 2, would use a combination of silvicultural stand treatments to accelerate development of late-successional stand characteristics on approximately 557 acres of 35-45 year old, even-aged, overstocked, managed stands within the Quartzville LSR in order to hasten attainment of habitat conditions for late-successional and old-growth related species and to improve habitat connectivity and function. Identical managed stands are being proposed for treatment in this alternative and the Proposed Action. Also, the desired outcome from silvicultural treatments is the same.

Similarly to Alternative 2, a variety of techniques would be utilized to attain late-successional stand characteristics including: (1) variable density thinning; (2) dominant tree release (DTR's); (3) retention areas left unharvested in 10% of the original stand boundary which contains the proposed harvest units; (4) species selection in thinning prescriptions to promote diverse native species composition including hardwoods and other minor species; (5) snag creation to ensure an ample supply of snags and down woody material; (6) reduction in road densities to improve habitat and minimize the spread of non-native plants into the LSR (*note the same 14+ miles of roads would be closed as in Alternative 2*); and (7) slash treatments.

The major difference between the two action alternatives is the proposed treatments in the portions of the stands that are in Riparian Reserve management allocations. In this alternative fewer acres are being treated in Riparian Reserves than in Alternative 2. In addition, no temporary spur roads would be reopened within the 172 foot, no-harvest buffers on perennial streams. This results in some variations in yarding methods between this alternative and the Proposed Action because of availability of road access and unit configurations resulting from elimination of harvest in Riparian Reserves.

Riparian Reserves: Similarly to Alternative 2, A "*"Sufficiency Analysis for Stream Temperatures*" was conducted to evaluate the adequacy of Riparian Reserves, within proposed harvest units, to achieve and maintain, water quality standards for stream temperatures in Quartzville Creek and its tributaries. Areas within the Riparian Reserves that were directly contributing to primary stream shade and channel bank stability were eliminated from harvest units and left intact. The discussion below, and Table 10 which follows, outline the prescriptions for fish-bearing streams, perennial non-fish-bearing streams and intermittent streams.

Riparian Prescriptions: No DTR's would occur in the Riparian Reserve management allocation. Instead of the variable-width, no-harvest buffers used in Alternative 2, this alternative would utilize 'one-standard-tree-height'(*172 foot*) width, no-harvest buffers on all perennial streams to provide the shading necessary maintain water temperatures and to create filter zones necessary to reduce sediment delivery to stream. Variable-width, no-harvest buffers of at least 25 feet would be used on intermittent streams. These buffers would include trees contributing to stream bank stability.

Outside of no-harvest buffers, thinning would be done to enhance stand growth and diversity. This Riparian Reserve thinning, in proposed harvest units would occur in the following locations:

- In the portion of the Riparian Reserves along intermittent streams (*which do not flow water*

Table 10: Riparian Reserve Treatments for Alternative 3

Stream Classification	NW Forest Plan Riparian Reserve Management Allocation Width	No-Harvest Buffers (in areas contributing to primary stream shade and	Areas in Riparian Reserves, outside of stream buffers where Thinning is Proposed

most of the year but do show channel scour) which is outside of the no-harvest buffer area to the outer edge of the Riparian Reserve (*172 feet from the stream*) .
- In the portion of the Riparian Reserves along perennial, fish-bearing streams which is outside of the 172-foot no-harvest buffer to the outer edge of the Riparian Reserve (*344 feet from the stream*). The exceptions are that no harvest would occur within 344 feet of McQuade Creek and the thinning area on Canal Creek would be outside of the 132-foot no-harvest buffer to the outer edge of the Riparian Reserve (*344 feet from the stream*).
- No thinning would occur in the Riparian Reserves on non-fish- bearing, perennial streams.

Figure 10: Riparian Reserve

Note: all stream buffers are measured from the trees nearest the stream, not the water's edge, and occur on either side of the stream *(See Appendix A; Unit Prescriptions for individual unit prescriptions)*

		channel bank stability)	
Fish-bearing streams (*except McQuade and Canal Creeks*) (includes Quartzville, Galena, Minniece, Bruler, Butter, Gold and Little Meadows Creeks)	344 ft. either side of the stream channel	172 feet no-harvest buffer either side of stream channel	Thinning would occur outside of the no-harvest buffer in the area between 172 feet and 344 feet from the stream channel
Fish-bearing streams McQuade Creek Unit 18	344 ft. either side of the stream channel	344 ft. no-harvest buffer either side of the stream channel	No thinning would occur in this Riparian Reserve in Unit 27.
Fish-bearing streams The portion of **Canal Creek** within Unit 27	344 ft. either side of the stream channel	132 feet no-harvest buffer on either side of stream channel	Thinning would occur outside the no-harvest buffer between 132 feet and 344 feet from the stream channel
Perennial non-fish-bearing streams	172 ft. either side of the stream channel	172 feet either side of stream channel	No treatment in Riparian Reserves on perennial non-fish bearing streams
Intermittent streams	172 ft. either side of the stream channel	Variable-width, no-harvest buffers to include trees contributing to channel bank stability	Thinning would occur outside of no-harvest buffers from the outer edge of the buffer to 172 feet from the stream channel

Connected actions

Roading: In order to implement the proposed silvicultural treatments it would be necessary to do to get logging equipment to the harvest unit landings. To do this, approximately 0.64 miles of closed logging spurs, constructed during the first harvest entry, would be re-opened. This is less than Alternative 2 because no spur roads would be re-opened within Riparian Reserves.

Table 11: Proposed Spur Road Construction and Reopening

Unit Number	Unit Acres	Feet of Spur Rd. Needed for this Entry	New Construction or Re-open Existing Spur Road
8	43	1400	Existing
19	78	1300	Existing
23	54	700	Existing
Total		**3400 ft = 0.64 mi**	**Existing**

Following harvest activities, spur roads that were reopened for harvest activities, would be decommissioned by blocking them with a berm and installing water bars. These spur roads are in the LSR but are located in 35-45 year-old stands that do not currently meet late-successional stand characteristics. It was determined that the tradeoff of constructing and re-opening these spur roads was outweighed by the benefits of improving habitat quality in the LSR.

Roads 1131-120 (*which accesses 49 acres in units 24 and 25*) and 1131-202 (*which accesses 85 acres in units 21, 22 and 23*) have been closed and water barred to protect them during storms. The road prism is in place for all of these roads, but in order to haul on them they would need to be reconstructed. This involves reconditioning the roadbed by smoothing out water bars, resurfacing the roads with rock, and reestablishing drainage ditches on 4.59 miles of road. The ditch-relief culverts will be removed and replaced by drain dips on road 1131-202. These roads would be closed and water barred following harvest activities.

Also, about 25 miles of road maintenance, consisting of spot rocking, brush cutback to provide a safe site distance, road blading, ditch cleanout, and ditch-relief culvert replacement would be required on existing access roads. Ditch-relief culverts that have exceeded their design life would be replaced on road 1131 between mile posts 3 and 6, road 1100 805 between mile posts 0.7 and 2, road 1142 between mile posts 0 and 6, and road 1145 between mile posts 1 and 1.5. Ditch-relief culverts do not intersect perennial streams.

Yarding: Careful consideration was given to appropriate **logging systems** to accomplish treatment objectives. Depending on topography, soil conditions, accessibility, suspension requirements to meet ecological needs, cost-benefit ratio, etc. a combination of helicopter *(119 acres)*, skyline *(371 acres)*, and ground-based equipment *(67 acr*es) was selected to harvest a total of 26 units, yielding about 5.57 MMBF of timber *(Refer to Table 13 and Appendix A for individual unit maps and prescriptions).*

There are five helicopter, three skyline, and two ground-based **landings** within Riparian Reserves that are outside of the no-harvest stream buffers. All of the helicopter landings are in existing openings, but one which would need to be expanded for this alternative. In addition, there is one ground-based yarding system **stream crossing**. Locations of these stream crossings would be designated, as per Best Management Practices and would be placed perpendicular to the stream channels.

In addition, there are two units in which skyline **yarding** would occur across streams. Logs would be fully suspended across stream channels and through Riparian Reserves. In addition, trees felled for yarding corridors within Riparian Reserves would be left in place to contribute to down woody material. Whenever possible, these trees would be felled into the stream channel to provide woody structure for the channel *(Refer to Appendix A, Unit Prescriptions for specific locations).*

Similar actions

Similar actions would be implemented as funding is available for post-harvest activities from this project. These actions include: existing harvest landing rehabilitation, existing spur road closures, recreation sign replacement, making firewood available for public use in areas permitted within LSR's as described in the *NW Forest Plan,* planting minor species such as western redcedar and western white pine in openings created in Dominant Tree Release areas, and underplanting minor species in some thinned areas. The above actions will be evaluated in this analysis. Additional actions that will not be included in this analysis are: restoration of old debris torrent tracks identified in some of the proposed harvest units, riparian area restoration near a mine site and a proposed harvest unit, rock pit restoration, introduction of structure into designated stream channels to reduce stream velocities during high water flow events, fertilization to increase plant growth, and pre-commercial thinning to enhance species diversity and increase growth rates of trees in young, managed stands near proposed harvest units *(see Appendix B for details on the above proposed activities*).

Mitigation measures

Mitigation measures would be implemented to minimize anticipated effects of the proposed action. These include restricting harvest operations during times of the year when it would be detrimental to species' reproductive success, buffering sensitive species and habitats from disturbance during harvest activities, buffering interior late-successional forest habitat especially in Landscape Blocks B1 and B2, road closures to ensure better habitat function and usability, dispersed campsite relocation to compensate for dispersed sites lost due to road closures, noxious weed control and monitoring to minimize introduction or spread of these plants into the LSR, trailhead rehabilitation following harvest activities in the vicinity, tree planting and release in riparian areas to improve stand structure and to diversify stand age and species composition, subsoiling portions of units where ground-based logging systems were used, and seeding disturbed areas with native seed to minimize erosion and potential seedbeds for establishment of noxious weeds.

For the majority of mitigation measures see the section entitled Mitigation Common to All Alternatives, after the description of Alternative 3. In addition, see individual unit prescriptions in Appendix A.

Funding would be collected from this timber sale to implement mitigation measures outlined in the upper portion of the table below. If additional funding is available, non-mitigation, post-sale activities listed on the bottom portion of the table below would be implemented as money allows. These non-mitigation, post-sale activities are listed in priority order for available funding. Both mitigation and non-mitigation activities are described in more detail in Appendix B.

Table 12: Mitigation and Post-Sale Activities for Alternative 3

Type of Project	Type of Action	Included in this Analysis
Mitigation Measures Funded by this Project		
1) Noxious Weed Monitoring and Control	Connected	Yes
2) Native Grass Seeding and Sub-soiling of Skid Roads	Connected	Yes
3) Planting and Release in Riparian Areas	Connected	Yes
4) Road Closures of roads re-opened for this sale	Connected	Yes
Dispersed Campsite Relocation and Reclamation	Connected	Yes
6) Trailhead Reconstruction	Connected	Yes
7) Snag Creation	Connected	Yes
Non-Mitigation, Post-Sale Activities to be Funded in Priority Order as Funding is Available From this Project		
8) Rehabilitate Existing Landings	Similar	Yes
9) Underplanting and DTR Planting	Similar	Yes
10) Debris Chute Restoration	Similar	Yes
11) McQuade Creek Restoration	Similar	Yes
12) Firewood	Similar	Yes
13) Pre-commercial Thinning of Other Managed Stands	Similar	Yes
14) Sensitive Species Monitoring	Similar	Yes
15) Fertilization of Commercially Thinned Managed Stands	Similar	Yes
16) Recreation Sign Replacement	Similar	Yes
17) Existing Spur Road obliteration	Similar	Yes
18) Rock Pit Restoration	Similar	Yes
19) Fertilization of Other Managed Stands	Similar	Yes

Table 13: **Summary Alternative 3**

Unit #	Refor. #	Total Acres	Trees Per Acre	Canopy Cover Percentage	Dominant Tree Release (DTR)	Skyline Acres	Helicopter Acres	Ground-based Acres	Fuel Treatment HP = hand pile 1 chain along roads YTA = yard tops attached
1	Q1	7	110	60%	10% above rd. 720	1	6	0	HP 7ac along 1100 rd
3	Q4	11	90	50%	3%	0	11	0	HP 2ac along 1100 rd
4	Q5	33	90	50%	10%	3	30	0	Pullback 7 acres of slash along 11 rd, end haul to west side of unit & dump for soil stabilization
5	Q6	32	90	50%	3%	7	7	18	YTA 14ac., HP 8ac along 11 and 1155 rds
6	Q7	26	90	50%	10%	8	10	8	HP 8ac 11 rd.
7	Q8	22	110	60%	3%	12	0	10	YTA 200ft below landings and HP 4ac along 11 and 1155 rds
8	Q11	25	70	40%	No DTR	11	0	14	HP 6ac 1155 rd
9	Q12, Q12A	3	110	60%	3% (1/8th acre)	3	0	falling only	HP 2ac along1100 rd
10	Q13	14	110	60%	3% (1/8th acre)	14	0	falling only	HP 5ac along1100 rd
11	Q14, Q14A,Q 14B	27	90	50%	10%	27	0	falling only	HP 2ac along 1100 rd.
12	Q41	8	70	40%	No DTR	0	0	8	HP 6ac along 1155 rd & around perimeter of dispersed site in NW corner

Table 13: **Summary Alternative 3**

Unit #	Refor. #	Total Acres	Trees Per Acre	Canopy Cover Percentage	Dominant Tree Release (DTR)	Skyline Acres	Helicopter Acres	Ground-based Acres	Fuel Treatment HP = hand pile 1 chain along roads YTA = yard tops attached
13	Q50, Q50A	9	90 West	50% west 90% east	10% west, 1/8 ac. openings east	6	3	0	HP 4ac along spurs 805 & 808
14	Q51	9	90	50%	3%	1	8	0	HP 3ac along spur rd 805 & around dispersed site
15	Q70	3	70	40%	No DTR	3	0	0	YTA 3ac
16	Q71	1	70	40%	No DTR	1	0	0	No treatment
17	Q72	3	110	60%	5 %	3	0	0	HP 1ac along 1142 rd
18	Q73	59	90	50%	10%	50	9	0	YTA 59ac
19	Q102	78	70 110	40% north of 1133 60% south of 1133	No DTR north 3% south	78	0	0	YTA 78ac, HP 11ac along 1133 rd
20	Q115	37	90	50%	3%	27	4	6	Burn landings only
21	Q201, Q201A	13	110 90	60% north of 202 50% in helicopter	3%	13	0	0	Burn landings only
22	Q202	27	110	60%	10%	21	6	0	Burn landings only
23	Q203	45	70 110	40% east of stream 60% west of stream	No DTR east, 10% west	35	10	0	Burn landings only
24	Q206	40	90	50%	3%	33	7	0	HP 4ac along 1131 rd
25	Q207	9	90	50%	3%	6	3	0	HP 2ac along 1131 rd
26	Q209	10	90	50%	10%	5	5	0	HP 2ac along 1131 rd
27	Q240	6	110	60%	3%	3	0	3	YTA 3ac
Total		**557**				**371**	**119**	**67**	

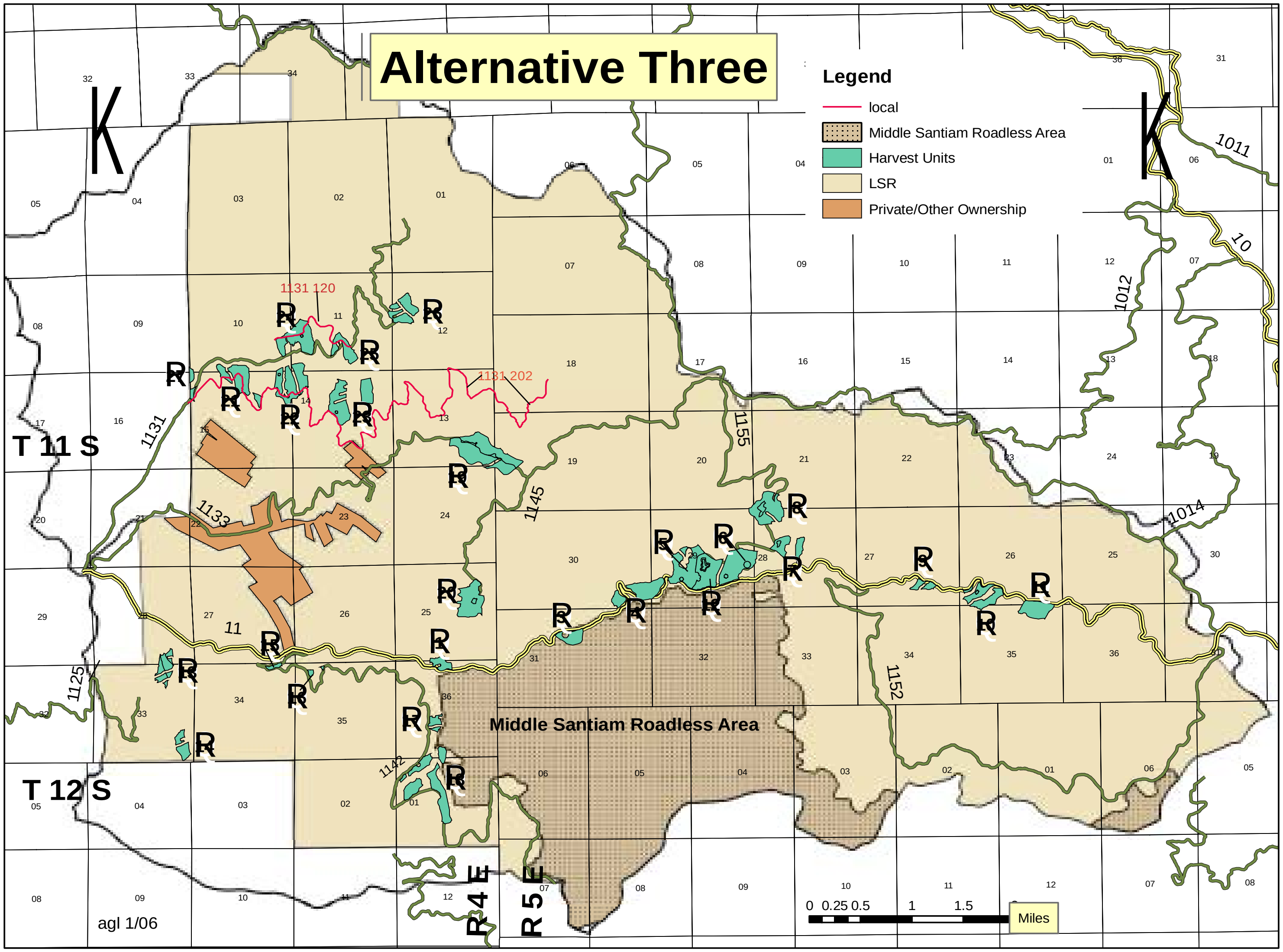


Figure 11: Alternative 3 Map

Mitigation Common to All Alternatives

Mitigation measures were developed to ease some of the potential adverse effects the various alternatives may cause. Common mitigation measures that apply to specific units, regardless of alternative, are also listed. The following mitigation measures would be applied to any of the action alternatives unless another mitigation measure is specifically identified in a particular unit prescription in Appendix A: Unit Prescriptions. Common mitigation measures that apply to specific units, regardless of alternative, are also listed

Table 14: Mitigation Measures Common to All Alternatives

Unit #	Required Mitigation Measures	Restriction Dates
	Wildlife	
5, 6, 8, 19, 23, and 26	Big Game Close all newly constructed and re-opened spur roads following timber operations for this harvest entry.	N/A
All	Snags and Down Wood • Retain existing snags in all harvest units, to the extent possible • Snags required to be felled for safety reasons would remain on site for down woody component • 10% Retention buffers required within the original stand boundaries that include the proposed harvest units, would be concentrated at accumulations of down wood wherever possible. • Leave 5 extra standing trees per acre, in addition to existing coarse woody debris and snags, to be topped after the timber sale to create snags. Trees in the large diameter class should be selected whenever possible for snags. • Five trees per acre would be felled and retained during harvest operations to contribute to down wood habitat. Trees selected would be within the median range of trees within the stand.	N/A
22, 23, 24	Oregon slender salamander Maintain a minimum 66-foot no-harvest buffer on known locations of Oregon slender salamander	N/A
All	Spotted Owl Standards outlined for spotted owls in the Biological Opinion (USDI March 2005) would be adhered to. All units are subject to restrictions identified in the Biological Opinion unless habitat is known to be unoccupied as determined by surveys done using Region 6 protocol.	Mar. 1 – July 15
All	Peregrine Falcon (if found in potential nesting locations during season(s) of harvest operations) Potential nesting locations would be determined prior to timber harvest activities. If active nests are located, implement seasonal restrictions on harvest operations in nest vicinity.	Jan. 15- July 31
1, 4, 5, 9, 10, 21, 22, 24, 25, 27	PETS: Harlequin Ducks Logging operations would be restricted within ¼ mile of streams during nesting period.	Mar. 1 – July 15

Table 14: Mitigation Measures Common to All Alternatives

<table>
<tr><th>Unit #</th><th colspan="4">Required Mitigation Measures</th><th>Restriction Dates</th></tr>
<tr><td colspan="6">Fuel Treatment /Air Quality</td></tr>
<tr><td>All</td><td colspan="4">• Slash in units logged by ground-based systems would be crushed and used in the skid roads.
• Slash would be hand piled within 1 chain of major forest roads: 1100, 1131, 1133, 1142, 1155 and 1100-805 within harvest units bordering these roads and piles would be burned.</td><td>N/A</td></tr>
<tr><td colspan="6">Infrastructure (Transportation)</td></tr>
<tr><td rowspan="10">All</td><td colspan="4">Selected roads would be closed within the LSR to improve habitat function and usability, reduce wildlife harassment and to minimize potential spread of non-native plants and noxious weeds into the LSR.</td><td rowspan="10">NA</td></tr>
<tr><td>Road #</td><td>Closure Type</td><td>Road Closure Miles</td><td>Comments</td></tr>
<tr><td>1131 120</td><td>Gate</td><td>1.18</td><td>Decommission (storm proof)</td></tr>
<tr><td>1131 202</td><td>Gate</td><td>7.98</td><td>Decommission (storm proof)</td></tr>
<tr><td>1100 720</td><td>Berm</td><td>1.61</td><td>Decommission (storm proof)</td></tr>
<tr><td>1145 000</td><td>Berm</td><td>0.59</td><td>Decommission (storm proof_</td></tr>
<tr><td>1100 811</td><td>Berm</td><td>0.17</td><td>Decommission (storm proof)</td></tr>
<tr><td>1100 737</td><td>Berm</td><td>1.00</td><td>Decommission (storm proof)</td></tr>
<tr><td>1100 743</td><td>Berm</td><td>0.56</td><td>Decommission(storm proof)</td></tr>
<tr><td>1145 387</td><td>Gate</td><td>1.33</td><td>Access through gate</td></tr>
<tr><td colspan="6">Fisheries</td></tr>
<tr><td>All</td><td colspan="4">• Any project activity such as culvert replacement that must occur within fish-bearing and other perennial streams would comply with Oregon Department of Fish and Wildlife seasonal restrictions on in-stream work activities. Best Management Practices including placement of sediment barriers, provision of flow bypass, and other applicable measures would be included in project design as necessary to control off-site movement of sediment.
• Native-surfaced roads would be restricted from hauling during the winter rainy season to maintain water quality and fish habitat unless conditions warrant a waiver of this requirement.
• Construction and or maintenance of roads would not be done when soils are saturated or run off occurs, to minimize erosion and sedimentation, and a stable fill would be constructed across all streams.
• All haul roads would be maintained in stable condition. Watering the road surface would be used if roads become excessively dusty during the summer.
• Ground-based yarding systems would operate only when soils are relatively dry following the rainy season in the spring though summer. Operations would be suspended if rainfall or precipitation results in pooling of water in skid trials or landings.</td><td>June 1 – Sept. 30

Nov. 1 – May 31</td></tr>
</table>

Table 14: Mitigation Measures Common to All Alternatives

Unit #	Required Mitigation Measures	Restriction Dates
	• Designated skid trails would be required in all ground-based yarding units. Skid trails would be located outside drainages, seeps, springs and/or concave landforms, which could accumulate and transport overland flow and sediment. Existing skid trails that are outside drainages, seeps and springs that meet the needs of the yarding system should be used wherever possible. • Ground-based equipment would be limited to slopes less than 30 percent for harvester/forwarder and conventional ground skidding operations. Short, isolated pitches up to 40 percent, on otherwise suitable slopes, may be approved after consultation with soil/watershed specialist determines that sediment transport to streams would not occur as a result. Adverse skidding conditions would be avoided through skid trail layout and use of alternative yarding systems • Full suspension would be required when yarding over perennial stream channels. Where full suspension is not obtainable over intermittent streams, partial suspension would be required and yarding would be limited to when the stream is dry. • Where cable yarding requires corridors through a Riparian Reserve, corridors would be laid out to result in the least number of trees cut for corridors. Trees located within no-harvest buffers that must be cut to facilitate yarding corridors would be felled into the channel whenever possible, and left on site. • All skid trails and landings would be water barred to provide adequate drainage. Water bars location should occur where local terrain facilitates effective drainage of the skid trail or landing. In general, water bars should be constructed every 100 feet on slopes less than 15 percent, and every 50 feet on slopes greater than 15 percent. Water bars should be "keyed in" to the cut bank and have a clear outlet on the down hill side. Where available, slash should be placed on skid trails and landings. • Areas of exposed soil, such as landings, skid trails, decommissioned roads, and cut and fill slopes associated with road construction or maintenance would be seeded with non-invasive cereal grains such as winter wheat, and native perennial species. • Temporary roads would be decommissioned after completion of logging operations. Decommissioning of roads may include: berming the entrance, removal of ditch-relief culverts and replacement with drain dips on road 1131 202, installation of water-bars, scarification and/or subsoiling, and re-vegetation of the road prism. • In units containing stream channels, all existing large woody debris would be retained within Riparian Reserves to maintain channel stability; provide nutrients and food for aquatic plants and insects, and to provide buffering so as to filter sediment from runoff and maintain water quality	

Table 14: Mitigation Measures Common to All Alternatives

Unit #	Required Mitigation Measures		Restriction Dates
Vegetation			
All	Residual Tree Protection No thinning during sap flow to protect remaining trees from damage during logging operations, unless approved by District Silviculturist		below 2500 ft = Mar 5- May 15 above 2500 ft = Apr 30-June 30
18, 26	Noxious weeds 100-foot containment buffer around existing noxious weed sites in Units 18 and 26 to maintain a dense canopy next to the roads and limit spread of noxious weeds		
All	Noxious Weeds (continued) Money would be collected from the proposed timber sale to survey and control noxious weeds on all harvest units and roads in the planning area. Pre-treat existing weed sites Survey to locate noxious weed populations and remove individuals and populations, where possible, in harvest units and along adjacent road systems. Existing weed sites of meadow knapweed, false brome and Scotch broom would be buffered from thinning activities to prevent weed seed from being transported throughout the harvested area. All road construction and logging equipment would be pressure washed prior to working in the area. Obtain gravel for road construction and reconstruction from a weed-free rock sources. Minimize areas of soil disturbance during all harvest activities including spur road construction and re-opening, road reconstruction, etc. Seed all disturbed areas with native species, including landings and subsoiled skid roads, to reduce weed establishment. Berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming weed seed due to vehicular traffic.		N/A
Unit #	**Sensitive Plant Species**	**Number of Sites**	**Protection Measure**
3	*Pseudocyphellaria mallota*	1	172’
4	*Pseudocyphellaria rainierensis* *Pseudocyphellaria mallota*	13 1	100’ 172’
5	*Pseudocyphellaria rainierensis* *Leptogium cyanescens*	2 1	100’ 172’

Table 14: Mitigation Measures Common to All Alternatives

Unit #	Required Mitigation Measures		Restriction Dates
6	*Pseudocyphellaria rainierensis* *Leptogium cyanescens*	1 1	100’ 172’
7	*Pseudocyphellaria rainierensis*	1	100’
8	*Pseudocyphellaria rainierensis* *Nephroma occultum*	1 1	100’ 172’
9	*Pseudocyphellaria rainierensis* *Leptogium rivale in creek*	2 linear	100’ 100’
10	*Pseudocyphellaria rainierensis* *Leptogium rivale in 2 creeks in unit*	1 2 linear	Out of unit 100’
11	*Pseudocyphellaria rainierensis* *Leptogium rivale in creek east of unit*	3 linear	100’ 100’
12	*Pseudocyphellaria rainierensis*	4	100’
13	*Pseudocyphellaria rainierensis* *Pseudocyphellaria mallota* *Leptogium cyanescens*	8 2 2	100’ 172’ 172’
14	*Pseudocyphellaria rainierensis*	3	100’
16	*Leptogium rivale in creek* *Leptogium cyanescens*	linear 5	100’ 172’
17	*Pseudocyphellaria rainierensis*	3	100’
18	*Pseudocyphellaria rainierensis* *Pseudocyphellaria mallota* *Leptogium rivale* in McQuade Creek	3 1 linear	100’ 172’ 100’
21	*Pseudocyphellaria rainierensis*	8	100’
22	*Pseudocyphellaria rainierensis*	8	100’
23	*Pseudocyphellaria rainierensis*	1	100’
24	*Pseudocyphellaria rainierensis*	7	100’
25	*Pseudocyphellaria rainierensis* *Leptogium cyanescens*	11 1	100’ 172’
26	*Pseudocyphellaria rainierensis* *Leptogium rivale* in creek south of unit	1 linear	100’ 100’

Table 14: Mitigation Measures Common to All Alternatives

Unit #	Required Mitigation Measures	Restriction Dates
Roads and Landings		
5, 6, 8, 19, 23, and 26	Spur roads construction and re-opening • Roads would not be reopened for use during thinning if they are within a Riparian Reserve's first site tree (172 feet distance) on perennial streams. • All existing spur roads opened to access harvest units and all new spur roads constructed would be closed, water barred and seeded with native seeds following activities.	N/A
3	Landing Construction • The landing for this unit would be located outside of the Middle Santiam Roadless Area. No roads would be constructed or re-used within this harvest unit because the unit falls within the roadless area.	N/A
Recreation		
All	Recreation • No log hauling operations on weekends during peak recreation season. A weekend is defined as starting at 5pm on Friday and ending at 7pm on Sunday. • Berms placed on local roads after logging operations would be placed far enough away from main roads to create dispersed recreation sites, whenever possible. • Reconstruct or replace any existing dispersed recreation sites impacted by logging operations or road closures. • Whenever possible, wildlife trees felled for downed wood should be directed across skid roads to block ATV access.	July 4 – Aug. 31

Unit Number	Required Mitigation Measures	Restriction Dates
Special Habitats		
All units with identified special habitats	Special habitats - general *Special habitats would be protected in accordance with the Forest Plan and the Special Habitat Management Guide (see Appendix A: Unit Prescriptions for specific information regarding protective measures for special habitats known to occur in or adjacent to proposed units).* ***General protection measures include:*** Directional falling away from special habitats Avoiding placement of equipment, skyline corridors, and designated skid roads through special habitat areas.	N/A
	Special habitats - Seeps/springs 172 feet, if seeps/springs greater than 1/4 acre in size. If less than ¼ acre and if contains riparian vegetation such as	

	skunk cabbage or devil's-club, then a buffer of 50 feet-172 feet would be implemented	
	Special habitats - Ponds 600 feet no-harvest buffer	
	Special habitats - Caves Variable buffer widths; determined by Wildlife Biologist	
	Special habitats - Rock gardens 200 feet buffer, if rock garden is greater than 1/2 acre in size	
	Special habitats - Rock outcrops 150 feet buffer, if rock outcrop is greater than 2 acres	
	Special habitats - Other Smaller seeps, rock gardens and outcrops would be buffered commensurate with their size and the adjacent harvest prescription. There should be no direct disturbance to the habitat or its ecotone. Small rock outcrops are abundant in the planning area and therefore do not require buffering in the thinning units, provided that direct disturbance is avoided. Additional special habitats encountered during project layout would be protected in consultation with resource specialists.	
	Mining	
All	Mining Mining claimants would be notified by mail that logging operations may affect access to their claims. Mining claimants would be given reasonable access to their claims during harvest operations as required by contract clauses.	N/A

Unit #	Suspension Requirements	Duff Retention Requirements
Heritage		
All	Heritage Resources Protect eligible heritage sites. In the event that heritage resources are encountered during project implementation project activity would cease until an archeologist can make a determination of effect on the heritage resource.	N/A
Soils		
Unit #	**Suspension Requirements**	**Duff Retention requirements**
1,4, 13, 14, 15, 20	Partial, some ground	60-80%
3, 7, 16, 17-26	Partial	60-80%
5, 9	Partial and ground	40-60%
6, 8, 11, 12	Partial and ground	30-50%
10	Ground and partial	20-40%
27	Ground	20-40%

Unit Number	Required Mitigation Measures	Restriction Dates
All	Soils • Upon completion of harvest activities, skid roads for ground-based equipment shall be ripped or subsoiled to return the site to near original productivity. All ripped and subsoiled areas would be seeded with native seed mix. • Erosion control measures would be implemented as soon as possible after soils have been disturbed. • Ground-based equipment should generally operate in the dry season, usually considered May through October, unless otherwise restricted by other resource concerns or agreed to by Forest Service personnel. • Harvested trees should usually be topped and limbed in the units in order to provide for nutrient recycling and control of ravel and slough on steep side slopes, unless otherwise specified in fuel treatment requirements. • Ground -based equipment shall generally be limited to slopes less than 30%, unless otherwise directed by Forest Service personnel. • Ground-based skidding equipment or forwarders shall stay on designated skid trails. Ground-based skid trails would be pre-designated and pre-approved before use (LTSR). They should generally be about 10 feet wide and should not usually exceed 15 feet in width, and where practical the skidder, cat or processor/ forwarder should travel on slash. Traveling on slash would help reduce off site soil erosion or lessen soil compaction. LTSR should be included in the contract. Tractor skid roads would generally be 150 to 200 feet apart. Processor/forwarder skid roads would generally be about 50 to 60 feet apart. • Partial or one end suspension is required on skyline units, except at tail trees and landings. Given the uneven terrain in some units, small areas of ground lead may occur along ridge lines or benches. • Unless otherwise approved, the reopening of closed logging spurs constructed during the first harvest entry should occur in the dry season, usually June through October to avoid surface erosion from exposed soil. Open roads should be storm proofed if they have to sit through extended periods of wet weather. • Where practical, at the completion of harvest activities, limbs and woody debris should be placed on areas of exposed soil to reduce the potential for off site soil erosion. • Unclassified or temporary haul roads used outside the standard operating season should generally be rocked to reduce erosion. • Cable corridors spacing should be set to both minimize damage to vegetation as well as the underlying soil. • Trees, not designated for harvest in riparian buffers that need to be cut to facilitate harvest operations, should be dropped into the stream to aid in woody debris recruitment. • Avoid disturbance to the existing down woody debris concentrations from the initial entry as much as practical. • At the completion of harvest activities, heavily used, tractor skid roads (existing or created) that are not part of the dedicated transportation system should be adequately subsoiled with a "Forest cultivator" or an equivalent winged ripper in order to return the site to near original productivity, unless otherwise waived by the Forest Service. This can be accomplished either by the contractor or through the KV process. • Standard contract language should provide for sufficient erosion control measures during timber sale operations (BMP T-	May – Oct June - Oct

	13). Revegetation of areas disturbed by harvest activities (such as landings, temporary roads, and equipment storage areas) is required with an appropriate grass seed mix (BMP T-14, T-15, and T-16).	

Unit #	Required Mitigation Measures	Restriction Dates
1, 4, 16, 18, 19, 21, 22, 23, 24 and 25	Soils Recent failures tracts are present in proposed units 19, 21, 22, and 24. Older sidecast failure scars are evident in Units 1, 4, 16, 18, 23 and 25. Consequently, for one to two chains below roads in these Units, leave trees would be designated such that the larger trees with extensive root mats, and especially those trees with pistol butt trucks (indicative of sidecast creep) would be maintained.	
Hydrology		
All	Riparian • No in-stream activities would take place in fish-bearing streams, or other perennial streams near their confluence with fish-bearing streams, outside of the in-water work window (July 15-Aug 30). • Assure stream crossings allow natural flow of water • No-harvest riparian buffers are prescribed to minimize sediment delivery to streams and reduce the potential for temperature increases. *The riparian buffers vary by alternative as stated in the Description of Alternatives*. All buffers are measured from the trees nearest the stream rather than the waters edge. • Dry weather haul would be required on native surface spurs. • To minimize impact from skyline corridors across streams and riparian areas, trees would be directionally felled into stream channels, where possible. If trees cannot be felled into stream channels, fell them away from riparian vegetation to minimize damage. These trees would be left on site. • Ground-based harvest operations would be restricted in Riparian Reserves whenever soils are wet and not frozen. • No DTR's would occur closer than 172 feet from streams or in units thinned to 40% canopy closure • Implement Best Management Practices (BMP's) for all project activities. Utilizing BMP's for this project specifically addresses direction and guidance in the protection of water quality. Objectives and mitigation for water quality for this project are listed in the following table:	

Objective	Mitigation
Maintain or improve existing temperature regime along perennial streams in relation to water quality	Designation of riparian management units to maintain and improve shade canopies over stream channels (BMP T-2; T-7; T-8).
Continue recovery of downstream riparian and channel conditions	Design units to insure channel bank stability, and provide adequate buffers to reduce sediment inputs and minimize peak flow effects

		(BMP T-2; T-7; T-8; T-12). Boundaries are placed in such a manner to avoid compromising stability of the channel banks. No trees are cut which attribute to bank stability.	

Unit #	Required Mitigation Measures		Restriction Dates
All	**Objective**	**Mitigation**	N/A
	Maintain or improve the quality of water for domestic and fisheries users	Designate riparian management units and specific prescriptions for each individual unit adjacent to stream courses requiring protection (BMP; T-7).	
	Maintain natural filtration of surface, overland flow, through post sale activities.	Establish appropriate riparian management units and establish fire lines to ensure maintenance of established buffers, filter strips (BMP T-7; T-8; F-2; F-3).	
	Maintain or improve channel bank stability.	Establish riparian management units that include channel bank areas and or establish marking prescriptions that prevent any tree attributing to bank stability from being marked (BMP T-2; T-6; T-7; T-8).	
	Control the amount of sediment leaving the road system.	Utilize appropriate clauses within the contract to ensure that winter haul occurs on roads with adequate surface rock and that erosion control techniques such as mulching of bare soils associated to the road system occur.	

Alternatives Not Considered in Detail

Heavy Thinning Prescriptions: The *Mid-Willamette LSR Assessment* recommends in Landscape Block A (*where several stands are proposed for treatment*) to “use minimum entries on those stands where site-specific factors show that they would benefit from treatment.” Generally a heavier thinning would be done here. The philosophy with this type of thinning is that only one harvest entry would be needed to set up the stands on a path toward developing old-growth characteristics. A heavy thinning of managed stands, down to 30-50 trees per acre was not pursued here for several reasons:

(1) A landscape populated by stands with minimum numbers of trees leaves little room for mortality from natural events such as strong winds, fire or insect/disease infestation.

(2) The analysis area falls within a Critical Habitat Unit (CHU) where a minimum of 40% canopy closure must be maintained for owl dispersal. Thinning to 30-50 trees per acre would not meet this criteria.

(3) Given that Quartzville Creek is 303(d) listed stream for temperatures, the IDT determined that heavy thinning would not address this issue.

Thinning in Natural Stands: The IDT considered thinning in five natural stands in the headwaters of Canal Creek. Upon further analysis, four stands were over 80 years old and were dropped from consideration. A 60 year-old stand was also dropped after an IDT field visit found that the stand was well on its way to developing late-successional characteristics and thinning would result in deleterious effects to the interior habitat in the stand.

Uneconomical and Deferred Stands: One stand (Unit 2) was dropped from consideration due to its small size after buffers for sensitive species and Riparian Reserves were put in place. Proposed Unit 28 has been deferred because it is the only stand in the Elk Creek planning subdrainage of the Canal Creek Subwatershed and including it in this proposal would require additional analysis. Several other stands in that subwatershed would be ready to thin in approximately 10 years and this stand would be evaluated with them at that time.

Thinning to Original Stand Boundaries: All of the proposed units in this sale were logged approximately 40 years ago. At that time, economics and logging feasibility were considered more important than resource concerns, and as a result unit boundaries extend to stream edges and through special habitats. Current management standards call for riparian buffers, TE&S buffers, special habitat buffers and 10% retention areas within these LSR stands. These buffers change original stand boundaries such that this potential alternative was dropped from further consideration.

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.

Table 15: Comparison of Alternatives

Comparison Factor		Alternative 1 No Action	Alternative 2	Alternative 3
Volume (MBF)		0	8280	5570
Acres Commercially Thinned		0	828	557
Percent of total area in original stands thinned		0	66%	44%
Cost to Benefit Ratio (*refer to Appendix C for additional information)*		0	2.2	2.0
Acres of Skyline Logging		0	584	371
Acres of Processor-Forwarder Logging		0	111	67
Acres of Helicopter Logging		0	133	119
Acres of Light Thin (90-110 TPA)		0	715	463
Acres of Moderate Thin (70 TPA)		0	113	94
Acres of ¼-acre gaps created with Dominant Tree Release prescription		0	57	36
Percent of canopy closure after treatment as a percentage of original stand acres		90%	64%	77%
Percent of canopy closure after treatment as a percentage of areas treated within stands (thinned and DTR openings)		NA	52%	50%
Percent of canopy closure after treatment in Riparian Reserves		90%	60%	85%
Changes in prescriptions between action alternatives. CC = canopy closure DTR = dominant tree release	Unit 4	NA	60%CC	50%CC
	Unit 10	NA	5% DTR	3% DTR
	Unit 11	NA	60% CC and 3%DTR	40%CC and No DTR
	Unit 12	NA	60%	50%
Acres of improved big game forage		0	57	36
Acres of Riparian Reserves Thinned		0	383	84
Percent of Riparian Reserves Treated (653 ac)		0	59%	13%
Percent of canopy closure retained in primary shade zones in Riparian Reserves		100% of existing	100% of existing	100% of existing

Table 15: Comparison of Alternatives

Comparison Factor	Alternative 1 No Action	Alternative 2	Alternative 3
Retention of at least 50% canopy closure in secondary shade zones	Meets or exceeds this criteria	Meets or exceeds this criteria	Meets or exceeds this criteria
Miles of road closures with this project.	0	14.27	14.27
Acres of Understory Development	0	69	50
Miles of Road Maintenance	0	25	25
Spur Roads Opened In Thinning Units	0	7600’ 1.44 Miles	3400’ .64 miles
New Spur Construction	0	100’ .02 miles	0
Miles of closed, system roads to be re-opened	0	5.28	4.59
Acres Noxious Weed Monitoring and Control	0	892 acres for five years	626 acres for five years
Acres of Pre-commercial Thinning in Adjacent Managed Stands	0	510	510
Snags Created (Five Per Acre)	0	4140	2785
Linear Feet of Down Woody Debris	0	248,400	167,100
Road Obliteration	0	0.1 miles	0.1 miles
Rock Pit Restoration	0	2 at ¼ acre	2 at ¼ acre
Mining Claim Restoration	0	1 at ½ acre	1 at ½ acre

Table 16: How Alternatives Meet Objectives

Objective	Alternative 1	Alternative 2	Alternative 3
Accelerate development of late-successional stand characteristics in young stands in the LSR The desired stand characteristics include the following: • an appropriate stand component of large diameter trees • multi-layered stands with well developed understories • snags and down woody material of sufficient size and arrangement to meet habitat and ecological needs now and into the future • complex stand structure and diversity • variations in stand densities that are occasionally interspersed with small openings. • diverse species composition including hardwoods and other minor species	Modeling suggests these stands would achieve some late-successional characteristics like large trees in about 160 years. But would not develop desired multi-canopy layers, etc.	828 acres would be treated 1. An appropriate stand component of large diameter trees – both alternatives reduce stand densities by approximately 50%. Average stand densities are 250 trees per acre (TPA); prescriptions reduce densities to 70, 90, and 110 TPA. By decreasing inter-tree competition more light and nutrients are available to the residual trees which grow faster as a result. Refer to diameter growth discussion and table. 2. Variations in stand densities that are occasionally interspersed with small openings – three densities are prescribed interspersed with quarter-acre gaps. 3. Multi-layered stands with well developed understories – reducing the tree densities would open up the stand so more light can reach the ground to promote shrub and young tree growth. 4. Snags and down woody material of sufficient size and arrangement to meet habitat and ecological needs – by thinning, 4 to 5 inches of growth is gained in 40 years. 5. Complex stand structure and diversity – see 1-4 and 6. 6. Diverse, native species composition including hardwoods and other minor species – Unit prescriptions in the Appendix state Douglas-fir, noble fir, Western hemlock and red alder would be thinned; all other species would be retained and cedar over 10-inch diameter would be spaced off for leave trees. Cedar would also be planted in Unit 13. This would provide a diverse composition of native species.	557 acres would be treated 1. An appropriate stand component of large diameter trees – both alternatives reduce stand densities by approximately 50%. Average stand densities are 250 trees per acre (TPA); prescriptions reduce densities to 70, 90, and 110 TPA. By decreasing inter-tree competition more light and nutrients are available to the residual trees which grow faster as a result. Refer to diameter growth discussion and table. 2. Variations in stand densities that are occasionally interspersed with small openings – three densities are prescribed interspersed with quarter-acre gaps. 3. Multi-layered stands with well developed understories – reducing the tree densities would open up the stand so more light can reach the ground to promote shrub and young tree growth. 4. Snags and down woody material of sufficient size and arrangement to meet habitat and ecological needs – by thinning, 4 to 5 inches of growth is gained in 40 years. 5. Complex stand structure and diversity – see 1-4 and 6. 6. Diverse, native species composition including hardwoods and other minor species – Unit prescriptions in the Appendix state Douglas-fir, noble fir, Western hemlock and red alder would be thinned; all other species would be retained and cedar over 10-inch diameter would be spaced off for leave trees. Cedar would also be planted in Unit 13. This would provide a diverse composition of native species.

Objective	Alternative 1	Alternative 2	Alternative 3
Encourage development of connectivity within the Quartzville LSR to aid in dispersal and genetic exchange that contributes to species viability.	Same as above	Encourage development of connectivity on 383 acres of Riparian Reserves which were intended to provide connectivity in LSR's.	Encourage development of connectivity on 84 acres of Riparian Reserves which were intended to provide connectivity in LSR's.
Reduce open road densities within the LSR to improve habitat function and usability while also providing adequate access for forest management and recreational activities (*USDA and USDI. 1998b*)	No reduction in open road densities. Roads would be allowed to close on their own.	Reduced open road density by 14+ miles and plan to reduce another 15+ miles as money becomes available	Reduced open road density by 14+ miles and plan to reduce another 15+ miles as money becomes available

Environmental Consequences

Environmental Consequences

This section describes the existing conditions of the resources and the anticipated environmental effects of implementing the proposed action and other alternatives. This analysis is organized by resource area. Within each section, the affected environment is described first, followed by the effects of the No Action Alternative that provides a baseline for evaluation and comparison of the other alternatives that follow.

The project IDT identified past, present and reasonably foreseeable future actions that might have cumulative effects with the proposed action. Those actions are listed and displayed on a map in Appendix M.

The cumulative effects discussed in this section 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 the alternatives. *(CEQ Memorandum, Guidance on the Consideration of Past Actions in Cumulative Effects Analysis, June 24, 2005).*

Several resource sections make references to resource reports that are in the project record. These resource reports provide more in-depth information than is presented in the environmental consequences section of this document.

Biological Resources

Terrestrial Wildlife

***Introduction*:** With respect to wildlife, the purpose of the project is to accelerate attainment of late-successional stand characteristics in young stands within the LSR in order to hasten attainment of habitat conditions for late-successional and old-growth related species and to improve habitat connectivity and function. The desired stand characteristics resulting from proposed stand treatments include: (1) development of large diameter trees, (2) creation of a mosaic of varying stand densities interspersed with occasional, small openings to improve stand structure and diversity, (3) establishment of multi-layered stands with well-developed understories, (4) promotion of stand conditions which encourage diverse, native species composition including hardwoods and other minor species, (5) creation of a supply of snags and down wood, and (6) increased resistance of the LSR to disturbances such as fire and disease. Additional objectives with respect to wildlife include improving connectivity within the LSR, minimizing spread/introduction of non-native plants or noxious weeds, reducing open-road densities and meeting state water quality standards for stream temperatures.

***Analysis Area**:* The analysis area varies by the habitat needs of the species being analyzed. For this analysis numerous management indicator species, migratory birds and sensitive species were analyzed. Their habitat needs vary from the individual harvest unit, to the subwatershed, to the watershed.

***Analysis Methods**:* Pre-field analysis, field surveys and species surveys, based on Regional protocol, were conducted by a wildlife biologist. Analysis included: spotted owl surveys and an analysis of habitat around individual known owls or nest sites; Wisdom Elk Model analysis to determine habitat effectiveness values for big game; analysis of the percent of snags by subwatershed; review of historical roading and harvest units; GIS analysis of current spotted owl habitat; determination of the relative amount of recreation use in the area that could affect wildlife; and considerations of proposed harvest methods and potential noise/disturbance levels.

A. Threatened and Endangered Species

1. Northern Spotted Owls

Overview of affected environment: The *Mid-Willamette LSR Assessment* describes the habitat in *Quartzville LSR* #RO213 (*USDA. 19998b, VI 160-164*). According to the assessment the key issues for this LSR are the amount of late-successional forest, road densities and connectivity within the LSR. Connectivity is an important issue because the checkerboard ownership here limits options, so federal lands are essential for providing the needed LSR connectivity.

Suitable habitat for the northern spotted owls has three main components: nesting, roosting, and foraging (NRF) habitat. Generally suitable habitat is 80 years of age or older, multi-storied with canopy closures exceeding 60 percent, and with sufficient large snags and down wood to provide opportunities for nesting, roosting, and foraging. Late-seral forest is superior habitat and preferred by spotted owls over other habitat conditions (*Thomas et al. 1990*).

Dispersal habitat does not have a multi-storied canopy, large trees or large snags and down wood. This habitat generally consists of mid-seral stands between 40 and 80 years of age with canopy closures of 40% or greater and trees with a mean diameter of 11 inches or more (*USDI, 2005*). Dispersal habitat allows spotted owls to move between stands of suitable habitat and for juveniles to disperse from natal territories. Figure 12 below shows owl habitat within the LSR. The map shows suitable spotted owl habitat in blue and dispersal and non-habitat in white. Proposed harvest units are outlined in red.

Spotted owls may be affected if habitat is modified within their medium home range of 1.2 mile radius around the nest tree. Habitat modification may occur in three different ways: (1) degradation of habitat which affects the quality of suitable or dispersal-only habitat without altering the functionality of such habitat, (2) downgrading of habitat which alters the functionality of suitable habitat so that it no longer supports nesting, roosting, and foraging, and (3) removing habitat which alters suitable or dispersal-only habitat to such an extent that the habitat no longer supports nesting, roosting, foraging, or dispersal of owls.

Spotted owls may also be affected by noise disturbance above ambient levels during the nesting season from March 1 through September 30. Disturbance can occur from any activity producing above-ambient noise within 0.25 miles of owls during the nesting season. These distances increase to 0.5 miles for aircraft noise and 1.0 mile for blasting noise.

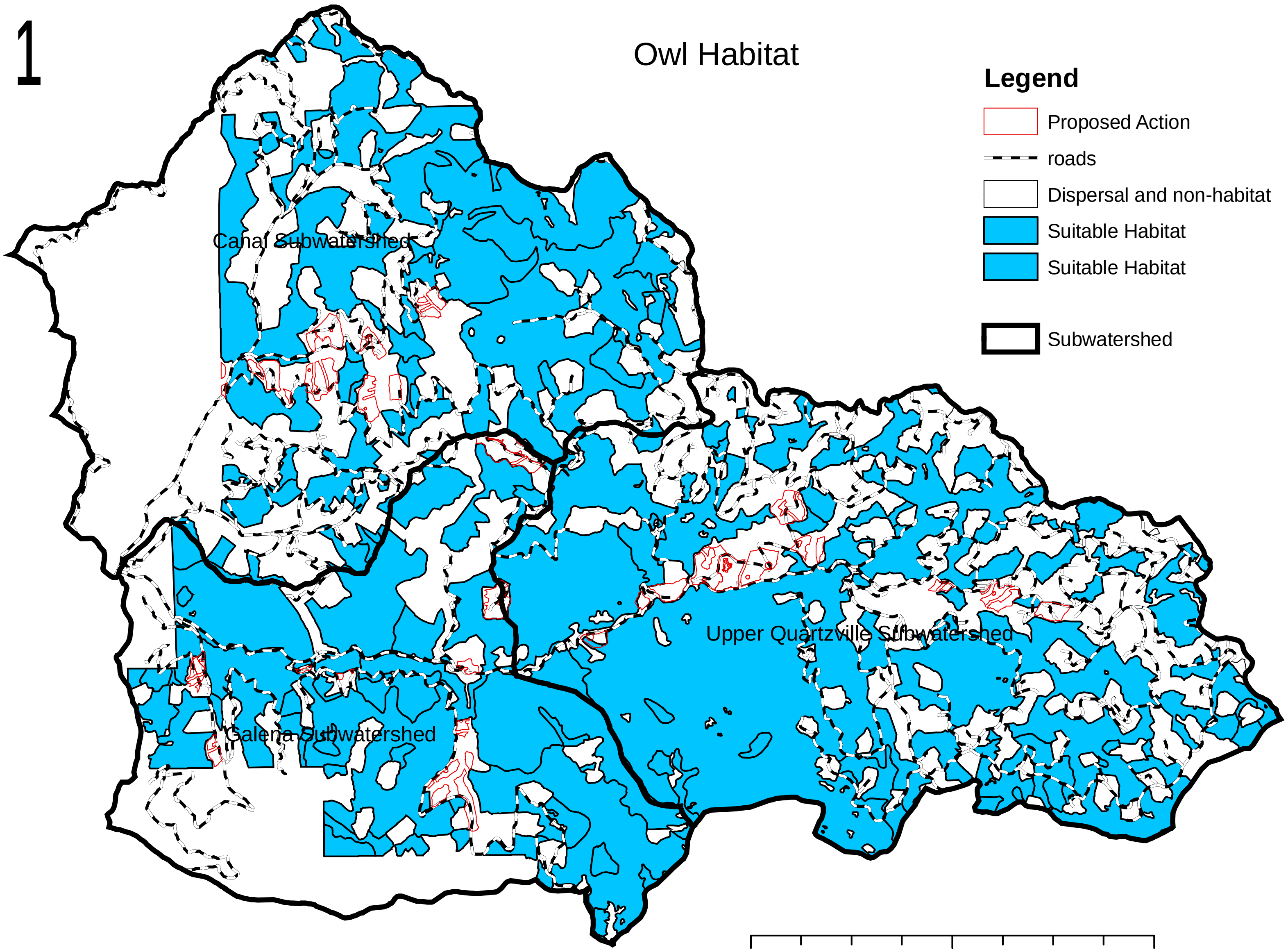


Figure 12: Suitable Owl Habitat

There are numerous historic spotted owl locations surrounding the plantations proposed for thinning. Most locations were from night audio responses over 10 years ago with little daytime verification of activity centers. Spotted owl surveys based on Region 6 survey protocol were completed in 2003, 2004 and 2005 to identify spotted owl activity centers. Spotted owls were located in the vicinity of some of the historic sites but not all.

Formal consultation with the U.S. Fish and Wildlife Service on this project was completed and a Biological Opinion received (*USDI, 2005*). This project would be implemented in accordance with the standards listed on pages 6-7 of that document. These standards also address the need for a biologist to participate in the environmental analysis and to minimize or eliminate disturbance to the spotted owls. Specific requirements are addressed in the mitigation section of this document.

The U.S. Fish and Wildlife Service designated Critical Habitat Units (CHU) across the range of the northern spotted owl. The physical and biological features, referred to as the primary constituent elements, that support nesting, roosting, foraging, and dispersal are essential to the conservation of the species (*USDI, 1992).* All proposed units are within CHU OR-14.

Two documents have recently been released that document a continued gradual decline in spotted owl populations: the *Status and Trends in Demography of Northern Spotted Owls 1985-2003 (Anthony et al.)* and the *Scientific Evaluation of the Status of the Northern Spotted Owl (SEI report)*

Environmental Consequences

Direct and Indirect Effects – Northern spotted owls

Alternative 1 – No Action*:* There would be no direct, indirect, or cumulative effects to spotted owls, spotted owl habitat, or spotted owl critical habitat. Habitat within the proposed units would continue to function as dispersal habitat and develop following natural successional pathways. These pathways are dependent on either natural disturbances (fire, insects, wind, pathogens) or self-thinning from natural mortality which would allow the remaining trees to develop some late-successional habitat characteristics such as large Douglas-fir at about age 200. Delays in habitat development, compared to stands that are thinned, would extend the recovery time for old-growth dependent species in decline, such as the spotted owl.

Alternatives 2 and 3: Units proposed for thinning were reviewed on-the-ground to verify tree size, canopy closure, and existing snags and down wood. These units currently provide low quality dispersal habitat for spotted owls. Thinning prescriptions were designed following recommendations from the *Northwest Forest Plan* and the *Mid-Willamette LSR Assessment*. All prescriptions would maintain a minimum 40% canopy to provide for spotted owl dispersal. Prescriptions would also retain areas in each unit where thinning would not occur and the canopy closure would remain close to 100%. These retention areas occur primarily in no-harvest riparian buffers but also in buffers for sensitive species (*plant and animal*). In Alternative 2 the no-harvest riparian buffers occur in the primary shade zones adjacent to stream channels, while in Alternative 3 the no-harvest buffers are based on standard tree heights (*172 feet)* so occur in both primary and portions of secondary shade zones in the Riparian Reserves. Thinning prescriptions were also designed to buffer the interior forest habitat in Landscape Blocks B1 and B2 (*see Figure 7*). There would be no reduction in old-growth and mature conifer habitat in either alternative.

Light to moderate thinning planned under these two alternatives would degrade, but not remove, the existing spotted owl dispersal habitat for the next 5 years or so because the stands would be more open. A minimum 40% canopy would remain after all logging and snag and down wood creation are complete. By maintaining and favoring a mixture of tree species, thinning would improve stand diversity, wildlife habitat and resistance to single species insect attacks and diseases. Through reduced crowding and competition between trees, stand vigor would improve and provide bigger, taller trees and begin the development of a multi-storied stand. Improving diversity and increasing vertical and horizontal stand structure would accelerate the stands towards development of suitable spotted owl habitat, perhaps decades sooner than would occur without treatment.

Thinning the stands now would improve dispersal habitat quality within 5 to 10 years as the tree canopies grow and begin to close in. This should accelerate the stands to become suitable spotted owl habitat in 40 to 50 years. Planned snag and down wood creation would also improve habitat conditions for spotted owl prey base, like Northern flying squirrels. Alternative 2 would treat 828 acres and Alternative 3 would treat 557 acres.

Dominant Tree Release prescriptions designed to introduce canopy gaps and promote the development of dominant trees within the stands, would encourage multiple canopy layers and structural diversity, desired characteristics in LSRs. These small 1/8 to ¼ acre gaps would not impede dispersing spotted owls.

The new temporary road construction in Alternative 2 and the re-opening of closed logging spurs, constructed during the first entry, and system roads in Alternatives 2 and 3 should not pose a barrier to dispersing spotted owls. These roads would be closed after harvest activities are complete. Especially on the temporary roads, trees remaining on the sides of the roads should quickly respond to the opening and fill in the gap.

Hazard trees (snags and live defective trees) would likely need to be felled within the stands, adjacent to work areas, and along haul routes in both action alternatives. All hazard trees that are felled would be retained as down wood. In addition, five plantation trees per acre would be retained as down wood during logging and five snags would be created after logging is complete. Habitat conditions for spotted owl prey species would be improved by the increased levels of snags and down wood.

All units proposed for treatment are located in Critical Habitat Unit OR-14. Removing up to 60% of the existing canopy within these units may affect critical habitat by temporarily degrading existing dispersal habitat for the next 5 years or so. Quality of this dispersal habitat should improve within 5 to 10 years as the canopy increases and should accelerate the stands to becoming suitable spotted owl habitat in 40 to 50 years.

Cumulative Effects – Northern Spotted Owls

The analysis area for cumulative effects is the project planning area. Cumulative effects result from the incremental impacts of past, present, and foreseeable future actions that affect spotted owl habitat. Past timber harvest activities and road building have removed suitable spotted owl habitat and reduced interior forest habitat, due to edge effect of the created openings. About 10,500 acres of harvest and 155 miles of associated road building has occurred on National Forest System land here in the last 5 decades. See Figure 13 below which illustrates past harvest and road building described here. The proposed commercial thinning would improve the quality of dispersal habitat on the landscape and accelerate the development late-successional habitat, eventually becoming suitable spotted owl habitat.

There are no additional habitat altering projects in suitable or dispersal spotted owl habitat on Forest Service land at this time within the Quartzville LSR. Current and future logging on private lands to the west is expected to provide only dispersal habitat for short time periods. It is unlikely the current dispersal habitat would remain long enough to provide for suitable owl habitat.

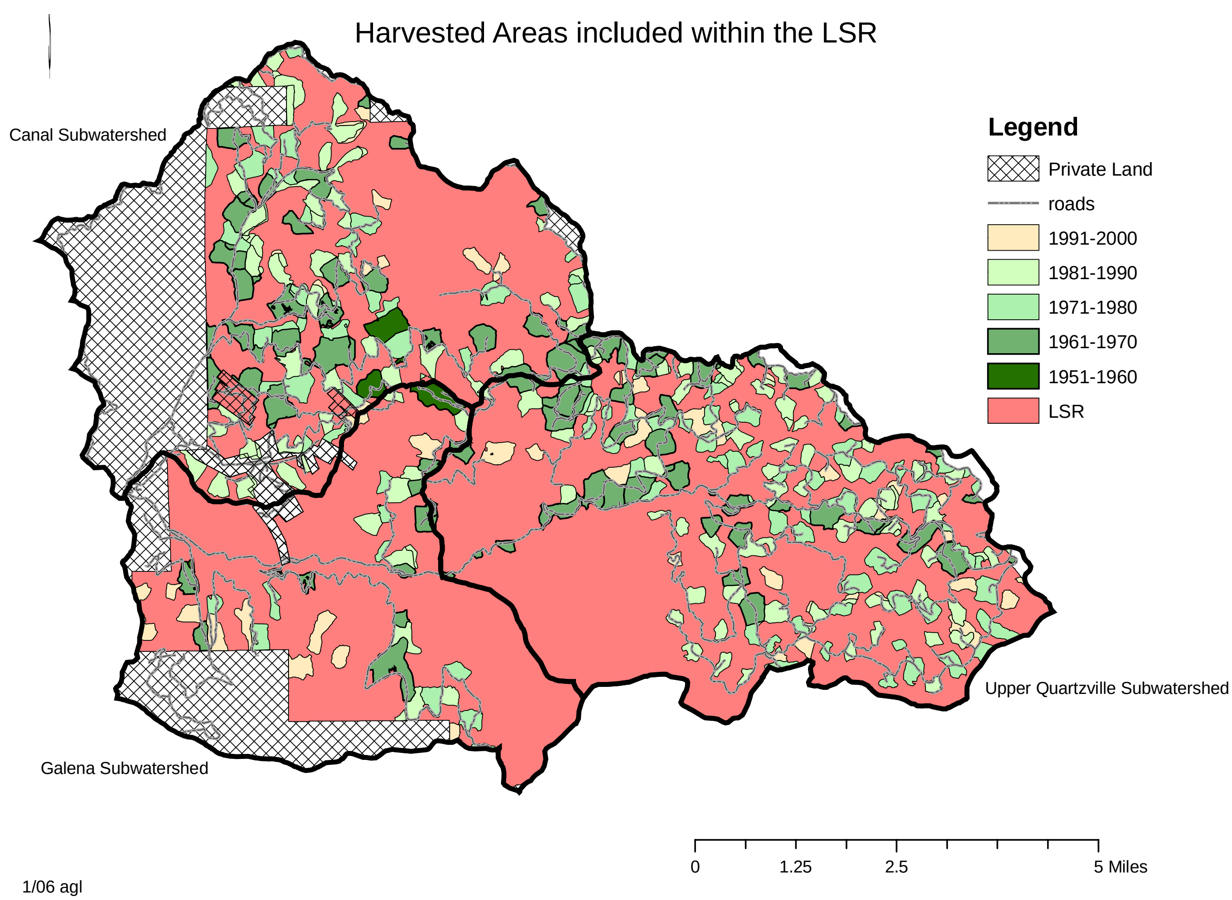


Figure 13: Harvested Areas in LSR

2. Bald Eagle

Bald eagles, listed as a threatened species, do not occur in the analysis area and will not be impacted by proposed project activities**.** There would be no direct, indirect or cumulative effects to bald eagles in any of the alternatives.

B. Sensitive Wildlife Species

There are known sites of sensitive wildlife species located within the planning area and potential habitat for sensitive species suspected to occur. Table 17 lists the eighteen Region-6 sensitive wildlife species suspected or known to occur on the Willamette National Forest (*Regional Forester's Sensitive Animal List, 2004*) and if potential habitat exists within the planning area. Detailed information on species that may be impacted is located in the Wildlife Biological Evaluation.

Table 17: Sensitive Wildlife Species on the Willamette National Forest

Species	Habitat Present in Planning Area?	Species Documented or Suspected in Planning Area?
Amphibians		
Oregon Slender Salamander	Yes	Documented
Cascade Torrent Salamander	Yes	Suspected
Foothill Yellow-legged Frog	No	
Oregon Spotted From	No	
Birds		
Least Bittern	No	
Bufflehead	No	
Harlequin Duck	Yes	Documented
Yellow Rail	No	
Black Swift	No	
Peregrine Falcon	Yes	Suspected
Invertebrates		
Mardon Skipper	No	
Mammals		
Baird's Shrew	Yes	Suspected
Pacific Shrew	Yes	Suspected
California Wolverine	Yes	Suspected
Pacific Fisher	Yes	Suspected
Pacific Fringe-tailed Bat	Yes	Suspected
Mollusks		
Crater Lake Tightcoil, also a survey and manage species	Yes	Suspected
Reptiles		
Northwestern Pond Turtle	No	

Alternative 1 – No Action: There would be no impacts to sensitive wildlife species under this alternative. Habitat within the units would continue to develop towards late-successional conditions by about age 200.

Alternative 2 and 3: Of the sensitive species listed in the table above, only the Oregon slender salamander, Harlequin duck, Baird's shrew and Pacific shrew may be impacted by the action alternatives, either through site disturbance or habitat modification. Proposed treatments may impact individuals or habitat for these species, but would not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species. Thinning should accelerate development of late-successional habitat, improving habitat within the units for these species.

Harlequin ducks typically nest close to streams that are over 30 feet in width with nest selection and brooding occurring from March 15 to July 15 (*Bruner 1997*). Seasonal restrictions would eliminate any effects to nesting Harlequin ducks (*see Mitigation Measures Common to Action Alternatives*).

No-harvest buffers identified for perennial streams would eliminate effects to the Crater Lake Tightcoil, a small mollusk species. Habitat where the temporary road in unit 6 would be located was surveyed, with no Crater Lake Tightcoils found. There should be no effects to this species.

The remaining sensitive species do not occur within the planning area or would not be affected by harvest activities *(See Appendix D: Wildlife Biological Evaluation)*.

Cumulative Effects – Sensitive Species

The area analyzed for cumulative effects was the project area. The amount of habitat being affected by this project is a small percentage of suitable habitat currently available within the planning area. Quality of the habitat to be treated is low, due to the lack of large down wood and understory vegetation. Thinning would improve this habitat by accelerating the development of large trees for future large down wood while increasing the amount of understory. The creation of snags and down wood during and after timber harvest, along with the retention of existing down wood, would also help maintain and improve habitat for these species.

Dispersed recreation along the lower potions of Canal, Elk, and Quartzville Creeks during the spring and summer is likely affecting use of these areas by Harlequin ducks for nesting. The amount of habitat being affected is quite small when compared to the amount of suitable streamside habitat available. Disturbance to the ducks once the broods leave the nest and are on the water is minimal; in fact Harlequins can be quite tolerant of human activity, even in-stream activity (*Bruner 1996*). There are no additional habitat altering projects on Forest Service land at this time within the Quartzville LSR. Logging on private land to the west is expected to continue.

C. Management Indicator Species

Forest planning regulations require the management of wildlife habitats to "maintain viable populations of existing native and desired non-native vertebrate species in the planning area" *(USDA. 1990, pg. II-69).* Management Indicator Species (*MIS*) were selected in the *Willamette Forest Plan* to facilitate management of all species. This analysis uses those species when analyzing environmental consequences of the various alternatives presented in this document. Table 18 below identifies the various indicator species followed by a discussion of how each of those species would be affected by the proposed alternatives being analyzed.

Table 18: Management Indicator Species

Indicator Species	Habitat Feature	Selection Criteria
Northern Spotted Owl	Old-growth and mature conifers	Ecological Indicator; Federal Register List of T&E species
Bald Eagle	Old-growth conifers near large bodies of water	Federal Register List of T&E species
Elk	Winter range	Commonly hunted
Deer	Winter range	Commonly hunted
Cavity Excavators (see Pileated Woodpeckers and snage and down woody habitat for discussion)	Dead and Decaying trees	Ecological Indicator
Pileated Woodpecker	Old-growth and mature conifers	Ecological Indicator
Pine Marten	Old-growth and mature conifers	Ecological Indicator
Peregrine Falcon	Cliff nesting habitat near abundant prey	Federal Register List of T&E species

1. Northern Spotted Owl

The assessment of the effects of the proposed project on the northern spotted owl and its habitat are addressed in the section on threatened and endangered species above.

2. Bald Eagle

There is no habitat for the bald eagle in analysis/project area and the activities proposed with this project will have no impact on the bald eagle or its habitat.

3. Big Game

Overview of affected environment: Big game species within the planning area include Roosevelt elk, black-tailed deer, cougar, and black bear. These four species are year-round residents with seasonal movement due to snow or availability of forage or prey. Roosevelt elk, blacktailed deer and mule deer utilize similar habitats on the forest. All three species migrate using summer and winter ranges. Elk appear to be more sensitive to the effects of forest management and are used to represent the habitat requirements of all three species (USDA. 1990, p. III-76)

Analysis Methods: A Model to Evaluate Elk Habitat in Western Oregon (Wisdom, et al. 1986) is used to evaluate elk habitat quality and project effects on this quality. Habitat values considered in the model are forage quality, cover quality, open road density, and the spacing of forage and cover areas. A mathematical equation is then used to integrate the four habitat variables to obtain an overall value of habitat effectiveness (HEI).

D*esired Future Condition:* Habitat would be managed to maintain viable populations. Distribution of habitat would provide for species viability and maintenance of populations throughout their historic range on the Forest.

Existing Conditions: The Willamette National Forest and the Oregon Department of Fish and Wildlife have defined the subwatersheds where the units are located as either "moderate or low emphasis" elk management areas. Canal and Galena are low emphasis and Upper Quartzville is moderate emphasis. Forest standards and guidelines say that habitat conditions shall provide good quality cover and forage distributed within the area emphasis boundaries (*FW-150, LRMP IV-69*). .

Table 19 below summarized the current Habitat Effectives values within the project area. Each of the habitat variables should be within the range of > 0.4 to 1.0 for moderate emphasis areas and >0.2 to 1.0 for low emphasis. The HEI overall value should be > 0.5 for moderate emphasis areas.

Table 19: Habitat Effectiveness Values in Big Game Emphasis Areas

Variable	**Desired Values Low Emphasis Areas**	**Low Emphasis Areas**		**Desired Values Moderate Emphasis Areas**	**Moderate Emphasis Area**
		Canal	**Galena**		**Upper Quartzville**
		Current Values			**Current Values**
HEI overall	>0.2	0.53	0.55	>0.5	0.56
HE forage	>0.2 to 1.0	0.35	0.28	>0.4 to 1.0	0.36
HE cover	>0.2 to 1.0	0.62	0.78	>0.4 to 1.0	0.72
HE roads	>0.2 to 1.0	0.45	0.49	>0.4 to 1.0	0.43
HE size and spacing	>0.2 to 1.0	0.82	0.85	>0.4 to 1.0	0.88

Habitat within the subwatersheds is classified as summer or winter range depending on elevation. In general, winter range is defined as habitat below 2400 feet on the north and east aspects and below 3500 feet on the south and west aspects. The rest is classified as summer range.

Within the 26 units proposed for treatment, habitat is classified as thermal cover due to the amount of canopy closure and tree height. Big game use within these units varies but is quite high where hardwood or wetland openings occur or where adjacent to forage areas.

Forage and cover habitat and their distribution in time and space are the primary factors that limit deer and elk populations (*Brown 1985*). Both species utilize edge, where food and cover habitat come together. The majority of elk use of forage areas occurs within 300 feet of edge and the majority of elk use of cover occurs within 900 feet of edge (*Wisdom, et al. 1986*). Use patterns may change during periods of severe weather or when they are intensively hunted.

Roads open to vehicle traffic can impact both deer and elk populations. Road traffic can reduce deer and elk use of available habitat through disturbance, where animals are forced out of an area, and can stress individual animals through fear, causing an increase in metabolic rates and the use of energy reserves. Such stress can be particularly critical during winter and spring seasons when their body condition is poor and forage quality is low. Finally, open roads increase the opportunity for poaching to occur. Roads closed to vehicles do not disturb deer and elk and are often used as travel lanes and forage sites. Current habitat model indices for road conditions are shown in Table 20. This project would use changes in these indices as criteria for comparing alternative effects on big game habitat effectiveness.

Table 20: Current Roading Conditions

Variable	Canal	Galena	Upper Quartzville
Miles of open road	40.9	25.1	64.8
Miles of closed road	9.4	3.6	11.5
Open road density miles/square mile	2.4	1.9	2.6

Environmental Consequences – Big Game

Direct and Indirect Effects

Alternative 1 – No Action: There are no direct, indirect, or cumulative effects under Alternative 1. Habitat values within the two low emphasis areas (Canal and Galena) are currently within Forest objectives but HE forage is below forest objectives in Upper Quartzville, a moderate emphasis area. There would be no immediate change to these values under this alternative.

Over time the overstory canopies in the proposed units would continue to close, retarding understory development for several years or decades until gaps begin to form as the stands self-thin. During the time before self-thinning, forage would likely be reduced even more in these stands. As self-thinning begins to occur, the understory would begin to develop as increased sunlight reaches the forest floor. Open road density in each emphasis area is not expected to change, unless the roads close naturally.

Alternatives 2 and 3: These two alternatives would increase the development of big game thermal habitat and improving the quality of big game forage habitat by introducing small gaps into the stands. Reducing tree density would allow more structural diversity to develop in the stands and increased sunlight to the forest floor would encourage development of the understory. Thermal cover is most valuable to big game on winter range when the overstory canopy can intercept and hold a substantial amount of snow and has small dispersed openings for foraging. The areas of dominant tree release would create small (<1/4 acre) gaps to provide additional areas of well-distributed, native forage habitat on both winter and summer range. Just over 14 miles of road in Alternatives 2 and 3 would be closed with berms or gates. In the reasonably foreseeable future an additional 15+ miles of roads are also proposed for closure as funds become available. Open road density would decrease in all three analysis areas (*see Tables 21).* Habitat values would improve slightly for both HE roads and HE overall but would remain the same for the other habitat variables. Both action alternatives result in a positive HE values trend.

Table 21: Road Conditions and Habitat Values for Big Game in Alternatives 2 and 3

Variable	Canal		Galena		Upper Quartzville	
	Before Treatment	After Treatment	Before Treatment	After Treatment	Before Treatment	After Treatment
Miles of open road	40.9	29.1	25.1	22.7	64.8	49.3
Miles of closed road	9.4	21.1	3.6	6.0	11.5	27.0
Open road density miles/square mile	2.4	1.7	1.9	1.7	2.6	2.0
HE roads	0.45	0.52	0.49	0.51	0.43	0.49
HEI overall	0.53	0.55	0.55	0.56	0.56	0.58

Cumulative Effects – Big Game

The analysis area for cumulative effects is the project planning area. Under the previous management scenarios, past timber harvest units within the Quartzville LSR were designed to provide for a distribution of big game forage and cover across the landscape. In general this was achieved throughout most of the LSR. In addition, an extensive road system was developed to access these harvest units.

Most of the created forage areas are now hiding or thermal cover. There has been very little development of new forage areas in recent years, except on private lands. This project would provide some low-quality forage for a few years, depending on how quickly the forest canopies close back in. Planned road closures in Alternatives 2 and 3 would provide increased security from motor-vehicle harassment. There are no additional habitat altering projects on Forest Service land at this time within the Quartzville LSR. Logging on private land to the west is expected to continue providing some minimal forage habitat.

4. Primary Cavity Excavators

Introduction*:* Snags (*dead and dying trees*) are important structural components of forest communities and are used by wildlife species in a variety of ways. In forests of western Oregon, snags are used by nearly 100 species of wildlife, of which 53 species (*39 birds and 14 mammals*) are cavity dependent (*Brown 1985).* Snag height, diameter, decay stage, and species of snags provide a range of habitat features for a variety of wildlife species. Hollow trees and snags are uncommon but are especially valuable habitat for some wildlife. Defective trees with deformities such as snow breaks, dead or broken tops, heartrot, and mistletoe brooms also provide valuable habitat for wildlife species.

Down woody material (*stumps, root wads, limbs, bark, and logs*) is also an important component of forest communities. In addition to cycling minerals and nutrients within the forest ecosystem, it creates structure and diversity of habitats for a variety of terrestrial and aquatic wildlife. Logs in various stages of decay are used by many wildlife species. Larger diameter logs provide habitat for a greater range of wildlife species and persist over a longer period of time than smaller material. In general, the larger the down wood the better it is for wildlife but even small material is better than none since small logs would provide habitat for some wildlife species (*Maser et al. 1979*). Hollow logs, like hollow trees and snags, are extremely valuable to wildlife and should be retained wherever they occur.

Purpose and Need: One of the desired stand characteristics that this project is trying to develop in the young, managed stands proposed for treatment is an ample supply of snags and down woody material to help meet desired late-successional or old growth habitat characteristics.

Analysis Area: The individual harvest units and subwatersheds were the areas analyzed for snags and down wood habitat.

Analysis Methods: A wildlife biologist did a pre-field and field review of the analysis area with respect to snag and down wood habitat. Then the Decayed Wood Advisor (DecAID) was utilized for recommendations on levels of snags and down wood that would be appropriate for the *Quartzville LSR.*

*Desired Future Conditions***:** The Willamette Forest Plan requires snags be retained in harvest units and throughout the drainage at a minimum 40% of the potential population of primary cavity excavators, and the full 100% population potential for two identified species (black-backed woodpeckers and flammulated owls). Retention of snag habitat for black-backed woodpeckers and other primary cavity excavators provides required suitable habitat for flammulated owls.

Existing Condition: Most of the snags and down wood were removed from the units being considered for thinning when they were originally harvested and broadcast burned approximately 35-45 years ago. A few large, well-decayed logs remain adjacent to landings and in drainages. There has been some accumulation of small snags and down wood from natural mortality and windthrow in these young stands, but the amount currently available is much less than occurs naturally. Young, natural stands often have large accumulations of down wood carried over from earlier stands (*Franklin et al. 1981)*.

Proposed units for this project are located in three different subwatersheds where natural stands (*seral 3 and seral 4*) comprise 61–76 % of the habitat. The amount of snags and down wood currently in these natural stands is estimated to be high, particularly in the seral stage 4 or old-growth stands.

Table 22: Distribution of Seral Stages

Seral Stage	Canal Subwatershed		Upper Quartzville Subwatershed		Galena Subwatershed	
	Acres	Percent	Acres	Percent	Acres	Percent
Seral 1- Stand Initiation	1,571	15	2,228	14	856	10
Seral 2 -Stem Exclusion	2,359	23	2,890	18	792	10
Seral 3-Understory Reinitiation	2,154	21	1,830	12	1,403	17
Seral 4 -Late-Succ./Old-Growth	4,162	40	8,493	54	4,822	59
Non-Forested & Special Habitats	189	2	411	3	293	4
Total acres on Sweet Home RD	**10,435**	**100.0**	**15,852**	**100**	**8166**	**100.0**

Environmental Consequences

Direct and Indirect Effects – Primary Cavity Nesters

Alternative 1 – No Action: As these plantations continue to grow, competition among individual trees would increase. As these trees compete for light and nutrients the intermediate and suppressed trees would begin to die. This natural mortality would contribute to increased snag and down woody habitat, but quality would be low due to the small size of the material. This small material would decay rapidly.

Alternatives 2 and 3*:* Hazard trees (*snags and live defective trees*) would likely need to be felled within the stands adjacent to work areas and along haul routes in both action alternatives. All felled hazard trees would be retained as down wood, thus adding to the existing supply of down woody material. In addition, five green trees per acre would be felled during logging operations and left on site for additional down wood.

Some small snags would be lost during harvest operations but provisions in the sale contract to leave these as down woody material and to protect existing snags, greater than 21 inches dbh during harvest operations, would increase the amount of down wood and should ensure that larger snag habitat is retained.

To mitigate for the loss of smaller snags during harvest operations and the existing deficit, five trees per acre would be topped or inoculated with native fungi following harvest operations.

The development of additional snags and down wood in the stands following harvest, along with the high quality snag and down wood habitat in the natural stands surrounding the plantations, would maintain a range of snag and down wood habitat in the *Quartzville LSR*.

Project objectives of accelerating green tree growth within the plantations to meet long-term objectives while maintaining a moderate level of snag and down wood habitat follows Strategy 3 as outlined in the Mid-Willamette LSR Assessment (*USDA and USDA. 1998b, Chapter IV, Page 131*).

Cumulative Effects – Primary Cavity Excavators

The area analyzed for cumulative effects was the planning area and individual harvest units. Past timber harvest, road construction, fire suppression and road maintenance activities (see Appendix M for more cumulative effects information).

Timber harvest, slash treatment, road building, and natural disturbances have all impacted the amount of snags and down wood habitat within the *Quartzville LSR*. Harvest and road building activities have contributed to losses in snag and down wood habitat for many decades while natural disturbances such as fire, insects and diseases have typically created snag and down wood habitat. About one third of the National Forest System lands within the LSR have been harvested since the 1950's. Much of the harvest was through clearcutting and burning where many snags and down logs were lost. Snag and down wood retention requirements have been in effect for more recent harvests, in the last 15+ years, but many young stands in the LSR are in deficit for snag and down woody habitat. Besides Quartzville LSR Thin, there are no additional habitat altering projects planned on Forest Service land at this time within the LSR. Logging on private land to the west is expected to continue on short rotations so it is unlikely these stands would ever develop large snags and down wood.

5. Pileated Woodpecker

Overview of affected environment: Pileated woodpeckers are associated with forest habitats that have large trees, especially snags, for nesting and foraging *(Csuti et al., 1997*). Pileated woodpeckers may do some limited foraging within the proposed units. The adjacent natural stands contain high quality habitat for pileated woodpeckers, due to the size of trees, canopy closure, and high levels of snags and down wood.

Environmental Consequences

Direct and Indirect Effects – Pileated Woodpecker

Alternative 1 – No Action*:* There would be no direct, indirect, or cumulative effects to pileated woodpeckers under this alternative. There would be no disturbance and no loss of current or future snag habitat. The stands would follow natural successional pathways, eventually becoming late-successional habitat in 50 years or longer.

Alternatives 2 and 3*:* Light to moderate thinning planned for these two alternatives would maintain a minimum 40% canopy closure. Through reduced crowding and competition between trees, stand vigor would improve and provide bigger, taller trees and begin the development of a multi-storied stand. Improving diversity and increasing vertical and horizontal stand structure would accelerate the stands towards late-successional habitat containing large trees and snags. Hazard trees (snags and live defective trees) would likely need to be felled within the stands, adjacent to work areas, and along haul routes in both action alternatives. Snags within the treated stands are small, less than 10 inches diameter, but may be used by pileated woodpeckers for limited foraging. Five snags/acre would be created in each stand following timber harvest to provide additional forage habitat. There would be no reduction in old-growth and mature conifer habitat.

Disturbance to pileated woodpeckers may occur from timber harvest activities during the nesting season. Seasonal restrictions identified for spotted owls and Harlequin ducks (*see Mitigation Measures Common to Action Alternatives*) would also reduce disturbance for pileated woodpeckers.

Cumulative Effects – Pileated Woodpecker

The area considered for cumulative effects was the project planning area. Past timber management within the LSR resulted in many acres of 20 to 50 year old habitat with few or no large snags remaining. Snags typically were not retained in clearcut harvest units. Snags that did survive the logging were often lost later when the harvest units were broadcast burned to remove slash. Snags were also regularly salvaged along roads from natural stands for wood volume and for public safety. By 1990, retention of large snags in harvest units improved and salvage of snags in natural stands was eliminated, except for catastrophic blowdown. Felling of snags for public safety along well traveled forest roads still occurs.

Thinning prescriptions identified for these managed stands would provide for increased tree growth and eventually large snags to improve habitat conditions for pileated woodpeckers. There are no additional habitat altering projects on Forest Service land at this time within the Quartzville LSR. Logging on private land to the west is expected to continue on short rotations so mature and old-growth habitat would likely never develop.

6. Pine Marten

Overview of affected environment: Marten prefer mature forests with closed canopies but would utilize other habitats provided down logs are available for cover (Csuti et al. 1997). Marten are likely to inhabit the project area.

Environmental Consequences

Direct and Indirect Effects – Pine Marten

Alternative 1 – No Action: There would be no direct, indirect, or cumulative effects to marten under this alternative. The stands would follow natural successional pathways, eventually becoming late-successional habitat in approximately 50 years or longer.

Alternatives 2 and 3: Light to moderate thinning planned for these two alternatives would maintain a minimum 40% canopy closure. Through reduced crowding and competition between trees, stand vigor would improve and provide bigger, taller trees and begin the development of a multistory stand. Improving diversity and increasing vertical and horizontal stand structure would accelerate the stands towards late-successional habitat containing large down wood. The increased levels of down wood after timber harvest would improve habitat quality for marten. There would be no reduction in old-growth and mature conifer habitat.

Cumulative Effects – Pine Marten

The area of consideration for determining cumulative effects is the project area.. Past timber management within the LSR has resulted in many acres of habitat with only light amounts of large down wood. Thinning prescriptions identified for these managed stands would provide for increased tree growth and eventually large down wood to improve habitat conditions for marten. Natural stands across the landscape that have not been salvaged do contain high levels of down wood. There are no additional habitat altering projects on Forest Service land at this time within the Quartzville LSR. Logging on private land to the west is expected to continue on short rotations so mature and old-growth habitat would likely never develop.

7. Peregrine Falcon

Overview of affected environment: Peregrine falcons require suitable cliffs with ledges for nest sites surrounded by a diversity of habitats for prey species. There is habitat that is suitable for peregrine falcons within three miles of proposed harvest units. Peregrine falcons would react to disturbances up to 3 air miles from the nest site (*USDI, 1999*).

Peregrines are not known to use this habitat and were not found during surveys in 2004 when reconnaissance was being done for this project. If peregrines are discovered here during the time of operation for this project, seasonal restrictions would be imposed on the harvest operations to protect the peregrines from disturbance during nesting season.

Environmental Consequences

Direct and Indirect Effects – Peregrine Falcon

Alternative 1 – No Action: There would be no direct, indirect, or cumulative effects to peregrine falcons under this alternative.

Alternatives 2 and 3*:* Thinning proposed in these two alternatives would have no effect on suitable nesting cliffs however several of the proposed thinning units are within 3 air miles of these cliffs. Most of the cliffs were surveyed to protocol in 2004 but no peregrine falcons were detected. With either seasonal restrictions, or surveys during the year of operation, there should be no effect to peregrine falcons or cliff nesting habitat *(See Appendix H: Wildlife Biological Evaluation).*

Cumulative Effects – Peregrine Falcon

The area of consideration for cumulative effects is the project area. Past timber management within the Quartzville LSR has resulted in a variety of habitats surrounding suitable nest cliffs. This variety of habitats is likely beneficial in encouraging a range of bird species to provide peregrine falcon prey. This project would encourage plant and structural diversity within the units thereby improving habitat conditions for peregrine falcon prey species. There are no additional habitat altering projects on Forest Service land at this time within the Quartzville LSR. Logging on private land to the west is expected to continue on short rotations.

D. Survey & Manage Species

1. Red Tree Voles

All proposed harvest units are in previously managed stands. Habitat is not suitable for red tree voles in the proposed harvest area.

2. Bats

Sites commonly used by bats for roost sites and hibernacula include caves, mines, snags and decadent trees, wooden bridges and old buildings. Provisions for retention of large snags and decadent trees are included in the standard and guidelines for green tree patches in the Matrix. Caves and abandoned mines, wooden bridges and buildings require additional protection measures to ensure their habitat value is maintained. No caves, abandoned mines, wooden bridges or buildings were found in near the proposed harvest units in the project area.

3. Great Gray Owl

Within the range of the northern spotted owl, the great gray owl is most common in coniferous forests adjacent to meadows. Surveys to determine occupancy are required in habitat that is above 3000 feet in elevation, within mature stands with greater than 60% canopy cover, and within 1000 feet of meadows larger than 10 acres. Known nest sites require a 1320 foot protection buffer and natural meadows require a 300 foot no-harvest buffer. The planning area does not possess meadows greater than 10 acres.

E. Migritory Birds

1. Neotropical Migrants

On January 10, 2001 an executive order was signed to protect migratory land birds. One purpose of the order is to ensure that environmental analyses evaluate the effects of actions on migratory birds. Habitats vary broadly for this group of species.

There are 85 bird species recognized as neotropical migrants on the Willamette National Forest. Thirty-five of these species are identified as “species of concern” in “Neotropical Migrants on National Forests in the Pacific Northwest” by Brian Sharp (*1992)*. These species are associated primarily with old growth, riparian, rocky cliffs, or grass habitats.

Environmental Consequences

Direct and Indirect Effects – Neotropical Migrants

Alternative 1 – No Action: There would be no disturbance or impacts to migratory land birds. Any large scale changes in species diversity or numbers would be dependent on natural and human-caused disturbances, primarily wild fire. More subtle changes would occur through time as tree density is reduced through natural thinning where snags and down wood are created through suppression of the overstory and the understory develops from increased sunlight to the forest floor.

Alternatives 2 and 3: The light to moderate thinning planned for each of these alternatives would result in a forest canopy closure of 40 to 60% within the plantations. Thinning should increase structural diversity within the stands by reducing competition of the overstory trees and accelerate understory development from increased sunlight to the forest floor. This would create a more open forest community than currently exists, benefiting some bird species but having a negative impact on others.

One study completed on bird response to thinning young Douglas-fir forests in the Oregon Coast Range (*Hayes et al. 2002*) showed that of the 22 bird species statistically analyzed, detections of nine species decreased and eight species increased relative to controls following thinning. Five species showed no change. The magnitude of response (either positive or negative) for eight of the 17 species varied with thinning intensity. This same general trend of bird response to thinning occurred in the Willamette National Forest Young Stand Thinning and Diversity Study. Four species had a positive response to thinning and six had a negative response (*Hager and Howlin 2001*). The authors identified five additional uncommon bird species that had much higher detection rates after the stands were thinned, indicating a positive response to thinning. A fairly large number of species in this study had no response.

Habitat for cavity nesting migratory birds would be lost through the removal of small snags within the units and hazard tree removal next to work areas and along roadways. Snag creation within the units after logging is complete would help mitigate for this loss. This thinning project would influence the abundance of migratory bird species in each stand. For those species that are negatively impacted, there are areas of no-harvest (primarily riparian habitat) where canopy closure would remain close to 100% and the small snags would remain.

Timber harvest activities during the spring and summer may also impact migratory birds through disturbance during the nesting season. Seasonal operating restrictions planned for spotted owls and Harlequin ducks (*see Mitigation Measures Common to Action Alternatives*) would eliminate disturbance in some stands for most of the migratory bird nesting season.

Cumulative Effects – Neotropical Migrants

The project area was considered for cumulative effects. Past timber management within the Quartzville LSR has resulted in a variety of habitats across the landscape. This variety of habitats is beneficial in providing for a range of migratory bird species within the Quartzville LSR. Different bird species occupy different habitats so changing one habitat to another through habitat manipulation can have an impact on migratory land birds, either positive or negative. This commercial thinning project would create a more open forest canopy and encourage shrub and understory vegetation development within the plantations, benefiting those bird species that utilize this type of habitat. There are no additional habitat altering projects on Forest Service land at this time within the Quartzville LSR. Logging on private land to the west is expected to continue providing early to mid seral habitat.

Fisheries

The project is located in Upper Quartzville, Galena Creek and Canal Creek sixth-field subwatersheds. Within these watersheds there are at least eight streams that support game and non-game fish (*see fish distribution map below (Figure 14) outlining historic winter steelhead distribution in pink, fish-bearing streams in the wider blue lines, other streams in lighter, narrow blue lines, roads in dashed black and white lines and proposed harvest units outlined in red).* Historically winter steelhead and spring Chinook salmon, both anadromous species, used Quartzville Creek for spawning and rearing. "…Upstream migration of both species in mainstem Quartzville Creek was blocked by a barrier waterfall at approximate river mile 15.3, which is located about 1.8 miles upstream from the mouth of Canal Creek. Upstream migration of Chinook may have been blocked by a steep cascade near the mouth of Yellowbottom Creek, just below the analysis area. Many Quartzville Creek tributaries were probably utilized by steelhead, and the larger ones by chinook, when accessible" (*USDA and USDI. 2002, Chap IV, pg 12*).

Construction of Foster and Green Peter dams blocked anadromous fish passage to historic spawning and rearing areas in the Middle Santiam and Quartzville drainages. Attempts have been made over the years to reestablish anadromous fish populations above the dams but have not been effective above Green Peter Dam to date.

Above Foster Dam, populations of Endangered Species Act (*ESA*) listed spring Chinook salmon have been reestablished and winter steelhead have been maintained in the South Santiam River.

Of the smaller steams, Minniece, Johnny, Galena and McQuade Creeks support resident salmonids.

Analysis Methods: Primary information sources used to analyze the existing condition of the Quartzville LSR Thin analysis area include the following information sources:

- Willamette National Forest Geographic Information System (GIS) Database.
- Aerial photos.
- Field reviews of the project area.
- Information from other resource personnel, including the hydrologist, wildlife biologists, silviculturist, fuels specialist, logging systems specialist and an engineer (roads).
- Region 6 Protocol Stream Surveys (1990's)
- Quartzville Watershed Analysis (2002)
- Other resource specialist reports prepared for this project

The District Fisheries Biologist reviewed existing information listed above and determined which streams, in the various units proposed for harvest, had incomplete information about fish distribution and aquatic habitat condition. These streams were identified for survey. Then a survey crew was put together to check identified streams for fish presence/absence reviews and to check the condition of stream crossings.

Desired Conditions for salmonid habitat in this area include: cooler summer-time water temperatures that meet State water quality standards, increased large woody material that adds structure to stream channels, less sediment production, more spawning gravel deposition, more and deeper pools, and an increase in stream-side cover.

Existing Aquatic Habitat Condition: Existing condition information for fish and fish habitat comes from stream surveys and accompanying reports completed in the 1990's. These surveys are incorporated into this document by reference and are available for public review at the Sweet Home District office.

Fish Habitat: Habitat for salmonid fish is fair to good in smaller streams in the analysis area. Larger streams such as Canal and Quartzville creeks, on the other hand, are in need of additional structure in the form of large woody material to intercept and trap more spawning-size gravel in the stream channels. Past management activities and flood flows have resulted in widened and shallowed streams channels contributing to increased stream temperatures and reduced channel complexity.

Life History Characteristics: General habitat requirements for various fish in the project area are very similar in that they require cold, clear water, a complex of diverse habitat (pools, riffles, etc.), hiding cover (logs, cutbanks, debris mats), spawning and rearing areas, and food. The quality of fish habitat is dependent on the quality of the stream channel and surrounding riparian area. Organic material (cones, leaves, stems, logs, insects, etc.) introduced into the stream channel and riparian area influence the type of food or habitat available to fish. If the organic material is decreased or removed, the quality of the habitat decreases.

Although different salmonid species have the same basic habitat requirements, differences in temperature adaptations exist. Generally, salmonids require a water temperature of 65 degrees F or lower to thrive. Most species can survive temperatures as high as 70 degrees F for short periods of time. However, such temperatures decrease growth rates, spawning, migration, and stamina among other things.

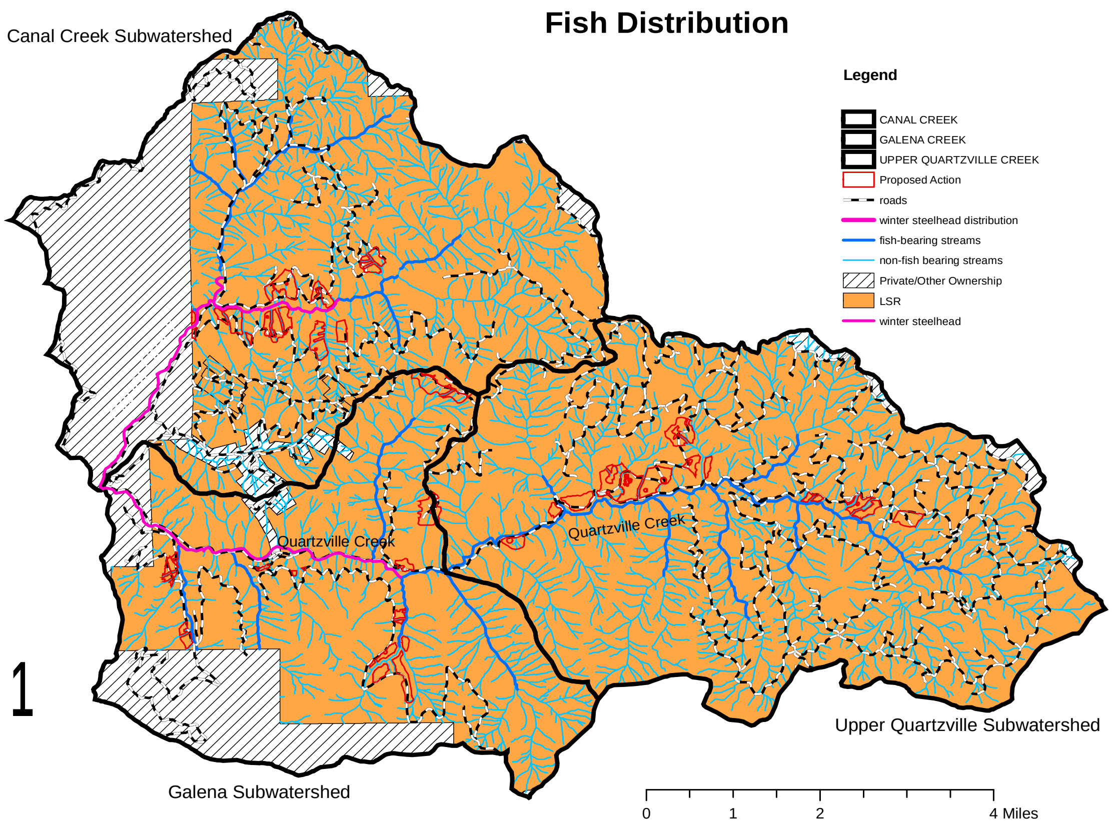


Figure 14: Fish Distribution

Management Indicator Species (MIS) - anadromous salmonids: Winter steelhead and spring Chinook salmon are both listed as threatened species in this area. Winter Steelhead are not present in Quartzville Creek at this time and haven't been for many years (*1980's*). Adult spring Chinook salmon have not been present in the Quartzville drainage for many years either. Juvenile Chinook were recently (*2004 and 2005*) released in upper Quartzville Creek in the form of 100,000 pre-smolts at 100 to the pound and as 100,000 fry each year (*2004 and 2005*). Some of these fish were found in the sport catch in April of 2005 as 8 to 9 inch fish but none were found in the creel in May. It was surmised they worked their way down through the reservoir and exited the system. Although an angler was interviewed in the fall of 2005 who said he caught a Chinook about 16 inches long at the end of the 2005 summer.

Resident salmonid fish are found in three forms in Quartzville Creek: cutthroat trout, resident rainbow trout and catchable rainbow trout. The catchable rainbow trout are stocked by the Oregon Department of Fish and Wildlife to maintain a sport fishery in the drainage by stocking 8,000 legals over the summer time period. Map Number 15 in the Quartzville Creek WA shows streams that support resident trout populations *(Refer to Appendix L for Fisheries Biological Assessment)*

Environmental Consequences

Direct and Indirect Effects – Fisheries

Alternative 1 (No Action)

No direct effects on resident or anadromous fish or their habitat is expected from Alternative 1, the No Action Alternative. Retention of shade along stream channels would help maintain stream temperature.

Not thinning trees in the Riparian Reserves would indirectly delay development of large trees in riparian areas that would eventually provide channel structure, in the form of large wood, to streams.

Alternative 2

There should be no direct effects on fish or aquatic resources from implementation of this alternative but there may be some short term *(<5 years*) indirect effects from ground disturbance during harvest activities. The analysis of the alternatives is more of a risk assessment than an actual measurement of effects. Thinning 828 acres of land, skid trail use during ground-based yarding, two intermittent stream crossings, landing development and use and road activities (*including construction of 100 feet of a native-surface, temporary road, reconstruction of 1.4 miles of closed logging spur roads constructed during the first harvest entry, reopening 5.28 miles of system roads and doing 25 miles of road maintenance*) could cause the production of sediments that could affect aquatic habitat. Unit design and prescriptions help to minimize sediment production by retaining intact buffers along stream channels that create filter zones to minimize sediment delivery to streams. Temporary road construction and reopening occurs outside the no-harvest buffers on streams, also leaving sediment filter zones between the roads and the streams. On fish-bearing streams the no-harvest stream buffers are 100 feet from stream channels. In perennial, non-fish- bearing streams, the buffers are variable in width from 66 to 172 feet from the stream (*see Table 6 for more information on harvest within riparian reserves*).

These buffers, plus implementation of Best Management Practices, and other required mitigation (*see Table 14*) should adequately protect fish and aquatic habitat from sediments from roads and management activities.

Leaving all the primary shade zones along stream channels intact should maintain stream temperatures.

Not harvesting in the primary shade zones along stream channels, would not accelerate attainment of large trees near streams that would eventually contribute to large woody structure in the stream channels.

Alternative 3

There should be no direct effects on fish or aquatic resources from implementation of this alternative but there may be some short term *(<5 years*) indirect effects from ground disturbance during harvest activities. The analysis of the alternatives is more of a risk assessment than an actual measurement of effects. Thinning 828 acres of land, skid trail use during ground-based yarding, one intermittent stream crossings, landing development and use and road activities (*including reconstruction of 0.64 miles of temporary spur roads, reopeing 4.59 miles of system roads and doing 25 miles of road maintenance*) could cause the production of sediments that could affect aquatic habitat. Unit design and prescriptions help to minimize sediment production by retaining intact buffers along stream channels that create filter zones to minimize sediment delivery to streams. Temporary road construction and reopening occurs outside the no-harvest buffers on streams, also leaving sediment filter zones between the roads and the streams. On perennial streams the no-harvest stream buffers are 172 feet from stream channels, which are generally wider than in Alternative 2.

These buffers, plus implementation of Best Management Practices, and other required mitigation (*see Table 14)* should adequately protect fish and aquatic habitat from sediments from roads and management activities.

Leaving all the primary shade zones and some secondary shade along fish-bearing, perennial stream channels intact and not harvesting in the Riparian Reserves on perennial, non-fish-bearing streams should maintain stream temperatures.

Not harvesting in the buffers along stream channels, would not accelerate attainment of large trees near streams that would eventually contribute to large woody structure in the stream channels.

Cumulative effects – Fisheries

The area of consideration for cumulative effects was the Quartzville LSR Thin analysis area. Cumulative effects on aquatic habitat and water quality in the Quartzville Creek watershed have been primarily tied to past timber harvest activities, road building, road maintenance, stream restoration projects, road failures, and hydrologic storage of roads. Some of these management activities probably led to negative cumulative effects on fish habitat such as increased sediment, turbidity and stream temperature increases due to not having up-to-date standards and guidelines to guide these activities.

Stream restoration projects helped to mitigate some of the past affects of various management activities and natural events such as fires and floods on fish habitat in treated areas by adding structure to stream channels. This structure, usually in the form of large woody material, helped to increase available pool habitat, collect sediments and spawning gravels and improve the overall quality of fish habitat in treated areas.

In addition, vegetative growth has stabilized soil and provided stream shade, thus helping the watershed to recover from past activities.

No significant cumulative effects are expected from this alternative due to past, present or reasonable foreseeable federal or non-federal projects in which effects overlap in both time and space, as long as Best Management Practices, Forest Plan Standards and Guidelines, In Water Work Guidelines, Northwest Forest Plan Standards and Guidelines, and mitigation actions are followed.

Consistency with Direction and Regulations

- ***Willamette Forest Plan*:** The alternatives are consistent with forest plan direction. None of the potential combined effects are expected to further reduce aquatic habitat elements below forest plan standards, adversely affect the viability of aquatic TES species, or increase watershed effects over natural, post-fire levels.
- ***NW Forest Plan**:* The application of the *NW Forest Plan* direction is expected to maintain or improve fish habitat conditions in the project area.
- ***Endangered Species Act:*** All alternatives are consistent with Endangered Species Act direction.
- ***Clean Water Act Section 303(d):*** Quartzville Creek is currently on the 303(d) list for water temperature concerns for summer rearing of salmonids. For all of the alternatives, no additional disturbance to the remaining shading vegetation on any stream riparian area would occur on perennial or fish-bearing streams. No measurable change in water temperature is predicted in any perennial stream as a result of any proposed alternative. 303(d) listed streams would not be at risk from any increased temperature from project activities.
- ***Executive Order 12962, Recreational Fisheries:*** Recreational fisheries are limited in the Quartzville Creek project area by legacy water quality and habitat degradation. All alternatives include aquatic conservation actions that would improve the quantity, function, sustainable productivity, and distribution of recreational fisheries as directed under Executive Order 12962, Recreational Fisheries
- ***Executive Orders 11988 and 11990:*** The proposed alternatives would have no impact on floodplains or wetlands as described.

Conclusions and Rational: None of the alternatives are expected to have any effect on threatened species of their habitat since they are not known to be present in the analysis area and have not been for many years. Given that spring Chinook have been planted above the dams, it is surmised that they worked their way down through the reservoir and exited the system. If these fish survive to spawn, or if adults are released into Quartzville Creek to spawn, this expectation should be reevaluated.

It is not expected that there would be any significant impact to resident fish populations from harvest activities in the Quartzville Creek Watershed due to the proposed riparian buffers and the mitigation actions listed above.

When considering risks, although no effects to fish and aquatic resources are expected, Alternative 2 has the highest risk of potential effects because it thins more acres in Riparian Reserves than Alternative 3 (*383 acres thinned in Riparian Reserves in Alternative 2 vs. 84 acres in Alternative 3*) and has more ground disturbance (*100 feet of temporary road construction, about ¾ mile more existing temporary roads reconstructed, and about 0.7 miles more of reopening system roads*). This risk is tempered by protection measures in unit design, no-harvest buffers, implementation of BMP's and other mitigation.

Monitoring: Implementation monitoring would be done to ensure that mitigation measures identified in the EA are implemented and included in the sale contract to give the sale administrator the authority to enforce their implementation.

*Irreversible and Irretrievable Commitments of Resources***:** No irreversible effects are expected. Reduced fish population viability could be an irretrievable commitment of resources, but is not expected due to the application of Northwest Forest Plan Standards and Guidelines.

Vegetation – General

*Stand Structure, Vigor and Diversity***:** Recent studies of old-growth forest development in the central Oregon Coast Range suggest that today's young, managed stands may not develop old-growth characteristics without thinning (*Muir et al. 2002*). This and other western Oregon studies support the notion of thinning young stands to accelerate the development of old forest structures. These studies have shown that thinning can help develop large diameter branches, large deep crowns, wind-firm stems, and can help develop a diverse understory of shrub and herbs.

Existing Landscape Conditions: The stand development of the proposed units is in the stem exclusion stage as included in the following definitions of seral stages in "Forest Stand Dynamics" written by Chad Oliver (1990, pp. 148-159):

- ***Stand Initiation* -** After a disturbance, new individuals and species continue to appear for several years.
- ***Stem Exclusion* -** After several years, new individuals do not appear and some of the existing ones die. The surviving ones grow larger and express differences in height and diameter; one species and then another may appear to dominate the stand.
- ***Understory Reinitiation* -** Later, forest floor herbs and shrubs, and advance regeneration reappear and survive in the understory, although they grow very little.
- ***Old-Growth* -** Much later, overstory trees die in an irregular fashion, and some of the understory trees begin growing to the overstory.

Appendix C in the *Mid-Willamette LSR Assessment* (1998) classifies these plantations as early mid-seral stage because of their age and mid-seral because of the dominant size class of 9-21 inches. The average Quartzville stand diameter is 11 inches and ranges between 7- and 22-inch trees (*see analysis file for summary of 2000 Stand Exams*). Since these plantations are growing in relatively highly-productive sites they have larger diameters, however, there is little understory development, and the forest floor is relatively bare of herbs and shrubs; relating to the stem exclusion stage addressed in the above definition.

In Chapter 7, page 6, of the *Quartzville Watershed Analysis* (2002) density management and thinning is recommended to develop and maintain late-seral forest stand characteristics. The following table displays the distribution of seral stages in the planning area subwatersheds. Approximately 51% of the three subwatersheds are in the late-successional seral stage and 18% is in the stem exclusion (early seral) stage. Thinning the stem exclusion stands would increase the rate they would grow into the desired understory reinitiation and late-successional structure. The remaining trees after thinning would have more growing space and nutrient availability thus increasing their vigor.

Table 23: Distribution of Seral Stages

Seral Stage	Canal Subwatershed		Upper Quartzville Subwatershed		Galena Subwatershed	
	Acres	Percent	Acres	Percent	Acres	Percent
Seral 1- Stand Initiation	1,571	15	2,228	14	856	10
Seral 2 -Stem Exclusion	2,359	23	2,890	18	792	10
Seral 3-Understory Reinitiation	2,154	21	1,830	12	1,403	17
Seral 4 -Late-Succ./Old-Growth	4,162	40	8,493	54	4,822	59
Non-Forested & Special Habitats*	189	2	411	3	293	4
Totals on Sweet Home RD	**10,435**	**100.0**	**15,852**	**100**	**8,166**	**100.0**
Sweet Home RD	**10,435**	**69**	**15,852**	**100**	**8,166**	**77**
Other Federal Lands	**2,674**	**18**	**0**	**0**	**106**	**1**
Private Ownership	**2,004**	**13**	**0**	**0**	**2,392**	**22**
Totals in the entire Subwatershed	**15,113**	**100**	**15,852**	**100**	**10,664**	**100**

For this analysis special habitats are considered non-forested stands. However, not all non-forested areas are special habitats.

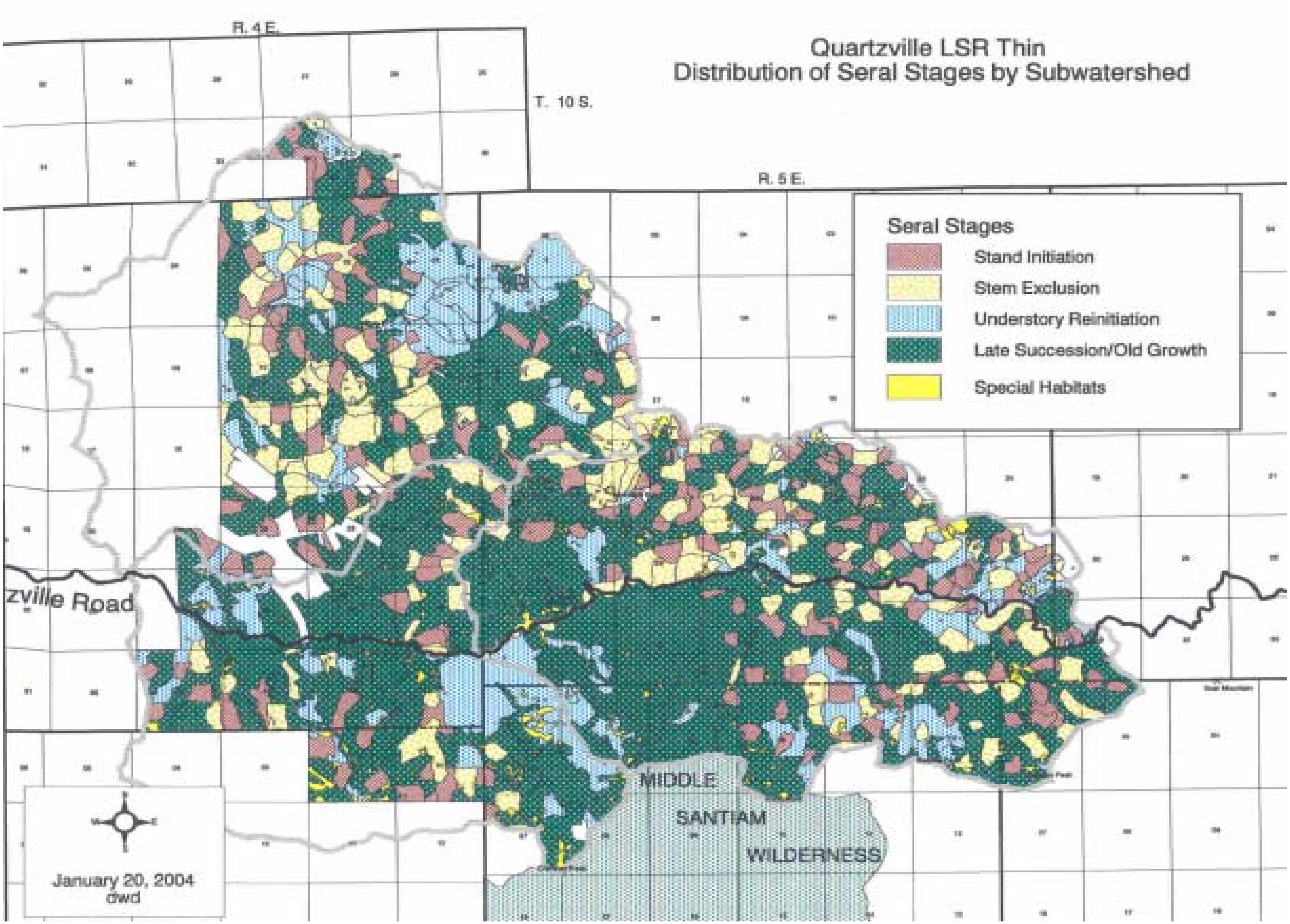


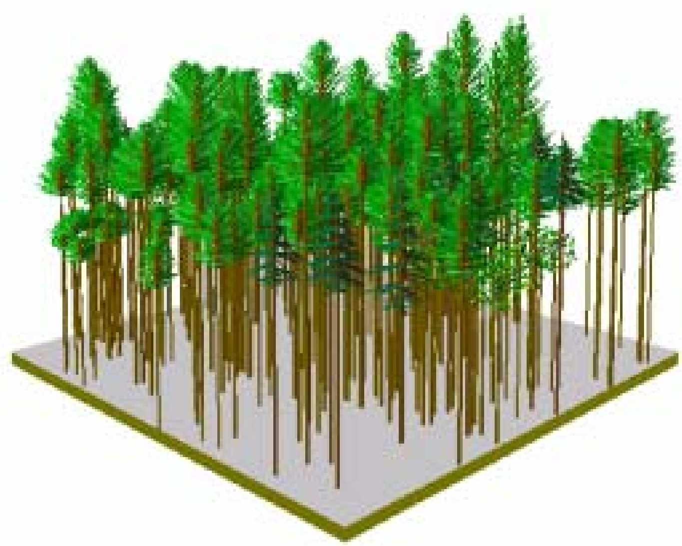
Figure 15: Seral Stage Distribution

Existing Stand Conditions: Stand vigor and growth is slowing, as indicated by decreased radial growth from stand exam increment boring core samples. Some smaller diameter trees have begun to die due to overcrowding and competition between trees for nutrients and light. These dense, even-aged, single-canopy stands are in early- to mid-seral development and have not yet transitioned to late-successional forest habitat.

The existing conditions of all the managed stands proposed for treatment are the result of clearcutting between 1961 and 1972. Since initial reforestation, additional conifer and hardwood seedlings have entered these stands through natural seeding. Generally, these 35-45 year old plantations are dense, even-aged, single canopy stands ranging from 200 to 340 trees per acre greater than 7-inch diameter. Stands average 11 inches in diameter. Considerable investment has been made as evidenced by 22 of the 27 stands being precommercially thinned at age 15. Fertilization has also occurred on 9 of the stands indicating high productivity potential.

The stands are mainly at lower elevations below 3,400' and are primarily composed of Douglas-fir. As elevation increases more true firs are present; Units 8, 10, 11, 19 and 20 are at or above 3,400'. Slopes range from 10% to 90% and average 40%. Usually, growth potential is better at lower elevations on the gentler slopes.

The 27 stands have a Relative Density (RD) range of 45% to 69% with an average of 52%. Relative Density is a percentage of the maximum Stand Density Index (SDI). SDI defines the limits of maximum stocking. Optimum densities for most combination of factors of a stand occur between 35% and 55% RD (*Drew and Flewelling, 1979*). At lower densities, greater than 15%, less growth per unit is obtained but this is offset by greater growth per tree. These 35-45 year old stands are approaching 55% RD and 11 of these stands are over 55% which is the point at which competition induced mortality starts.



Existing Stand Condition
Modeled at Age 40 at year 2002

Environmental Consequences

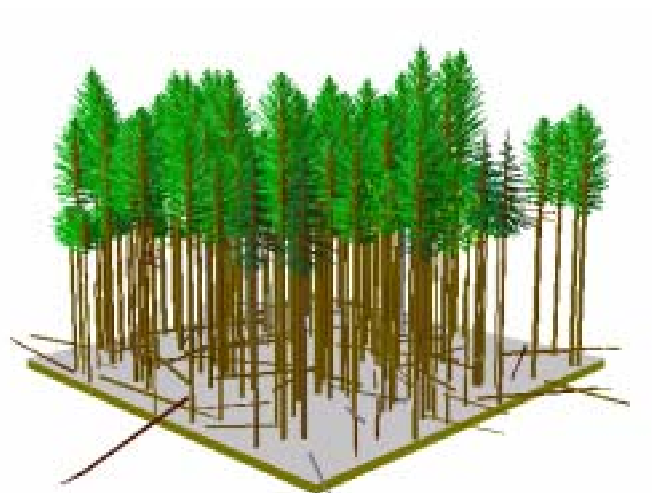
Direct and Indirect Effects – Vegetation – General

Alternative 1 – No Action*:* These plantations would continue to grow gradually, over time but they would develop differently from existing stands that have achieved old-growth dimensions (*Tappeiner et al. 1997*). Tappeiner states "…it appears that the old stands developed with low-density, regenerated over time, and had little inter-tree competition."

Inherent in managed stands are high-density plantings to ensure growth survival. For these stands, Douglas-fir would become more dominant as crowns crowd together and shade out understory conifers, shrub vegetation, and many hardwoods. The dominant trees would continue to develop and many of the intermediate and suppressed trees would slowly be removed from the stand through mortality and decay. On most acreage, the stems per acre would decrease to approximately half of current conditions in about 70 years. A relatively even-aged stand of predominately Douglas-fir would emerge with a scattering of shade-tolerant conifers in the understory.

In those areas with heavy stocking and stagnant growth, little change would occur and trees in these stands would remain small and suppressed. In overstocked conditions, crowns become smaller indicating less vigor and more susceptibility to insect and disease attack.

The desired future condition to accelerate late-seral characteristics would not occur through the No Action Alternative. Through modeling, the stands are predicted to reach some late-successional characteristics such as large Douglas-firs at stand age of 200 or year 2163. However, there is no new cohort or multiple canopies developing, the shade tolerant trees are stagnating and there is a lost opportunity for recovery of wood fiber.



Alternative 1 – No Action
Growth Modeled at Age 80 at year 2043

In the Gordon Three Thin Environmental Assessment (2004) Unit 10 was used as a sample stand and modeled to grow out over 200 years. This sample stand is similar to the low elevation,high-site, managed stands at Quartzville.

Stand growth and treatments were modeled using the updated Forest Vegetation Simulation (FVS) Model 6.21, Suppose Version 1.14, Westside Cascades Geographic Variant (*Wykoff, et al. 1982*). This model simulates the growth and yield of stands over time. Treatments were modeled for ten-year increments to a 200-year time period. Model runs are available in the analysis files at the Sweet Home Ranger District and as of

January 2006 on the Willamette National Forest web page under Resources, NEPA Projects Documentation, Sweet Home, and Gordon Three Thin EA and Appendix I.

In summary, the plantations would continue to grow with competition increasing among individual trees. This competition would result in natural mortality increasing for the intermediate and suppressed trees. These dead trees would increase both snag and down wood levels but would provide only low quality habitat due to the small size that would decay rapidly.

Alternatives 2 and 3

The proposed stand treatments have been designed to meet the purpose and need of accelerating the development of late-successional stand characteristics in young stands within the Quartzville LSR, while also meeting other resource requirements/objectives.

Alternative 2 thins 828 acres and Alternative 3 thins 557 altogether. The main difference between these action alternatives are the acres treated in riparian reserves. Of the 828 acres treated in Alternative 2, 383 are in Riparian Reserves. Only 84 acres are treated in Riparian Reserves in Alternative 3. The untreated areas in the Riparian Reserves would take longer to reach late-successional stand characteristics.

Optimum densities for most stands occur between 35% and 55% Relative Density (RD); and at lower densities, greater than 15%, less growth per unit is obtained but this is offset by greater growth per tree (*Drew and Flewelling, 1979*). Alternative 2, after thinning, would have a range of 26% to 43% RD and an average of 34% RD. Alternative 3, after thinning, would have a range of 28% to 50% RD and an average of 40% RD. Both action alternatives would be near or within optimum average RD; however, Alternative 2 would treat more acres and would have greater tree growth towards meeting late-successional characteristics sooner.

Project objectives are to encourage the development of the following six stand characteristics and are met with the prescribed treatments for both alternatives. More specific direct and indirect effects are further discussed in the next pages.

1. An appropriate stand component of large diameter trees – both alternatives reduce stand densities by approximately 50%. Average stand densities are 250 trees per acre (TPA); prescriptions reduce densities to 70, 90, and 110 TPA. By decreasing inter-tree competition more light and nutrients are available to the residual trees which grow faster as a result. Refer to diameter growth discussion and table.
2. Variations in stand densities that are occasionally interspersed with small openings – three densities are prescribed interspersed with quarter-acre gaps, plus some areas are left unthinned.
3. Multi-layered stands with well developed understories – reducing the tree densities would open up the stand so more light can reach the ground to promote shrub and young tree growth.
4. Snags and down woody material of sufficient size and arrangement to meet habitat and ecological needs – by thinning, 4 to 5 inches of growth is gained in 40 years.

5. Complex stand structure and diversity – see 1-4 and 6.
6. Diverse, native species composition including hardwoods and other minor species – Unit prescriptions in the Appendix state Douglas-fir, noble fir, Western hemlock and red alder would be thinned; all other species would be retained and cedar over 10-inch diameter would be spaced off for leave trees. Cedar would also be planted in Unit 13. This would provide a diverse composition of native species.

Both alternatives have similar thinning treatments applied to the 27 units. Growth projections and modeling of future stand conditions were analyzed by the FVS model for three thinning density reductions to 70, 90, and 110 TPA. Trees per acre reflect the net tree numbers to be retained on each stand after snag and coarse wood prescriptions are met.

The sample stand used, Gordon Three Thin Unit 10, is somewhat better than average with respect to growth than the other units, but is representative in species composition, aspect, slope, and general attributes of the stand. The model uses data from stand exam plots taken to the Pacific Northwest Forest Service Region 6 specifications.

The results of this growth model are displayed in the diameter growth figure for the stand when thinned in year 2003 to 70, 90, and 110 TPA (respectively) and grown to age 80 at 2043. The most notable result is increased small tree regeneration with thinning; allowing more light to the ground for seedling and understory development (refer to the No Action Model figure).

Diameter growth rates would increase as a direct effect of thinning. The resulting stand, freed from inter-tree competition, would have large-diameter trees sooner thus accelerating the development of late-successional structure. At age 80, the quadratic mean diameter greater than 7 inches (at Diameter Breast Height –DBH) would be three to four inches larger than if left un-thinned (*see Table 24);* thinning to 70 TPA results in 22.48 inch diameter at age 80 versus with no treatment (*existing 225 TPA at average 11 inch diameter*) the trees grows slower reaching 18.42 inch diameter at age 80.

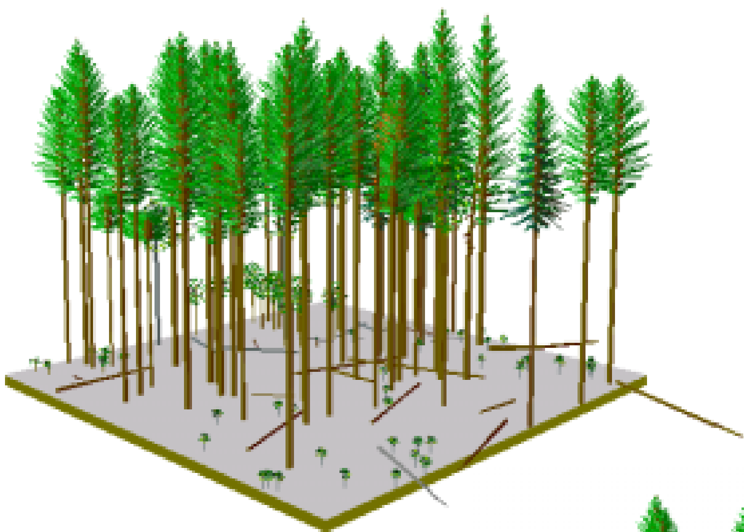
Table 24: Diameter Growth Simulation using FVS Model

Age 40 @2003	Age 80 @2043
Thinning Density (Trees per Acre)	Diameter (DBH) in Inches
Existing 225 TPA	18.42
Thin to 70 TPA	22.48
Thin to 90 TPA	22.05
Thin to 110 TPA	21.55

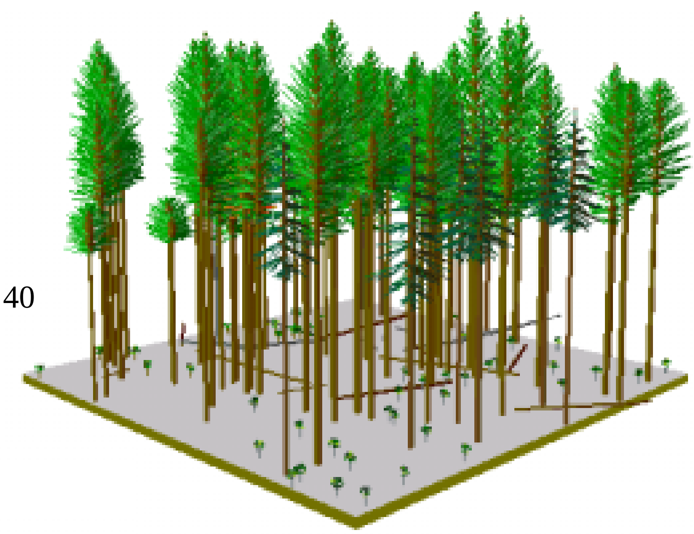
Increased growth rates would speed the development of high-quality snags and large, coarse woody debris.

Live-crown ratios would increase under all treatments. Conifers go through a replacement period within their crowns after thinning, where needles maintained under low light (shade needle) would be replaced by needles adapted for higher light conditions (sun needles). Once that replacement occurs, crown growth would accelerate until crowns grow together and light again limits growth. Live crown ratio (to bare bole/stem of tree) can be considered an index of individual tree vigor (*Oliver and Larson 1996*). Thinning to 70 TPA would maintain the larger crown ratios longer. Trees with large crown ratios would not only grow faster, but would be more resistant to insects, diseases, and other environmental hazards.

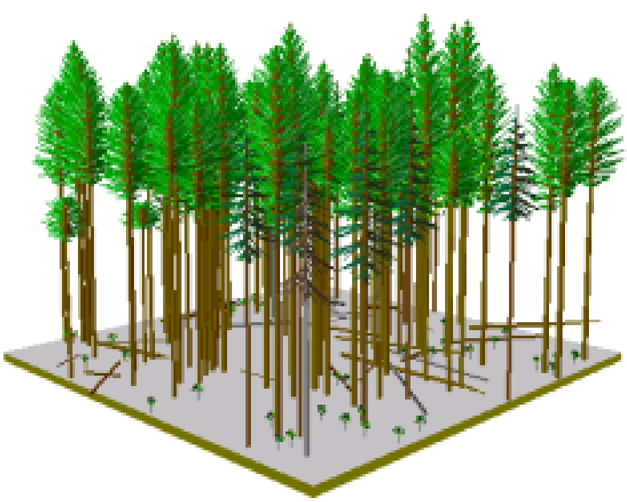
The illustrations on the following page shows modeled growth at age 80 years that resulted from thinning to 70, 90, and 110 trees per acre when the stands were 40 years old.



Resulting stand at age 80 when thinned to 70 trees per acre at age 40



Resulting stand at age 80 when thinned to 90 trees per acre at age 40



Resulting stand at age 80 when thinned to 110 trees per acre at age 40

Because of previous management direction, Douglas-fir was the species of choice when planting for pre-commercial thinning activities. Now some stands or portions of units show high percentages of Douglas-fir in the overstory. Thinning would allow for the selective removal of Douglas-fir, a high value wood product, and the enhancement of other conifer species and hardwoods by their selective retention. This would also make the stand, as a whole, more resilient.

A second thinning entry is likely to occur in the next 20 or 30 years due to retaining a relatively moderate level of trees per acre at these initial thins. Units located near main roads and benefits to further accelerating late-successional structure from the second thinning density reduction would result in increased diameter growth along with other late-successional characteristics such as multiple canopy enhancement.

Variable thinning as discussed in the Mid-Willamette LSR Assessment (1998) would be achieved with dominant tree release (DTR) and no-thin Retention Areas (RA) interspersed with the 70, 90, or 110 TPA thinning densities throughout the units. A certain amount of the best dominant trees would be located and the smaller trees would be removed around them for 66 feet or ¼-acre DTRs.

Dominant trees would be released for 10% of the acres in 9 units, 5% of the acres in 2 units, 3% of the acres in 13 units, and no DTRs in 5 units. The dominant trees would be released from direct competition.

Only Unit 13 would have cedar tree seedlings planted in the 1/8-acre opening to start a second age class and ensure species diversity. Natural seed in is expected surrounding the retained dominant trees released and new cohort/multiple canopy to develop.

Retention areas (RA) would be at least 10% of the original stand boundaries which contain the proposed harvest units. The size range of these retention areas would vary but would be at least ¼-acre and would be grouped to retain processes and conditions for plant and wildlife diversity benefits. Different combinations of DTR and RA, or neither, are prescribed based on site specific conditions and are fully disclosed in Appendix A: Units Prescriptions. The resulting combination of thinning prescriptions would give the stands and landscape a variable thin appearance and in the long-term would more closely resemble the randomness of late-successional stands.

The *Mid-Willamette LSR Assessment* also directs the consideration, depending on site-specific conditions, of no-thin buffers next to existing Late-Successional structure. Buffers have been prescribed for units where appropriate; see Appendix A: Units Prescriptions. These no-thin buffers are generally 100-feet wide; however, some snags and down wood creation would occur in these areas. This coarse woody debris would remain on site to provide additional stand structure and diversity of habitat.

Harvest operations would eliminate most of the existing small snags plus any future snags that would have died from natural suppression. These snags and suppressed trees are smaller and of less value than future snags and down wood. In general, the larger the diameter and the greater the length of a log, the more useful it is, however small material is better than none since even small logs would provide habitat for some wildlife species (*Maser et al. 1979*). The development of additional snags and down wood in the stands following harvest, along with the high quality snag and down wood habitat in the natural stands surrounding the plantations, would maintain a range of snag and down wood habitat in the subwatersheds.

In summary, thinning these plantations should result in stand attributes, such as tree density, species diversity, snags, and down wood similar to what occurs in natural stands. This should allow plantations to develop late-succession characteristics sooner that would occur under Alternative 1.

Cumulative Effects – Vegetation

The area analyzed for cumulative effects was the project area. Past timber harvest, road construction, trail construction, and other ground-disturbing activities (see Appendix M for more cumulative effects information).

The additive effects of past, present, and reasonably foreseeable silvicultural activities have cumulatively lead to the existing landscape and stand conditions in the Quartzville planning area.

Past actions include the harvest of a little over 1/3 of the analysis area since the 1950's. In the next decade or so, it is estimated that another 1,300 acres of managed stands would reach appropriate relative density for commercial thinning. Approximately 1,000 acres of commercial thinning could be planned from these stands. Buffers for stream, special habitat, sensitive species, and other resource protections generally omit 30% of the original stand acres.

There are approximately 5,000 acres of stands that were clearcut harvested between 1980 and 1995 that would require density management in the following decades in the planning area. Variable density thinning would be implemented to improve stand characteristics for late-successional forest development.

There are about 1,000 acres of private ownership involving over 30 landowners within the planning area. Patented mining claims comprise most of the private land. The timber stands were logged over to facilitate mining operations about one hundred years ago. The resulting stands are dense Douglas-fir dominated stands. Many of the stands are currently experiencing self thinning. Predicting timber harvest on private lands in this planning area is problematic.

Non-Forested and Special Habitats: For this analysis special habitats are considered non-forested stands. However, not all non-forested areas are special habitats.

To speed the development of late-successional habitat and provide habitat for those organisms requiring dead wood, existing large snags and all down wood would be retained during logging operations, five plantation trees per acre would be topped or inoculated with native fungi for future snags, and five plantation trees per acre would be left on the ground during logging for down wood. Small snags that need to be felled during harvest operations would be retained as down wood. For more information about vegetation refer to Appendix M.

Vegetation - Invasive Plants

Introduction*:* An invasive plant is defined as “a non-native plant whose introduction does or is likely to cause economic or environmental harm or harm to human health” (*Executive Order 13122*). An estimated 420,000 acres of Forest Service lands in Region 6 are infested with invasive plants (*USDA 2004*). Invasive non-native plants, including noxious weeds, are a threat to native plant communities. These species thrive in a new environment because they arrive without the complement of predators, disease, and other ecosystem components found in their native region of the world. Most of these species take advantage of disturbance gaps such as logged units, roads, rock quarries, burned areas, the areas surrounding human structures, and trails. Weed seeds and other propagules can be introduced into an area by a variety of agents, most notably wind, highway and off-road vehicles, and construction equipment. They can also disperse by way of water, animals, and humans. Once established, these populations serve as a seed source for further dispersal, generally along road and trail corridors.

One of the project objectives for Quartzville LSR Thin is “minimizing the spread of existing non-native/noxious weeds and avoid introduction of any additional species or populations of non-native plants/noxious weeds into the LSR for the long term’.

Timber sale contracts are now required to include provisions to minimize the introduction and spread of invasive plants. Weed populations in the units and along transportation routes must be mapped on the sale map and equipment-cleaning areas need to be identified.

Thinning may enhance habitat for all of these weed species by opening up the canopy and creating seed germination sites by disturbing the soil. In addition, new weed species may be introduced on logging and slash treatment equipment.

*Analysis Methods***:** Surveys for invasive species, including noxious weeds, were conducted in all stands in concurrence with the sensitive species surveys. Additionally, a survey for non-native blackberries in the Quartzville watershed was done in 1997. Priority treatment sites covered by the Willamette National Forest *Integrated Weed Management Plan* are mapped in a GIS layer and tracked in a database. These sites are managed cooperatively thorough a *Memorandum of Understanding* with the Oregon Department of Agriculture.

Desired Future Condition: The desired condition is prevention of new invader establishments and a cessation of established weed spread with a corresponding reduction in established weed presence. Allowing for the return of disturbed areas to a more natural condition helps retain sensitive species habitat and other special native habitats, and impedes noxious weeds from dominating these areas. This condition can be advanced through implementation of good management practices, minimizing disturbance where possible, and executing mitigation measures such as invasive weed removal and native species revegetation.

Existing condition: The most serious weed infestations in the Quartzville LSR Thin sale area are meadow knapweed (*Centaurea pratensis*), Scotch broom (*Cytisus scoparius*), false brome (*Brachypodium sylvaticum*), Himalayan blackberry (*Rubus discolor*), evergreen blackberry (*Rubus laciniatus)* and reed canarygrass (*Phalaris arundinacea*).

Meadow knapweed is a perennial Eurasian weed that is found at two locations in the LSR, one of which is a large population adjacent to Unit 1 at the Big Minerals reclaimed mining site. It is spread by vehicles and windblown seed and prefers open areas such as roadsides.

Scotch broom is an established weed that favors roadsides and early seral plantations. It is shaded out in late-successional stands. There is a large population in Unit 26 and it is scattered along Roads 11, 1131 and 1133. The seeds of Scotch broom can persist in the soil for decades and germinate if the soil is disturbed.

False brome is a highly invasive grass that has the capability to dominate the forest floor to the exclusion of native species. It has broad ecological amplitude that allows it to succeed in heavy shade or in openings, such as meadows and roadsides. It does not appear to have forage value for big game and so receives little or no grazing pressure. Possible mitigation measures include deleting infested areas from units, leaving a no harvest strip along roadsides, pre-treating the sites with herbicides or hot foam. False brome is found in Unit 18 and along Quartzville Road approximately ½ mile above Big Minerals.

Himalayan and evergreen blackberries prefer open areas and roadsides but 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 found along the roads in or adjacent to Units 9, 13, 16, 22, and 24.

Reed canarygrass (*Phalaris arundinacea*) is found at scattered locations on Roads 11, 1142 and 1131-202. This is a tall, perennial rhizomatous grass with a deep root system. It is especially well suited to invade aquatic ecosystems, particularly wet meadows, riparian areas, and lakeside habitat.

Environmental Consequences

Direct and Indirect Effects- Invasive Plants

Alternative 1 – No Action

The No Action Alternative has the least risk of spreading weeds. Few weed species can survive the deep dark conditions that would result from foregoing thinning in these stands. Although opportunities for funds would not be generated, 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.

Alternatives 2 and 3

It is a combination of soil disturbance and transport of seed that constitutes the direct effects of timber harvest on weed introduction and persistence. In the proposed action alternative, the areas that would be permanently opened up to light and disturbance would be most at risk, e.g., roads and landings. These areas are disproportionately subject to ground disturbance and exposure to vehicles and equipment that may bring seed in. Risk decreases in areas where roads and landings are closed, rehabilitated, and seeded with desirable species (see *Risk Matrix* below).

In both Alternative 2 and 3, a 100-foot containment buffer would be left around Scotch broom, false brome, and meadow knapweed to maintain a dense canopy adjacent to the road. These buffers would prevent these species from spreading by maintaining a dense canopy and limiting mechanical disturbance that could spread the existing weed seed bank into the stand. Although care has been taken to treat existing sites prior to thinning, there remains a seed bank in the soil of unknown longevity.

Alternative 2 has a higher risk of increasing weed sites than Alternative 3 because it treats 271 additional acres where potential soil disturbance could provide seed beds. In addition, Alternative 2 constructs 100 feet of new, native-surface, temporary spur road that isn't built in Alternative 3 and opens an additional 4,200 feet of existing temporary spur roads. This additional disturbance increases risk of weed establishment. Roads are well documented as vectors of weeds (*Parendes*, *1997*) and new populations could easily establish outside of the 100-foot buffers.

In the *Risk Matrix* below, Alternative 2 shows the highest risk of promoting noxious weeds due to a larger level of ground disturbance and habitat modification represented by more disturbance via ground-based and skyline harvest vs. helicopter harvest, and the construction and reopening of temporary roads. Due to the increase of acres in Alternative 2 over Alternative 3, more money generated from this timber sale would be available for weed surveys and control after thinning occurs.

Table 25: Risk Matrix: Comparison of Invasive Weed Introduction and Establishment Potential by Alternative

Activity	Alt. 1	Alt. 2	Alt. 3
Acres treated (*828 in Alt. 2 and 557 in Alt. 3*)	0	3	2
Construct new native-surface temporary road (*100' in Alt. 2*)	0	2	0
Reopen existing temporary roads (*7600' in Alt. 2 and 3400' in Alt. 3)*	0	3	2
Reopen system roads (*5.28 miles in Alt. 2 and 4.59 miles in Alt.3*)	0	3	3
Road maintenance (*25 miles of haul routes for both Alts. 2 and 3*)	0	2	2
Subsoil skid roads (*11 acres in Alt. 2 and 7 acres in Alt.3*)	0	3	2
Helicopter and other landings	0	3	3
Sale-generated dollars collected for mitigation	2	0	0
Totals	**2**	**19**	**14**

Assigned risk values of 0 = no risk; 1 = small risk; 2 = moderate risk; and 3 = large risk. Derived from relative risk of invasive weed introduction and establishment by alternative based on the level of weed promoting activities within each alternative.

Cumulative Effects – Vegetation – Invasive Plants

The area analyzed for cumulative effects is the analysis area and the road system accessing the analysis area.. Ground-disturbing activities such as ground-based yarding systems used during timber harvest, road construction and reconstruction, vehicular traffic and recreation use contribute to the incremental increase in invasive weeds (see Appendix M for more cumulative effects information).

Analysis included reviewing all proposed harvest units in the field to determine existing weed infestations. Then the pattern of known invasive weed sites was reviewed along with the mechanisms for introduction, establishment and/or expansion of invasive weeds and comparing this with similar past, present and future foreseeable actions to determine potential impacts.

The impact of non-native invasive weeds on native plant communities is cumulative. The more disturbance and activity any given area is subject to, the more the risk of noxious weed introduction, establishment, and/or expansion.

Past road construction and maintenance (approximately 131 miles), timber harvest (approximately 11,000 acres), and recreation use have resulted in numerous weed sites. This project would open and reclose approximately 5 miles of road, would close an additional 29 miles of road, and thin between 557 and 828 acres. Road maintenance, vehicular traffic, and ATV use would continue in the foreseeable future and may spread or introduce weed seed, leading to new infestations.

The spread of invasive weeds would be minimized through preventative measures taken prior to, during, and after thinning operations. Both action alternatives provide mitigation measures that would reduce the long-term likelihood of expanded weed populations. These include buffers around known weed sites, logging equipment washing, post-treatment survey and control funding through KV, and pretreatment of existing weed sites. The canopy in the treated stands is expected to close in 10 to 20 years, and this would further reduce habitat for some weed species. False brome, a species that can flourish in the understory even in closed canopy stands, has the highest likelihood of expanding despite mitigation measures. Diligence would be required to keep this highly invasive species from overtaking the understory over the long-term. These efforts would be required whether the stands are thinned or not because the species is so tolerant of low light conditions (*Refer to Table 14 for a complete list of required mitigation measures*).

Vegetation - Survey and Manage and Sensitive Botanical Species

Introduction: Survey and manage species and sensitive botanical species, including vascular plants, lichens, fungi and bryophytes contribute to the overall diversity of the Quartzville LSR and many of these species are considered old-growth related. Two project objectives relate explicitly to sensitive botanical species; these are encouraging development of diverse species composition including hardwoods and other minor species, and encouraging development of connectivity within the LSR to aid in dispersal and genetic exchange that contributes to species viability. A number of survey and manage and sensitive species, particularly lichens, are disproportionably found on hardwoods and Pacific yew, and most are dispersal limited. Many of the sensitive species are also designated as survey and manage species (refer to the 2001 *Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines* and Appendix D to determine which species are sensitive, survey and manage or both).

Analysis Methods: A *biological evaluation* was completed for Quartzville LSR Thin and is included in Appendix D. There are three steps in a plant biological evaluation which fulfill the requirements dictated by the USFS Manual (2672.4):

Step 1. Prefield Review: Each area to be affected by management actions is investigated for sensitive plant habitat in the prefield review. The following sources are consulted to determine whether potential habitat exists: R-6 Regional Forester's and Willamette NF Potential Endangered, Threatened and Sensitive Plant Lists, Willamette NF Sensitive Plant Handbook, Oregon Natural Heritage Data Base and Willamette NF Data Base records, previous botanical surveys, aerial photos and USGS topographical maps, and knowledge provided by individuals familiar with the area. Each plant on the Willamette NF Sensitive Plant List is considered. Effects of actions on sensitive plant populations are analyzed and Conservation Strategies and the *Willamette Forest Plan* are consulted to determine whether actions are consistent with direction.

Step 2. Field Reconnaissance: Units which have been identified as having high probability habitats in or surrounding the unit during the pre-field review are surveyed. Surveys include an intense search of all high probability habitat during the season when identification is possible. If a sensitive species is found, R-6 sighting forms are filled out and sent to the Willamette NF Supervisor's Office and the Oregon Natural Heritage Data Base and the effects on the plant population analyzed.

Step 3. Risk Assessment: If a sensitive species is found on or adjoining a site where an action is proposed, risk assessment (an analysis of the effects of a proposed action on species and their habitats) must be performed. A risk assessment considers (a) the likelihood of beneficial/adverse effects and (b) the consequences of these effects on sensitive species populations to determine cumulative effects on the overall population. Management recommendations are then made to mitigate adverse effects.

There are 16 species of fungi for which surveys were not conducted. Fungi fruit inconsistently and would require multiple surveys each year for several years to determine their presence, therefore surveys are considered impractical (*USDA, USDI 2001*). Eleven of these fungi are mycorrhizal, four are saprophytic on duff or wood and one is a parasite on truffles. In general, the habitat requirements of fungal species found on the Willamette National Forest sensitive species list and on the Survey and Manage list are poorly understood. The literature provides very general habitat characteristics for most of these species. See the biological evaluation for sensitive botanical species in Appendix D for more details.

Desired Future Condition: The desired condition for survey and manage and sensitive botanical species is to retain existing occurrences and to promote stand structure diversity and complexity that would provide more suitable potential habitat for many of these species in the future.

Existing Condition: Prior to the 2002/2003 sensitive species surveys, one Region 6 sensitive plant species had been documented in the Quartzville watershed. Thompson's mistmaiden (*Romanzoffia thompsonii)* occurs near the top of the Bruler Creek drainage, 1/2 mile from the nearest proposed Quartzville LSR Thin unit. Habitat for this species is limited to seepy meadow slopes at low to mid elevations with south aspects. Also, a sensitive plant population of *Corydalis aquae-gelidae* was incidentally located in 2003 in the headwaters of McQuade Creek, ½ mile from the nearest thinning unit. It prefers cold, fast-flowing steams. One sensitive lichen species (also survey and manage), *Pseudocyphellaria rainierensis*, had been documented along Elk Creek. This species is generally found in or near old-growth forests. These populations appear to be stable, and would not be affected by activities within the Quartzville LSR Thin project area.

Seventy-one Region 6 sensitive plant, lichen and fungal species were evaluated to determine if they or their habitat would be impacted by this project. Many sites of sensitive lichen species were found in or adjacent to the planned thinning units.

Habitat exists for 40 of the 71 species. Of the 40 species, 16 are fungi for which no surveys were conducted. Fungi are listed in Survey and Manage Categories B and D, for which surveys are considered impractical (*USDA, USDI 2001*). Surveys were done for the remaining 24 species. The species that were found and the number of populations located are listed in Chapter 2 under Mitigation in All Action Alternatives. One hundred eleven sensitive lichen populations were located of the following three species: *Leptogium cyanescens* (10 sites), *Nephroma occultum*, (three sites) and *Pseudocyphellaria rainierensis* (89 sites). All three species are on both the sensitive and survey and manage lists. Additionally, five populations of *Pseudocyphellaria mallota* were located. This species is listed on Oregon Natural Heritage Program's List 2 and is expected to be added to the sensitive species list in the Fall of 2006. *Leptogium rivale* is a survey and manage species and it was found in nine streams. It was not transferred to the Sensitive Species Program because it is presumably protected by Riparian Reserves. It is now on Oregon

Natural Heritage Program's List 4, their Watch List. Further information about these species is found in the Biological Evaluation (*Appendix D*).

Environmental Consequences

Direct and Indirect Effects - Survey and Manage and Sensitive Botanical Species

Introduction: Changes in hydrology, including water temperature and sediment may affect *Leptogium rivale*, an aquatic lichen found on submerged rocks in clear, cold streams (*USDA, USDI 2003*). Persistence of the other lichen species may be threatened by host tree removal, windthrow, 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*). In some cases thinning may be beneficial to these epiphytes by enhancing tree species diversity, including Pacific yew and bigleaf maple, two tree species known for their abundant lichen communities. *Leptogium cyanescens* is found on the bark of trees and shrubs, particularly bigleaf maple. Most of the *Pseudocyphellaria rainierensis* sites in this planning area were located on remnant Pacific yew trees.

Documented sites were evaluated and those deemed at risk from the proposed action would be protected under all alternatives. See Sensitive Species in Chapter 2 Mitigation Common to All Alternatives.

Alternative 1 – No Action

Alternative 1 would provide the most benefit to survey and manage and sensitive fungi because most of them 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*).

Under Alternative 1, No-action, no acres would be thinned and the stands would undergo a slow decline before presumably opening up enough to provide an understory. Windthrow, snowdown, 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. However, most of the sensitive lichens were located on remnant Pacific yew trees that could be shaded out by the very dense canopies that may result in the absence of thinning.

Although no sensitive plant populations were found, the stands do provide potential habitat for three plant species, *Botrychium minganense, Botrychium montanum* and *Cimicifuga elata*. Potential habitat for these plants would deteriorate as the dense canopies of Douglas-fir close in and darken the forest floor. The *Botrychium* species require the presence of western redcedar, which is currently a minor component of the stands. Without thinning, the western redcedar would be suppressed by the dominant Douglas-fir and would not provide habitat for these species. *Cimicifuga elata* prefers more open stands with a well developed hardwood component. Foregoing thinning would delay the development of these stand characteristics.

Alternative 2 and 3

Due to mitigation measures in the action alternatives, no direct effects to known lichen sites are anticipated. 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, Ameranthus and Perry 1994*). Reductions in the number of fruiting bodies of chanterelles, a common mycorrhizal species, were noted after initial thinning but appear to rebound after several years (*Pilz et al 2003*). Two hundred seventy-one more acres are thinned in Alternative 2 than in Alternative 3 and 115 acres are thinned with ground-based equipment as compared to 58 acres thinned by this logging system in Alternative 3. Given this, Alternative 2 would likely have greater direct impact on fungi if they occur in these stands. Although individual and short term impacts may occur, it is not likely to result in a trend toward Federal listing or loss of viability for survey and manage and sensitive fungi species.

Indirect effects to survey and manage and sensitive species and their habitats vary. The stand prescriptions include the creation of ¼ acre gaps that would increase stand complexity over the long term (*20-100 years*), however, 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, the proposed action may reduce habitat for sensitive mycorrhizal fungi. Alternative 2 creates more gaps than Alternative 3. However, thinning 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. Late-successional forest provides better habitat for sensitive lichens as well. Alternative 2, which treats more acres than Alternative 3, may have an increased beneficial effect over the long term.

Buffers around sensitive lichen species protect the sites from direct disturbance but may have indirect adverse effects as the trees grow and a dense canopy results. Big-leaf maple may get shaded out, therefore no longer providing habitat for *Leptogium cyanescens*.

Cumulative Effects - Survey and Manage and Sensitive Botanical Species

The area analyzed for cumulative effects was the analysis area. About 10,500 acres of old-growth forest was clear-cut in the Quartzville watershed from 1950 to 1990. These forests certainly contained multiple populations of survey and manage and sensitive botanical species. Fungal diversity declines with clear-cutting and fire (*Byrd, et al 2000, Bruns, et al 2002*) and all of the stands were burned after harvest. *Pseudocyphellaria rainierensis* and *Nephroma occultum* were most certainly in some of those old-growth stands. Numerous western redcedar stumps attest to the past presence of a greater amount of cedar that may have provided habitat for the *Botrychium* species. An increased interest in Pacific yew bark in the early 1990's led to the death of 100's of yew trees in the Quartzville area. Yew bark poachers girdled the trees, particularly those near roads. This undoubtedly led to a decline in sensitive lichens, several of which prefer growing on Pacific yew. Dead yew trees do not support lichen communities. There has been no timber sale activity in the Quartzville LSR for nearly 10 years. Habitat disturbing activity has been limited to mining, recreation, and road maintenance that affect small areas.

Despite the large amount of past harvest activity there are 23,240 acres of mature and old-growth forests still remaining in the watershed. These forests 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 is structure and diversity.

Conclusions: In the long-term (*20-100 years*) habitat for survey and manage and sensitive botanical species would be enhanced in the action alternatives. Many species would re-colonize the younger stands as they mature and become more complex is structure and diversity.

Physical Resources

Special Habitats

Introduction: Special habitats are non-forested areas including, meadows, ponds, caves, rock gardens, talus and cliffs. These sites are important reservoirs of biodiversity and provide habitat for a wide variety of plants, fungi, and animals, many of which are not found in forested areas. In fact, while special habitats cover only about 5% of the area in the Cascades Range, 85% of native flowering plants are found in these areas (*Hickman 1976*). In addition, special habitats provide habitat for many species currently on the Region 6 Sensitive Species List.

*Analysis Methods***:** Special habitats are identified on aerial photos and from the GIS data base and are inventoried during the course of vegetation typing and project area survey for sensitive botanical species. This information is also stored in GIS files.

Desired Future Condition: The desired condition for special habitats is to minimize direct and indirect influence from project disturbance, and to maintain microclimatic and site conditions within the historical range. A large part of maintaining the integrity of special habitats is to preclude the introduction and establishment of non-native invasive weeds.

Existing Condition: Many of the units in Quartzville LSR Thin contain special habitats as illustrated in Table 26 below. Scattered rock opening and cliffs are the most common special habitats in the area. These special habitats provide habitat for various plant communities and contribute species diversity to the area, which is otherwise fairly uniform. The noxious weed, St. John's-wort is colonizing some of the rocky openings.

Table 26: Special Habitats by Unit

Unit No.	Special Habitats
4	Rock gardens and cliffs along southern edge; multiple tiered waterfall at southeast corner.
5	Several wetlands, one with open water; two perennial springs; large rock garden in northeast corner.
6	Rocky opening, cliffs, incense cedar community along southern edge.
13	Rocky openings
18	Rocky openings; many small seepy hardwood dominated wetlands.
22	Scattered rocky openings and cliffs; cave
23	Scattered rocky openings and cliffs.
24	Scattered rocky openings and cliffs.
25	Scattered rocky openings and cliffs; cave
26	Scattered rocky openings and cliffs; waterfall on south edge

Environmental Consequences

Direct and Indirect and Cumulative Effects – Special Habitats

Special habitats are buffered from physical disturbance in all action alternatives. No special habitats occur in proximity to planned temporary spur roads or landings. Buffers should be sufficient to protect the microclimate and prevent invasive weed introduction. Therefore, no direct, indirect, or cumulative effects on special habitats are anticipated as a result of implementation of any alternative.

Hydrology, Water Quality and Stream Channels

Introduction: The purpose of the proposal as it relates to hydrologic resources is to maintain or improve development of late-successional stand characteristics within Riparian Reserves. The Riparian Reserve allocation overlays the Late-Successional Reserve allocation and is designed not only to address Aquatic Conservation Strategy Objectives but also to address travel and dispersal corridors for many terrestrial animals and plants, and to provide for greater connectivity within and between LSR's. Nearly 50 percent of the acreage in stands proposed for treatment are in Riparian Reserves.

Encouraging development of late-successional stand conditions in both the LSR and the Riparian Reserves would contribute to a healthy ecosystem and improve habitat connectivity within the LSR. Thinning proposed in the Riparian Reserves would encourage the development of larger trees more quickly, perhaps decades faster, than under natural conditions. This would contribute to (1) additional shade for streams, (2) future large wood recruitment potential for both riparian areas and stream channels thus adding to channel complexity, (3) increased stand structural diversity and (4) improved dispersal and habitat conditions within the Riparian Reserves.

A dilemma here is the associated risk of treating riparian reserves and maintaining shade over Quartzville and its tributaries. Quartzville Creek is on the State Department of Environmental Quality's 303(d) list of water-quality impaired water bodies because temperatures exceed state water quality standards during a portion of the summer months. Retaining shade here is important to meet water quality temperature standards.

Analysis Methods: The proposed units, surrounding areas and streams were reviewed in the field by the district hydrologist. This review included walking through, and around the perimeter of, the proposed units. Streams and wet areas encountered were recorded on either a map base or an aerial photo. These were then transferred to integration maps for interdisciplinary team discussion and development of site-specific prescriptions. Slope stability, soil types, vegetation, aspect, and juxtaposition of the unit were all considered in developing prescriptions for Riparian Reserves.

Stream, slope, and vegetative conditions were compared to information provided in the *Quartzville Watershed Analysis* to determine if changes occurred since the drafting of that document. Conditions appeared to be responding typically for Cascade environments and no discoveries were made to modify the watershed analysis determination.

Since Quartzville Creek is listed on the State's 303 (d) list of water quality impaired water bodies for summer-time stream temperatures, an analysis was also done utilizing the *Sufficiency Analysis* protocol. The Water Quality Management Plan guidance established in the *Northwest Forest Plan Temperature*

TMDL Implementation Strategies, September 9, 2005, was adhered to in the establishment of primary shade zones and prescriptions developed to treat Riparian Reserves. The following steps were utilized in the evaluation.

- Silvicultural information was used to obtain tree density, (basal area), diameters, and heights of trees found within the Riparian Reserves. This information, along with site visitation, was used to establish existing tree canopy closure along all perennial streams.
- All perennial streams were mapped and their azimuths established in order to select the correct shade nomograph, as directed in the *Sufficiency Analysis*.
- The appropriate shade nomograph was used to determine existing percent shade.
- Tree response time and growth rates were established to determine the effectiveness of thinning. This was done in consultation with the District Silvicultural Technician.
- Tree response time and growth rates in response to thinning were used to determine the percent of shade of the treated stand after a given time period. It was determined from a literature review that it takes between 5 and 10 years for the tree canopy to close, once thinned. A value of 10 years was used to determine the increased height. This height was then compared to an untreated height to determine the benefit of thinning the riparian. Results showed that effective shade could be produced in ½ the time if area was thinned. (*Growth rates were taken from Loree, Silviculture Technician, personal communication 2004*).

All prescriptions involving perennial streams endured this rigor to establish the benefits of thinning. Site visitation to validate the effectiveness of riparian thinning and to evaluate stream conditions was also considered in riparian prescriptions. As a result a complex range of full-leave riparian buffers, of at least 25 feet and ranging up to 344 feet, were site-specifically placed on all streams. It is therefore anticipated that these prescriptions, following the *Sufficiency Analysis* protocol meet the intent of the State and Federal government in protecting water quality here.

The Aggregate Recovery protocol and standard observations of past activities within the watershed were used to determine hydrology, stream channel, and water quality responses to disturbance from these activities.

In addition, stream temperature information, gathered from a monitoring network of thermographs which had previously been placed in Quartzville Creek and its tributaries was evaluated to determine the areas of greatest temperature increase. This information was used to aid in the development of riparian prescriptions, especially for shade retention.

An interdisciplinary process was then use to develop a proposed action to address the project objectives and alternative ways to accomplish those objectives. The IDT then evaluated the environmental consequences of those actions. All actions were considered in relation to the prescriptions. Risks were evaluated using models, past management track records, and professional judgment.

Desired Future Conditions: Conditions desirable for hydrology, stream channels, water quality and riparian areas can best be described in a range of variability. This range has been established through time to represent the natural changes the various elements experience during a wide variety of outside influences. Flood, drought, fire, wind, snow, ice, and land movement all play a natural role in determining the changes to these elements. Add to this natural condition social political drivers and one can see the complexity of stating a Desired Future Condition. The following bullets are an attempt to discuss the hydrology; stream channel, water quality and riparian portion of this condition.

- Range of flow, discharge, which allows for a variety of species within riparian areas.
- Maintenance of wet areas and hyporheic zones, no net loss.
- Maintenance of flows within historic range, no artificial peaks that exceed range.
- Maintenance of channel conditions that represent natural range.
- Reduction of stream energies through channel complexity. (Adding structure into channel, riparian areas.)
- Recovery and maintenance of historic water temperatures found within the system (encourage riparian development and complexity)
- Broad range of diversity associated with the riverine systems

Opportunities: Riparian development through the use of silvicultural treatments is the greatest opportunity that exists at this time. Secondary shade zone health could be improved by reducing competition and allowing larger taller trees to be developed.

Additional opportunities such as closing and restoring of roads, subsoiling and planting compacted areas such as landings and old skid trails also exist.

Existing Conditions: The main streams in the analysis area are Quartzville Creek, Canal Creek and Galena Creek and their tributaries. Both Canal and Galena Creek flow into Quartzville Creek which drains into the Middle Santiam River and then empties into the South Santiam River. The map below displays the stream network within the three subwatersheds included in the analysis area.

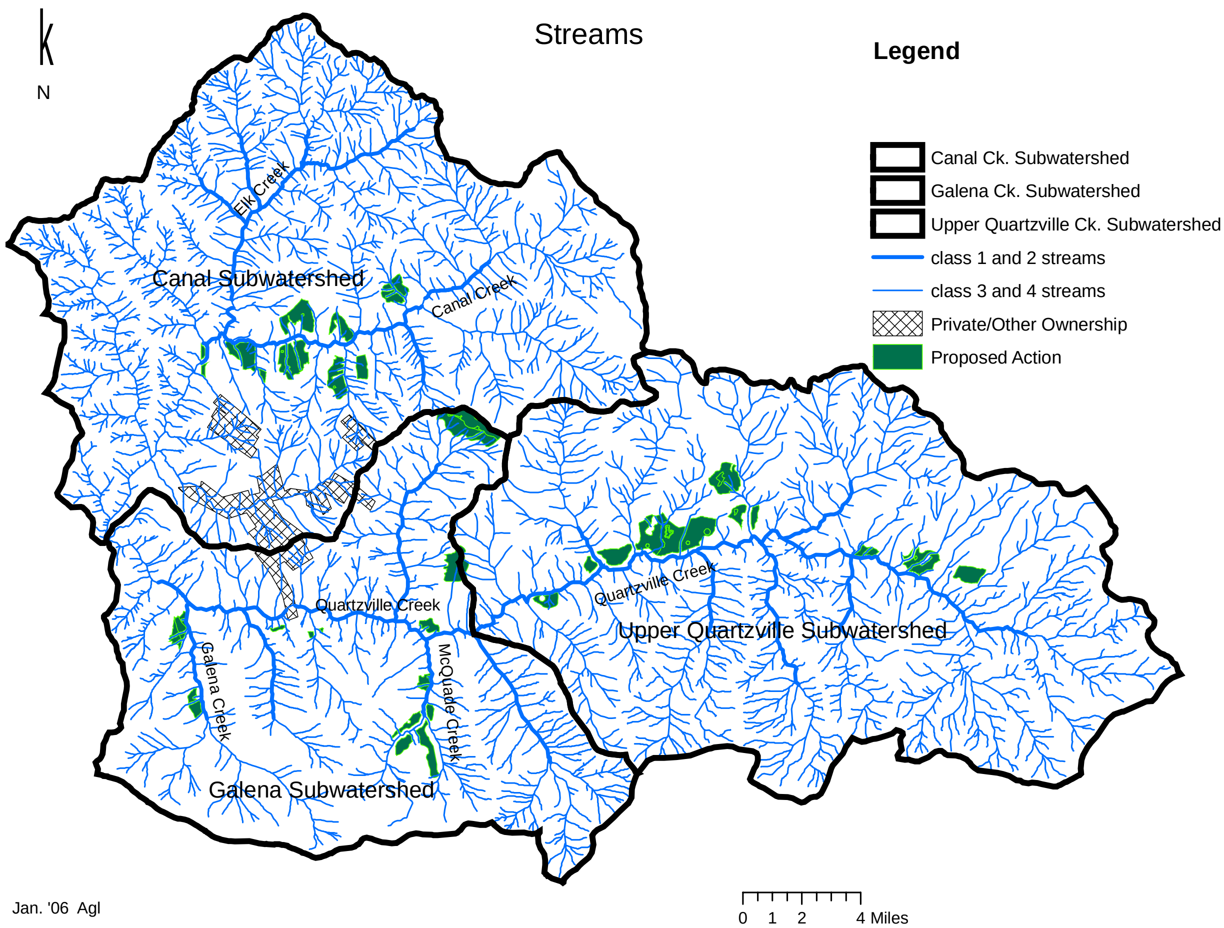


Figure 16: Streams

A more complete description of the hydrology and water quality within the Quartzville watershed can be found in the Aquatic portion of the *Quartzville Watershed Analysis* (*Chapter 5, pg 25*). The following discussion relates specifically to areas being proposed for treatment in this analysis.

The hydrology in the Quartzville LSR Thin project area is similar to other documented watersheds within the Western Cascades. Average annual precipitation in the project area ranges from 48 inches in the valleys to 122 inches on peaks and ridges. The majority of the precipitation occurs between October and May and falls as rain at the lower elevations (<2000 feet) and as either rain or snow at the upper elevations (1,200 – 4,900 feet). These upper elevations are in the Transient Snow Zone (TSZ) or the part of the watershed where snow accumulates and melts on a seasonal basis. All of the proposed harvest units fall within the TSZ.

The dominant hydrologic mechanisms are rain, and rain-on-snow events which generate peak flow events in the transient snow zone. Surface precipitation drives the flow levels of tributary streams to Quartzville Creek. Minor sag ponds, less than 5 acres, exist and meter out some flows to tributary streams. These ponds are associated with large earthflows that are found within the Watershed (*see soils and geology report in Appendix K*). Smaller wet areas associated with the broken earthflow topography punctuate the landscape and create vegetative diversity. Margins of the earthflows provide paths for water to work and create channel networks.

Water storage in these watersheds is limited to some deeper upland soils, colluvial deposits, flood plains, earthflow perimeters. These areas create small forested wetlands. Colluvial soils, ancient earthflow terraces, and flood plains act like sponges, retaining water and releasing it slowly during periods of low precipitation. General storage is low due to the shallow and rocky nature of the soils.

Minimum flows within the Quartzville are regulated by water storage features which allow flow to persist during drought periods. Much of the summer flow comes from water stored in the broad alluvial floodplains along the main channel of Quartzville Creek and the colluvial and glacial soils found throughout its tributaries. Theses valley areas provide opportunity for hyporheic interactions with the stream (this is the subsurface movement of water through depositional areas). Proposed units within the project area are adjacent to these types of features.

Vegetation is the primary user of water with in the watershed, with main use occurring between April and October. Diurnal fluctuations in stream flow are the result of vegetative transpiration rates associated to diurnal changes in light and climatic conditions.

Environmental Consequences

Direct and indirect Effects - Hydrology

Implementation of **Alternative 1 - No Action**, would not accelerate development of late-successional stand conditions in young, overstocked, managed stands. As competition increases in these dense stands, tree growth and vigor would decrease and mortality would increase. Tree mortality would contribute to increased fuel loadings above natural levels. Transpiration rates would likely decrease due to loss of canopy, crown diameters and the decline in the stands ability to utilize available water. This could contribute to a potential for increases in summer flows.

Densely stocked stands are more likely to be less healthy and their small tree crowns have a decreased ability to intercept and hold snow, resulting in greater risk for tree damage (breakage) through the accumulation of snow loads. Infiltration rates could be affected by the loss of canopy and the drip that occurs from snow interception. Warm rains would remove the snow and not allow for the water to infiltrate at the same rate that would occur within a healthy canopy. Reduced canopies are more exposed to latent heat transfer and rapid snow loss. This reduces the contact time the water stored in the snow has with the soil. (*Harr 1981*).

Alternative 2 treats 828 acres and reopens 7.1 miles of system and closed logging spurs constructed during the first entry. Reopening of these roads would reduce vegetation and interception associated with these roads. In addition if connected to the natural drainage network, roads may lead to quicker delivery of runoff to stream networks. This could potentially lead to lower low flows (and higher peak flows) as a result of some water bypassing the normal routing (drainage) pathways. (*Pike and Scherer, 2003*)

Under this alternative thinning would be maximized using a combination of logging systems, (helicopter, skyline, and ground based logging systems). Of the 828 acres treated under this alternative, approximately 385 acres of Riparian Reserves would be treated, or 58% of Riparian Reserves found to be associated with these units. The effects of implementation, varies depending upon the type of logging system utilized.

Hydrologic consequences would be in response to reduced competition for light, water, and nutrients in the thinned stands, and increased snow accumulation on the openings created by roads and landings. A short term (*5-10 years*) increase in discharge during the wet and dry periods would occur from two mechanisms for the thinned stands. Increased snow accumulation (wet period) would create small (<1year return interval) increases in peak flows (*Jones, and Grant; 2001*), and reduced canopy (dry periods) would reduce transpiration rates which would account for small increases in summer flows. It is not anticipated that either of these changes create detrimental effects. These effects may not even be measurable (*Pike and Scherer 2003*).

With target canopy closures ranging from 40-60%, snow accumulation would increase until such time that canopy closures reach 70 percent. On units 1, 3, 4, 6, 9, 10, 11, 13, 14, 17, 18, 22, 23, and 26 Dominant Tree Release (DTR) would create small, 1/8 to ¼ acre openings around dominate trees. These areas would accumulate additional snow caused by loss of tree canopies. Depending on the spacing of these openings, it is anticipated that with a 3 to 10% DTR additional snow accumulation would be dispersed across the landscape and result in a minor effect to the hydrology of the area. DTR’s would not be placed within the riparian reserve.

Under **Alternative 3**, thinning would occur only in portions of selected Riparian Reserves, in the area outside the riparian buffers on fish-bearing streams and outside of variable-width buffers on intermittent streams. Riparian buffers on perennial streams would be at least “on site tree” or 172 feet and on intermittent streams buffers would be at least 25 feet. The main difference between Alternative 2 and 3 is the amount of Riparian Reserves treated: 383 acres in Alternative 2 and 84 acres in Alternative 3. Thinning would be accomplished using a combination of logging systems, (helicopter, skyline, and ground based logging systems) on approximately 557 acres. The 84 acres treated in Riparian Reserves account for headwater reserve areas, small wetland reserve areas and the 172-344 foot portion of Riparian Reserves associated with fish-bearing streams. The effects of implementation, vary depending upon the type of logging system utilized.

Hydrology of the area is anticipated to experience slight fluctuations resulting from the removal of vegetation during the project, 271 fewer acres would be treated under this alternative than with Alternative 2, so these fluctuations would be less than with Alternative 2. Effects similar to those described for Alternative 2 would occur on areas treated in Alternative 3. Similar short-term disturbance to the forest floor and canopy would occur as described in Alternative 2. With the utilization of Best Management Practices and contact requirements, there are no anticipated adverse impacts to downstream beneficial users.

Table 27 below compares the alternatives and Table 28 depicts the mechanisms of change for each alternative.

Table 27: Comparison of Alternatives

Comparison Factor	Alternative 1 No Action	Alternative 2	Alternative 3
Total acres treated	0	828	567
Percent canopy closure after treatment, averaged over the entire stand including thinned and unthinned areas.	90%	64%	77%
Percent canopy closure after treatment, averaged over the treated portions of the stands. This includes thinned areas and DTR openings	NA	52%	50%
Percent canopy closure after treatment in Riparian Reserves	90%	60%	85%
Acres of cleared for landings.	27*	47	34
Acres of Riparian Reserves Thinned	0	385	84
Percent of Riparian Reserves treated in comparison to all of the Riparian Reserves within harvest units (total area of Riparian Reserves in units = 653 acres)	0	59%	13%
Acres of Understory Development	0	69	50
Percent of primary shade zone thinned	0	0	0
At least 50% canopy closure maintained in secondary shade zone	Yes	Yes	Yes
Miles of Road Maintenance	0	25	25
Miles of road Reopening	0	5.3	5.3
Spur Roads Opened In Thinning Units	0	1.4 miles	1.0 miles
New Spur Construction	0	0.02 miles**	0

*These landings are part of the existing road network.
** This road is within a Riparian Reserve management allocation.

Table 28: Hydrology; Direct and Indirect Mechanism of Change by Alternative.

Mechanism/ Action	Cause	Alternative 1	Alternative 2	Alternative 3
Fire	Natural	Due to the location of most of these stands near open roads they have a higher risk of associated fire starts than the treated stands due to the amount of available fuel. This equates to detrimental soil damage from a hotter, intense burn creating hydrophobic conditions in the soil and affecting the hydrology by not allowing infiltration to occur.	Reducing the fuel loading through treatment in high risk areas and thinning reduces the risk of hotter, intense burns and subsequent creation of hydrophobic conditions.	Reducing the fuel loading through treatment in high risk areas and thinning reduces the risk of hotter, intense burns and subsequent creation of hydrophobic conditions within stand outside of the riparian reserve. Potential increase of fuels around the Riparian Reserves.
Felling	Canopy	N/A	Reduction of canopy is directly associated with the ability of the site to accumulate snow. Thinning would create sparser canopies and less snow interception for the short term, 3-5 years, resulting in additional snow accumulation here. Reopening 1.4 miles of additional temporary road would create an additional 3 acres of openings that could collect snow and affect hydrology.	Same as Alternative 2 with fewer trees felled to reopen 1 mile of additional road. These roads would create an additional two acres of openings that could collect snow and affect hydrology.
	Solar Radiation	N/A	Increase solar radiation reaches the ground with a reduced canopy. Changes in microclimate and heat transfer would occur. This could change the duration snow stays on the site and the type of flora and fauna occupying the site and their water use.	Same as Alternative 2 with the reduction of 262 acres not being thinned.
	Ground Skidding	N/A	Capture of runoff and compaction could occur on 111 acres where ground-based logging is used. Hydrology could be affected if rerouting of water occurs from the skidding pattern and method. Low risk of capture due to prescription in the Riparian Reserve and maintaining the primary shade zone intact.	Capture of runoff and compaction could occur on 67 acres where ground-based logging is used. Hydrology could be affected if rerouting of water occurs from the skidding pattern and method. Low risk of capture due to prescription in the Riparian Reserve which leaves the primary shade zone intact.

Mechanism/ Action	Cause	Alternative 1	Alternative 2	Alternative 3
Removal of Trees	Skyline yarding	N/A	Units or portions of units that would be skyline yarded would require corridors through primary buffers. These corridors are typically 10 to 15 feet wide. 569 acres would be skylined. Trees cut for these corridors within primary shade zone would be left on site. Hydrology is not anticipated to be affected due to the size and spatial orientation of these corridors.	Units or portions of units that would be skyline yarded would require corridors through primary buffers. These corridors are typically 10 to 15 feet wide. Corridor trees cut within the Riparian Reserve area would be left on site. 371 acres would be skylined. Hydrology is not anticipated to be affected due to the size and spatial orientation of these corridors.
	Helicopter yarding	N/A	This is the most protective way of removing trees from a site. 148 acres of thinning removal would not create an increased risk to hydrology	114 acres of helicopter. No effect similar to Alternative 2.
	Haul	N/A	Maintenance of 25 miles of existing road, reconstruction of 5.3 miles of system road, opening of 1.4 miles of haul road and constructing 0.02 miles of road has various positive and potential negative effects on the hydrology. Maintenance and reconstruction would improve road drainage, while reopening and constructing roads can capture water and direct it out of its natural flow path.	Additional risks associated with increasing the road network are reduced from Alternative 2 by not constructing 0.02 miles of new temporary road and not reopening 0.42 mile of closed logging spur roads constructed during the first entry. Drainage would be improved through road maintenance and reconstruction.
	Clearing		Clearing reduces the canopy and allows for precipitation to fall directly to the surface. Minor effects would be attributed to the 7.1 miles of road reopening and reconstruction.	See Felling above. A reduction in roads of 0.42 miles would reduce the acres of clearing.

Mechanism/ Action	Cause	Alternative 1	Alternative 2	Alternative 3
Construction of Landings and Roads	Grubbing (*Digging of root wads and vegetation*.)	N/A	Grubbing would be associated with the construction of landings. Approximately 20 of the 47 acres in landings and 7.1 miles of road work would require some grubbing. Possibility of bringing ground water to the surface with digging. Low risk of intercepting ground water associated with the landings. Moderate to high risk associated with the road construction of intercepting ground water flow.	Grubbing would be associated with 10 acres of landings and 6.3 miles of additional road reconstruction. Low risk of intercepting ground water associated with the landings, Moderate to high risk associated with the road construction of intercepting ground water flow.
	Travel	Status Quo	Travel along existing roads, tends to be restricted to rocked mainline roads. Hydrologic effects are similar to Alternative 1. Additional risks associated with increasing the road net work by 7.1 miles. Risks are associated to the capture and rerouting of water from its historic path.	Additional risks associated with increasing the road net work by 6.3 miles. Risks are associated with the capture and rerouting of water from its historic path.
	Closing	Moderate risk of catastrophic road failures from not maintaining drainage structures because of lack of funding from not managing the timber resource. Since there would be no management activities to fund road maintenance, drainage features would not be maintained. So there is moderate risk of increased sediment and catastrophic road failures from failed drainage structures not kept functioning through maintenance.	Short-term (3-5 year) moderate risk and once roads are reclosed and have recovered then there is a low risk of catastrophic failures due to reconstruction of drainage patterns and maintenance funded by management activities which reduces the risk of capturing flow and routing.	Low risk of catastrophic failures due to no roads being reopened or constructed in the Riparian Reserves, because of reconstruction of drainage patterns, and maintenance funded by management activities. This reduces the risk of capturing flow and routing on the 6.3 miles of upland road which would be closed upon sale completion. Subsurface flow would be drained on the surface where intercepted.
	Subsoiling	N/A	Subsoiling would occur on the intensely used skid roads. 111acres are being yarded with ground-based systems. A positive effect to hydrology occurs in increasing permeability of compacted areas.	Ground-based systems would be utilized on 67 acres. Sub-soiling could have a positive effect due to increasing permeability of compacted areas and no new roads are being built
Slash Treatment	Piling	N/A	No effect occurs with hand piling.	Similar to alternative 2

Mechanism/ Action	Cause	Alternative 1	Alternative 2	Alternative 3
Prep Work	Burning	N/A	Burning of hand piles would create small, 15x15 foot, areas of soils that are at risk of hydrophobic conditions. The spatial distribution of these small sites does not create an impact to the hydrology of the area and is therefore not determined a risk.	See Alterative 2

Cumulative Effects: Hydrology

The area analyzed for cumulative effects included the subwatersheds that contain the analysis area. Traditionally, projects involving timber harvest on the Willamette National Forest are analyzed for their cumulative impact on the quantity and timing of peak flows and water yields, using an accounting methodology known as Aggregate Recovery Percentage or ARP. The ARP model compares the amount of an analysis area within the transient snow zone that is recovered against a threshold value (Midpoint) that was calibrated for the area during development of the Forest Plan. The Midpoint values were developed based on the soil, geology, vegetation, climate, and stream channel conditions of each sub-watershed, and are intended to represent a minimum safe level of vegetative recovery in the sub-watersheds to prevent significant alteration of peak flow regimes as a result of management activities. Recovery generally occurs when stand diameters average 8" dbh and crown closures exceed 70%. The transient snow zone is generally considered to include those areas of the forest between the elevations of 1,500 and 4,000 feet respectively (*Note: the entire area proposed for thinning in this project is considered to be in the transient snow zone*).

The stands in the project area are greater than 35 years of age, and are expected to have recovered hydrologically from the last harvest (*Harr, 1983, pg. 385*). Since the project area includes small streams, all of the catchment's area is expected to be in a state of full hydrologic recovery. Therefore, the existing water yield and base flow off of the project area is expected to be within the natural range of variability. Aggregate Recovery Percentages (ARP) calculations show Canal Creek sub-watershed at 84% recovered, Galena Creek Sub-watershed at 88% recovered, and Upper Quartzville Creek at 87% recovered. Full hydrologic recover is considered to be 100%. The reduction in recovery from 100%, or what Harr projected, was determined to be due to the site productivity of the stands and the effect of past harvesting within the sub-watershed. Mid-point ARP levels from the *Willamette Forest Plan* (*Appendix E-21*) have Canal at 85%; Upper Quartzville at 75% and McQuade at 85%. Due to re-mapping of the sub-watersheds McQuade Creek was incorporated into Galena sub-watershed and is being reported as Galena.

As a result of current vegetative conditions, the sub-watersheds found within the Quartzville LSR Thin planning area are well-above desired levels of recovery. Table 29 summarizes the current levels of recovery for the sub-watersheds affected by the project area, and the Forest Plan Midpoint ARP levels. These current levels are derived from data in the Forest's VEGIS database, which includes all past harvest activities. The table also includes estimates past and ongoing harvest activities on private lands.

Table 29: Pre- and Post-Project Hydrologic Recovery as Compared to midpoint ARP thresholds

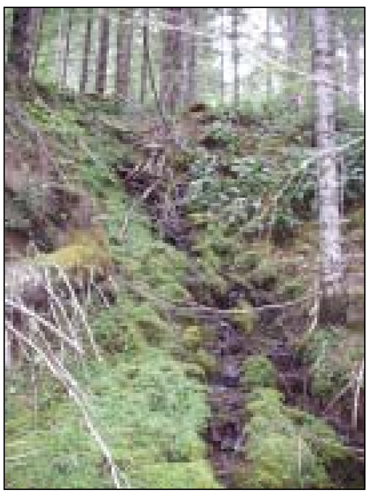
6th Field Watershed Name	Mid-point ARP Threshold	Alt 1 (Current ARP values)	Alternative 2 Treatment Acres by Subwatershed	Post Harvest ARP values for Alternative 2	Alternative 3 Treatment Acres by Subwatershed	Post Harvest ARP values for Alternative 3
Upper Quartzville	75	88.4	326	87.7	201	88
Galena	85	84.5	214.5	83.7	167	84.4
Canal	85	87.5	287.5	86.9	189	87.1
			828		**557**	

Stream Channels

Existing conditions: A description of the stream channels within the Quartzville watershed can be found within the Physical Domain Chapter of the Quartzville Watershed Analysis (*Chapter II*). The following discussion relates specifically to the planning area.

Deeply-incised dendridic streams are found within the project area as evidenced by first to third order stream channels. This pattern of dendridic streams is the result of high-gradient channels draining colluvial, glacial, and volcanic formed slopes that have been altered by erosion. High-gradient stream channels are associated with valley walls greater than 65 percent slope and contain channel bottom materials that are dominated by bedrock and boulders. These high-energy stream channels exhibit very little sinuosity. Rosgen type Aa+, A, B, and G channels are present within the proposed project area.

Typical stream channels in the analysis area

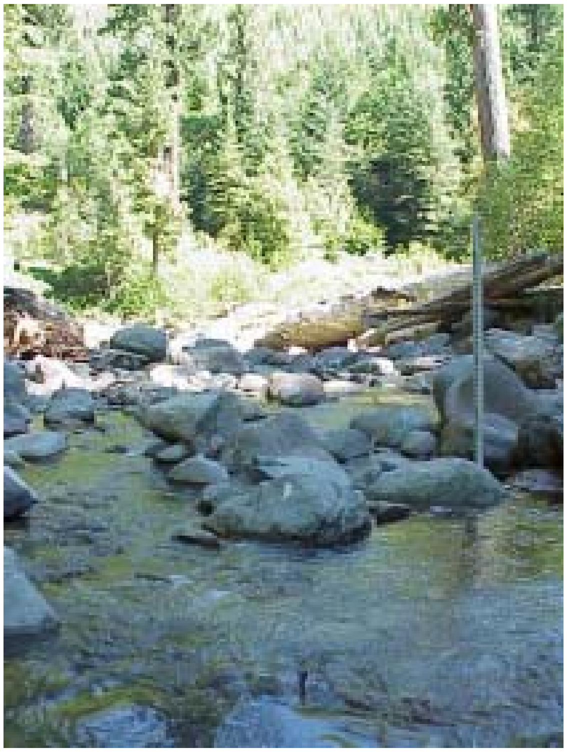


Example of Rosgen Aa+ stream channel

Example of Rosgen A stream channel

Headwater channels have low sediment storage capacity due to the lack of channel structure such as logs and boulders. Sediment storage capacity increases as streams transition into the valley regions in areas associated with structure and meander bends. Streams within the proposed project are typified as transport streams. Portions of Quartzville Creek contain depositional reaches associated with wider valley segments and junctions with tributary streams.

Debris torrents have at times played an important role in the development of the first and second-order stream channels in this planning area. Large earthflows dominate the erosional processes within the watershed. Material from debris torrents and earthflows build terraces in third and fourth-order stream channels, which are shaped and reshaped by peak flow events. Units 4, 7, 13, 14, 16, 17, 18, 19, 21, 22, 23, 24, 25, and 27 are adjacent to channels that have experienced torrent activities within the recent past (< 25 years) or contain channels where torrents originated.



Example of Rosgen B Channel

Quartzville Creek – example of a bridge which washed out in a flood event to show the effects of peak flows

Type B channels are present in higher order channels such as Quartzville Creek, McQuade Creek, Galena Creek, Little Meadows Creek, Gold Creek, Canal Creek and Elk Creek. These B type channels contain a high percentage of exposed bedrock and large boulders. In addition, debris torrent activity in headwaters streams feed these creeks with structure. Most of the fine sediments are, transported out of the system and into Quartzville Creek.

The historic morphological characteristics of stream valleys in Quartzville project area are similar to existing conditions. The basic stream patterns and channel gradients are largely influenced by the underlying geology. The geology has not changed a great deal since the reference time frames, 100 years ago. The valley of Quartzville has been artificially narrowed outside of the project area, with rip-rap to protect and maintain road access into the area. This has reduced the storage capacity of the valley in these sections and maintained sediment transport through these reaches.

Environmental Consequences

Direct and Indirect Effects – Stream Channels

Implementation of **Alternative 1, No Action**, would maintain the stream channels in their current conditions. Changes to stream channels occur with the changes in hydrology, vegetation and physical changes. These elements change naturally and artificially through disturbance.

Indirect affects could occur if riparian stands decline to a point of increasing the wood load into the stream and creating accelerated bank erosion.

Alternative 2 is designed to use ground-based yarding systems on 111 acres. Using these logging systems poses a moderate risk of capturing water and creating additional channels. Ground-based yarding also requires crossings of existing stream channels to allow access to various locations in some units. The direct effect of these crossings involves short-term sediment input into the channel and disturbance to channel banks. Units where ground-based yarding is used in this alternative include units: 5, 6, 8, 11, 12, 20, and 27. Each of these units has its own complexities and would, for the most part, be yarded away from stream courses/ channels. Unit 5 poses the greatest risk associated with stream crossings due to its associated wetland areas. Implementation of Best Management Practices would minimize this effect.

Alternative 3 is designed to use ground-based yarding systems on 67 acres. During this operation, provided the Best Management Practices are met, there is a low risk of capturing water and creating additional channels.

Table 30: Stream Channels: Direct and Indirect Mechanisms of Change by Alternative

Mechanism/ Action	Cause	Alternative 1	Alternative 2	Alternative 3
Fire	Natural	Stands that are not treated have a higher risk of associated fire starts than the treated stand due to the amount of available fuel. This equates to detrimental channel damage from a hotter, intense burn reducing woody material within channels that regulates stream energy and allowing for accelerated bank erosion.	Reducing the fuel loading through thinning and treating high-risk reduces the risk of hotter, intense burns and subsequent loss of woody material. Conversely it removes intermediate size wood, (12-20 inch diameter) that could regulate stream energies. A change in the temporal loading of wood in the streams occurs.	Fuel loading would not be reduced within the riparian reserve. A risk of hotter, intense burns and subsequent loss of woody material that assists in regulating stream energy. Conversely intermediate size wood, (12-20 inch diameter) that could regulate stream energies would be maintained in the riparian reserve.
Felling	Directional felling	N/A	Very low risk but when felled, trees have the potential to destabilize channel banks upon impact.	Same as Alternative 2
	Ground Skidding	N/A	Capture of runoff and compaction could occur on 111 acres. Stream channels could be affected if rerouting of water occurs from the skidding and extended drainage network. Low risk of capture due to intensity of turns on skid roads and riparian treatment. This alternative has two stream crossings perpendicular to the stream channel.	Capture of runoff and compaction could occur on 67acres. Stream channels could be affected if rerouting of water occurs from the skidding pattern and method. Very low risk due to no treatment in most of the Riparian Reserves.

Mechanism/ Action	Cause	Alternative 1	Alternative 2	Alternative 3
Construction of landings and roads	Grubbing (*Digging of root wads and vegetation*)		Grubbing would be associated to the construction of landings. Approximately 20 of the 47 acres in landings would require some grubbing. Moderate risk associated to the road construction and creation of stream crossings. Short term instability would be created with the placement of culverts at crossing location	Grubbing would be associated to 7acres of landing and 6.3 miles of additional road construction/reconstruction. Moderate risk associated to the road construction and creation of stream crossings. Short term instability would be created with the placement of culverts at crossing location
	Travel	Status Quo	Travel along existing roads, tends to be restricted to rocked mainline roads. Effects to stream channels would be associated to fines being generated off the 25 miles of road maintenance and the 7.08 mile of reconstructed road. This would be short term (duration of sale), due to roads being closed at the end of the sale.	Additional risks associated to increasing the road net work by 5.3 miles. Risks are associated to the capture and rerouting of water from its historic path and the capturing of fines and moving them into the stream channel. Less than alternative 2 due to reduced roads.
	Closing	Moderate risk associated to maintaining open roads and not maintaining drainage features.	Reconstruction of drainage patterns and maintenance reduces the risk of capturing flow and routing.	Reopened roads would be closed upon sale completion. Pipes would be pulled and additional disturbance to channels would occur.
	Subsoiling	N/A	Sub soiling could possibly occur on the intensely used skid roads and landings. 111 acres are being ground based and no new roads are being built and approximately 20 acres of new landings. A positive effect to stream channels occurs in increasing permeability of compacted areas and reducing the potential of channel routing.	Ground based systems would be utilized on 67 acres. And approximately 7 acres of new landings are proposed. Positive effects would be anticipated due to increased permeability of compacted areas and reducing the potential of channel routing.

Mechanism/ Action	Cause	Alternative 1	Alternative 2	Alternative 3
Removal of Trees	Skyline yarding	N/A	Units or portions of units that would be skyline yarded would require corridors through primary shade buffers. These corridors are typically 10 to 15 feet wide. 569 acres would be skylined. Stream channels are not anticipated to be affected due to full suspension being required with these corridors.	Units or portions of units that would be skyline yarded would require corridors through Riparian Reserves. These corridors are typically 10 to 15 feet wide. 371 acres would be skylined. Stream channels are not anticipated to be affected due to full suspension being required within these corridors and no treatment within most of the Riparian Reserves.
	Helicopter yarding	N/A	This is the most protective way of removing trees from a site. 148 acres of removal would not create an increase risk to stream channels	114 acres of helicopter. No effect
	Haul	N/A	Construction/reconstruction/reopening of 7.1 miles of system road would intersect numerous stream channels. Crossing would be designed to withstand 100-year flood events. Road template currently in place.	Additional risks associated with increasing the road network by 6.3 miles. Risks are associated with the capture and rerouting of water from its historic path. And increasing the number of stream crossings. Design would be similar to Alternative 2.
	Clearing		Clearing removes vegetation along existing road templates to allow travel. Minor effects would be attributed to the 7.1 miles of road reconstruction.	Additional risks are associated with increasing the road net work by 6.3 miles and removing vegetation that contributes to channel bank stability at crossings.

Mechanism/ Action	Cause	Alternative 1	Alternative 2	Alternative 3
Slash Treatment	Piling	N/A	Stream channel effects associated with piling are dependent on type. No effect occurs with hand piling. 111acres available for piling. Piles may be within the riparian reserve.	Similar to alternative 2 with 67 acres available to pile. These areas would be outside the Riparian Reserves.
Prep Work	Burning	N/A	Burning of hand piles would create small 15x15 foot areas of soils that are at risk of hydrophobic conditions. This spatial distribution of these small sites doe not create an impact to the drainage network and is therefore not determined a risk. A minimal, if any, effect on the stream channel exists.	See alterative 2

Cumulative Effects: Steam channels

The area considered for cumulative effects included the subwatersheds that contain the analysis area. Previous stand management affected the streams in the area by removing large wood, vegetation and channeling runoff down skid roads. Past activity created areas which have developed into ephemeral channels and, in some locations, perennial channels. Where old landing locations have collected runoff, stands of alder have developed and are currently decreasing in vigor.

Cumulative effects are those effects which independently do not pose a risk to water quality yet, when added together may have some measurable effect on water quality. Looking at the watershed condition types for streams found within the project area, determines what management prescriptions should be followed. (*USDA. 1990, E-10 to E-17*) "This criterion is intended to address the potential for changes in peak flows during rain-on-snow events, and the associate potential change in the stability of the stream banks and streambed." (*USDA. 1990, E-6*). The Watershed condition types are type 1, 2, 3, and 4 channels (*USDA. 1990, E-10-12*). Under types 1 & 2 no recommended ARP is required due to the stability of the channels, and under types 3 & 4 ARP levels can be within 5 points +/-, of the threshold. Upon reviewing these criteria, the streams involved in this project, and the prescriptions developed for the Riparian Reserve areas, it is not anticipated that adverse cumulative effects would occur to stream channels.

Water Quality

Existing Condition: Beneficial users, dependent on aquatic resources, in this planning area are: domestic water use; resident fisheries use; aquatic non-fish species use; riparian dependent species use; water-related recreation; hydroelectric power generation; and water-related fire suppression and road maintenance needs.

Historically, Quartzville Creek provided anadromous habitat for winter steelhead and spring Chinook salmon prior to the construction of Foster and Green Peter dams, which began in 1961 and was completed in 1968.

Water from this project area flows into Quartzville Creek and into Green Peter Reservoir. Water then joins the South Santiam River, which serves as a domestic water supply for 19,000 people in several downstream municipalities, including Foster, Sweet Home, and Lebanon, Oregon.

Water quality parameters critical to beneficial users are temperature, and type and timing of sediment input and biological contaminants. Stream segments of Quartzville Creek are listed under 303(d) classification with the State of Oregon because they exceeded the temperature criterion of 18.0 C (*64.4 F*) for salmonid migration and rearing (*December 2003 Temperature criteria adopted by the Environmental Quality Commission and approved by USEPA in March 2004*). The main-stem of Quartzville Creek is listed from river-mile 3.3 at Green Peter Reservoir, to river-mile 26.8 at its headwaters for exceeding summer rearing temperatures of 18^{0}C.

Environmental Consequences

Direct and Indirect Effects – Water Quality

Effects on water quality could occur with increases in inputs such as contaminants like petroleum products, sediment or solar radiation as the result of the timber sale. All of these could have an adverse effect of the quality of water within the project area. Table 31 evaluates the effects by alternative for water quality.

Table 31: Water Quality - Direct and Indirect Mechanism of change by Alternative

Mechanism/ Action	Cause	Alternative 1	Alternative 2	Alternative 3
Fire	Natural	Stands that are not treated have a risk of associated fire starts due to the amount of available fuel. This equates to detrimental water quality changes due to inputs of ash, increased solar radiation, and sediment from eroding channel banks if a fire ever starts. This risk is low in this area.	Reducing the fuel loading through thinning and slash treatment in high risk areas reduces the risk of hotter, intense burns and subsequent inputs of nutrient and solar radiation input to streams. This risk is low.	A combination of risks between Alternative 1 and Alternative 2. Portions of the stands would be thinned and slash treatment would occur along high risk areas but the area closest to the stream channels would not be treated. The route of contaminants getting to streams would be hindered due to spatial positioning to streams. Low risk.
Felling	Directional felling	N/A	When felled, trees have the potential to destabilize channel banks upon impact thus inputting sediment into flowing water. No treatment would occur on 270 acres of the 653 acres of Riparian Reserves within harvest units.	Trees would not be felled along stream channels, except in 84 acres of Riparian Reserves along intermittent streams, which have no water most of the year, but do show channel scour. No treatment would occur on 569 of 653 acres in Riparian Reserves. This reduces the risk of sediment input into flowing water.
	Bucking/ Limbing	N/A	When trees are bucked and limbed an increase in organic material in contact with the water surface is possible. This increase can load a stream to a point where available oxygen is utilized and water quality is affected	Very slight possibility of organic material entering flowing channel due to treatment on only 84 acres of Riparian Reserves in areas with no water flowing. No treatment is planned on 569 of 653 acres of the Riparian Reserves.
	Ground Skidding	N/A	111acres of would be yarded using ground-based equipment so there is low risk of potentially spilling petroleum products and/or introducing sediment into streams.	67 acres of skidding and risk associated to skidding would occur. Low risk of spilling of petroleum products or inputs of sediment into streams.

Mechanism/ Action	Cause	Alternative 1	Alternative 2	Alternative 3
Removal of trees	Skyline yarding	N/A	Units, or portions of units, that would be skyline yarded would require corridors through primary buffers. These corridors are typically 10 to 15 feet wide. 569 acres would be skylined. Sediment and debris could be dragged into these crossings if suspension requirement are not met and solar radiation could reach channel if prescriptions are not followed.	Units or portions of units that would be skyline yarded would require corridors through primary buffers. These corridors are typically 10 to 15 feet wide. 371 acres would be sky lined. Sediment and debris could be dragged into these crossings if suspension requirement are not met. No treatment of Riparian Reserves reduces risk of opening channel to solar radiation.
	Helicopter yarding	N/A	This is the most protective way of removing trees from a site. 148acres of helicopter removal are proposed. Water quality risks are associated with service landing locations and potential spills.	Only 114 acres of helicopter yarding. Effects are similar to Alternative 2.
	Haul	Without a sale in the area money available for road maintenance does not cover adequate maintenance of the road systems. Increased sediment from road surfaces being washed when ditches fill and maintenance of road system does not occur.	Reopening, construction and reconstruction of 7.1 miles of road would intersect numerous stream channels and provide sources of sediment into the channel. Loss of current vegetative cover and loss of vegetation increase the potential of sediment input.	Additional risks associated to increasing the road network by 6.3 miles. Risks are associated to the loss of fines off the road surface and increasing the number of stream crossings.

Mechanism/ Action	Cause	Alternative 1	Alternative 2	Alternative 3
	Clearing		Clearing removes vegetation along existing road templates to allow travel. Minor effects would be attributed to the 7.1 miles of road reconstruction/construction.	Additional risks are associated to increasing the road net work by 6.3 miles. And removing vegetation that attribute to bank stability at crossings. Increasing sediment and solar inputs.
Construction of landings and roads	Grubbing (*Digging of root wads and vegetation.)*	27 acres of existing …..	Grubbing would be associated with the construction of landings and 7.1 miles of road reopening, reconstruction and construction. Approximately 20 of the 47 acres in landings would require some grubbing. Creation of bare soil allows water to wash sediments into channels. Moderate risk associated with the road construction and creation of stream crossings Moderate risk of sediment entering stream channels.	Grubbing would be associated with 7acres of 34 landings and 6.3 miles of road reopening and reconstruction. Creation of bare soil allows water to wash sediments into channels. Low risk of sediment entering stream channels because no road construction in riparian areas.
	Travel	Status Quo	Additional risks associated with increasing the road net work by 7.1 miles. Travel along existing roads, tends to be restricted to rocked mainline roads. Effects to water quality would be associated with fine sediments being generated off the 7.1miles of reopened, reconstructed, and constructed roads.	Additional risks associated to increasing the road net work by 6.3 miles. Risks are associated to the capture and rerouting of water from its historic path and the capturing of fines and moving them into the stream channel.
	Closing	Moderate risk associated with keeping open roads and not maintaining drainage features.	Reconstruction of drainage patterns and maintenance reduces the risk of capturing flow and routing and sediment input.	Reopened roads would be closed upon sale completion. Pipes would be pulled and additional disturbance to channels would occur. Short -term input of sediment would occur (1 year).
	Subsoiling	N/A	Subsoiling could possibly occur on the intensely used skid roads. 111 acres are being ground based and 20 acres of landings and new roads are being built. A positive effect to water quality occurs in increasing permeability of compacted areas and reducing the potential of channel routing and sediment movement. Potential for petroleum spill.	Ground based systems would be utilized on 67 acres. Reopened roads and approximately 7 acres of landing could be subsoiled. Positive effects would be anticipated due to increased permeability of compacted areas and reducing the potential of channel routing and sediment movement. Potential for petroleum spill.

Mechanism/ Action	Cause	Alternative 1	Alternative 2	Alternative 3
Slash Treatment	Piling	N/A	Water Quality effects associated to piling are dependent on type, No effect occurs with hand piling while minor effects occur with machine piling. By having equipment on the site you increase the size of the piles and the risk of petroleum spills. 111 acres available for piling	Similar to alternative 2 with 67 acres available to pile.
Prep work for reforestation (piling and burning)	Burning	N/A	Burning of hand piles would create small 15x15 foot areas of soils that are at risk of hydrophobic conditions. Nutrients from these piles could enter water ways. This spatial distribution of these small sites creates a low impact to water quality and is therefore not determined a risk. Machine piles tend to be larger 25 x 25 feet, and spaced at greater distance and are also not considered to pose a risk.	See alternative 2

Cumulative Effects - Water Quality

The area considered for cumulative effects analysis included the subwatersheds that contain the analysis area. Water quality Cumulative affects would be similar to the hydrology and the stream channel discussions. The effect of all the activities that would occur under this proposal is tempered by the timing of the action in relation to the recovery of the stands, the buffers required and the utilization of the sufficiency analysis and water quality management plan. Provided the Best Management Practices prescribed in this report are met, it is not anticipated that adverse cumulative effects would occur as a result of this project to water quality. Retention of shade along stream channels in the primary shade zone should maintain current stream temperatures.

Riparian Reserves

Existing Conditions: Riparian Reserves for this planning area are based on the interim widths established in the *Northwest Forest Plan* as outlined in Table 32. All units, except Unit 18, fall within the western hemlock plant association.

Table 32: Riparian Reserve Widths established by NW Forest Plan

Stream Class	Plant Association	Site Tree Height	Riparian Reserve Width in Site Trees	Riparian Reserve Width in Feet	Total Riparian Reserve Width
III and IV	western hemlock	172 feet	One potential site tree	172 feet either side of stream	344 feet
Fish-bearing streams	western hemlock	172 feet	Two potential site trees	344 feet either side of stream	688 feet
III and IV	Pacific silver fir	150 feet	One potential site tree	150 feet either side of stream	300 feet
Fish-bearing streams	Pacific silver fir	150 feet	Two potential site trees	300 feet either side of stream	600 feet

Quartzville Creek, McQuade Creek, Galena Creek, Canal Creek, Little Meadows Creek and Johnny Creek are the known fish-bearing streams associated with this project.

Riparian conditions are varied and site specific. Past management activities have compacted soils in skid trails and directed overland flow, which creates scoured stream channels and small wetlands (*25' x 50'*) with alder growing in the vicinity. The tree species mix contains an alder component for approximately 25-50 feet from the stream channel, and then transitions into a more upland species character, dominated by Douglas-fir. Diversity within the riparian area varies depending upon slope, aspect and hydrology. Field observations show units 5, 6, 7, 10, 12, and 18 to have the greatest diversity within the Riparian Reserves. Remaining units tend to be more monotypic and single-species dominated. Approximately 653 acres of Riparian Reserves are associated with the units proposed.

From field observations and measured acreages, it was determined that about 65 percent of the Riparian Reserves do not contain the vertical diversity or the complexity that signifies a healthy Riparian Reserve. These areas contain dense, overstocked stands with a closed canopies, small crown diameters, sparse vertical crowns (*<25% of total tree height*), an increase in fuel loadings associated with mortality of suppressed trees, and a lack of large down wood. These characteristics are similar in the upland areas as well.

Direct and indirect effects on the Riparian Reserves are a compilation of the hydrology, stream channels, water quality and terrestrial wildlife components and would not be restated here.

Summary, Conclusions and Rationale: In looking at the direct and indirect effects for hydrology, stream channels, water quality and Riparian Reserves, it is not anticipated that any of effects would be detrimental or create significant downstream effects.

Alternative 1: The greatest potential effects associated with this alternative are the result of fire and the effects that might have on the landscape, if and when a fire occurs. Due to fire management protocols, fire starts within this area would be actively pursued and controlled as soon as possible. So the risks associated with fire for this alternative would be low.

Alternative 2 treats 828 acres with various prescriptions and logging systems. Of the treated acres 383 acres fall within Riparian Reserves, but outside of the primary shade zones. The greatest risks associated with this alternative are the small 1/8 to ¼-acre openings scattered among thinned stands in Riparian Reserves (*although they are at least 172 feet from streams*), thinning in Riparian Reserves, and the use of ground-based yarding systems in Riparian Reserves. The loss of canopy through thinning and in DTR openings could potentially accumulate more snow and contribute to increases in peak flows. The use of ground-based yarding systems can cause compaction and gouging which can redirect overland flow from natural drainage patterns.

In addition, in this alternative 1.44 miles of temporary roads would be reconstructed, 0.2 miles of temporary road would be constructed and 5.28 miles of closed and water barred, system roads would be reopened to allow access to these units. These roads would be closed and water barred following harvest activities. There are also five helicopter, six skyline and six ground-based landings within Riparian Reserves, but outside of no-harvest buffers. All of the helicopter landings already exist, although one would need to be expanded. In addition, there are two ground-based stream crossings on intermittent streams and skyline yarding would occur across streams in two units. Logs would be fully suspended across stream channels. The risks associated with these activities include sedimentation and water re-routing. This risk is somewhat higher than Alternative 3 because more roads, thinned areas, etc. are in closer proximity to stream channels.

Sufficiency Analysis protocol was followed and determined that the management of riparian areas would reduce the recovery time of creating shade over the channels from about 20 years to about 10 years.

Floodplains occur within the planning area. No activities would occur on within flood plains due to no-harvest stream buffers.   Wet areas would be protected on an individual basis under the stand-specific recommendations and wetland areas less than 1/4 acre would be treated as special habitat areas (FW-211).

The risks discussed above are short-term (5-10 years) that are expected to be minimized by implementation of Best Management Practices and Willamette Forest Plan standards and guidelines. Best Management Practices (BMP's) were utilized in the development of mitigation and compliance to Aquatic Conservation Strategy Objectives. These BMP's can be found in "General Water Quality Best Management Practices" Pacific Northwest Region, November, 1988. This action falls well within the *Willamette Forest Plan* standards and guidelines. Stream-side management prescriptions are designed to maintain Aquatic Conservation Strategy Objectives (ACSO), as defined in *Willamette Forest Plan*.

This alternative meets Federal and State water quality objectives. These objectives are met through the implementation of BMP's. Riparian Reserves are adequate to maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems and meet the ACS Objectives. Table 27 shows the acres of Riparian Reserve acres being treated and the canopy closures being left on stream buffers.

Provided these riparian areas are maintained in a healthy state the stream systems are anticipated to obtain their desired future condition.

Alternative 3 treats 557 acres with various prescriptions and logging systems. Of the treated acres 84 acres fall within Riparian Reserves, but outside of the primary shade zones. The greatest risks associated with this alternative are thinning in some of the Riparian Reserves and the use of ground-based yarding systems in Riparian Reserves. The loss of canopy through thinning could potentially accumulate more snow and contribute to increases in peak flows, although the risk of this is much less than with Alternative 2 because far fewer acres are treated here and there are no small, DTR openings in the Riparian Reserves. The use of ground-based yarding systems can cause compaction and gouging which can redirect overland flow from natural drainage patterns.

In this alternative 0.64 miles of temporary roads would be reconstructed, 0.2 miles of temporary road would be constructed and 4.59 miles of closed and water barred, system roads would be reopened to allow access to these units.   These roads would be closed and water barred following harvest activities. There are also five helicopter, three skyline and two ground-based landings within Riparian Reserves, but outside of no-harvest buffers. All of the helicopter landings already exist, although one would need to be expanded. In addition, there are one ground-based stream crossing on an intermittent stream and skyline yarding, with full suspension, would occur across streams in two units. The risks associated with these activities include sedimentation and water re-routing. This risk is somewhat less than Alternative 2 because there are fewer roads, thinned areas, and no DTR openings in close proximity to stream channels.

Sufficiency Analysis protocol was followed and determined that the riparian areas would begin to create shade over stream channels in about 20 years, or about twice as long as Alternative 2.

Floodplains occur within the planning area. No activities would occur on within flood plains due to no-harvest stream buffers. Wet areas would be protected on an individual basis under the stand-specific recommendations and wetland areas less than 1/4 acre would be treated as special habitat areas (FW-211).

The risks discussed above are short-term (5-10 years) that are expected to be minimized by implementation of Best Management Practices and Willamette Forest Plan standards and guidelines. Best Management Practices (BMP's) were utilized in the development of mitigation and compliance to Aquatic Conservation Strategy Objectives. These BMP's can be found in "General Water Quality Best Management Practices" Pacific Northwest Region, November, 1988. This action falls well within the *Willamette Forest Plan* standards and guidelines. Stream-side management prescriptions are designed to maintain Aquatic Conservation Strategy Objectives (ACSO), as defined in *Willamette Forest Plan*.

This alternative meets Federal and State water quality objectives. These objectives are met through the implementation of BMP's. Riparian Reserves are adequate to maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems and meet the ACS Objectives. Table 27 shows the riparian reserve acres being treated and the buffer leave acres.

Provided these riparian areas are maintained in a healthy state the stream systems are anticipated to obtain their desired future condition.

Monitoring: Water temperature recorders have been placed throughout the watershed in previous years to collect temperature information. This information would be utilized as part of the water Quality Management Plan to determine if management effects are occurring.

As part of Best Management Practices monitoring, riparian conditions would also be monitored for their response to stand treatments.

Consistency with Direction and Regulations: The following list shows the various direction and regulations that were utilized in the development of hydrology, stream channel, water quality and Riparian Reserve prescriptions for this proposal. In all action alternatives unit layout and design considered and applied the intent of the direction and regulations. All of the units were reviewed on-the-ground and recommendations and effects were considered. All actions within the alternatives are anticipated to be consistent with this direction with regard to water quality, hydrology, and stream channels protection. As described under the Regulatory Framework in section 2 of this report, thought processes are disclosed.

Table 33: Consistency with Regulations for Hydrology, Stream Channels, and Water Quality

Regulation	Alternative 1	Alternative 2	Alternative 3
Willamette Forest Plan Watershed requirements	yes	yes	yes
Aquatic Conservation Strategy Objectives	yes	yes	yes
NW Forest Plan	yes	yes	yes
Clean Water Act	yes	yes	yes
DEQ Sufficiency Analysis for Stream Temperature 303(d) listing Water Quality Management Plan.	yes	yes	yes
Best Management Practices	yes	yes	yes

Irreversible and Irretrievable Commitments of Resources

It is not anticipate that any irreversible or irretrievable commitments of resources would occur relating to hydrology, stream channels, water quality, or Riparian Reserves.

There is a short-term irretrievable commitment of water use by thinned stands. Shortly after the stands are thinned there would be a short-term (*5-10 years*) increase in flows, but as the stands begin to grow rapidly they would use more water making it unavailable for downstream uses. This commitment of resources would last (10-20 years).

Fuels

Introduction: One of the purposes of the project is to contribute to long-term forest health in the LSR by increasing resistance of the LSR to disturbances from fire, insects and diseases, etc. This is needed to maintain habitat function over the long-term.

Issues: The biggest fuels issue associated with the project is the amount of fuels generated by slash from commercial thinning. The economics of thinning makes it difficult to afford extensive slash treatment. Eventually the fuels would break down but in the mean time, they add to the risk of fire starts within treated stands. A large fire in the LSR would be detrimental to the intended function of the area.

Fire History: Historically fire was a predominant natural disturbance process in the Quartzville watershed. These fires were often the result of lightning but were sometimes ignited by Native Americans to manage vegetation on the landscape. The lightning fires were common throughout the drainage, especially at higher elevations. Native American fires were more targeted to specific areas, such as huckleberry fields or in meadows to improve big game habitat. Historic fires burned at various time intervals and intensities in the watershed, sometimes underburning stands and sometimes replacing stands. These fires sometimes consumed more than 1,000 acres at a time. As the burned areas became revegetated, they created a mosaic of large blocks of similar-age stands across the forested landscape.

From the 1950's to the 1980's timber harvest activities eliminated much of the structural complexity of timber stands in the watershed. These harvests and the associated slash disposal treatments resulted in patchwork landscapes that, at the small scale, tended to replicate intense fire regimes. Aggressive salvage and utilization requirements removed much of the woody debris and snags while seasonally-prescribed fire operations often removed most of the duff and litter layers.

Fire ignitions in the Quartzville area are still the result of two primary ignition sources, lightning and humans. Lightning ignitions still generally occur at higher elevations while fires in the lower elevations are more likely to occur as a result of human use. At present time fire ignitions are promptly extinguished, so fire, as a major disturbance mechanism, has been virtually eliminated from the ecosystem through fire prevention and suppression.

The Quartzville Thin LSR Project Area is represented primarily by the following fire regimes, which refer to the rate of fire occurrence within a given area in a given period of time and severity refers to the amount of replacement in the dominant overstory:

- Fire Regime III - mixed frequency and mixed severity
- Fire Regime IV - low frequency high severity.

Fire Regime Condition Class (FRCC) describes the degree of departure of current vegetation from the historic fire regime (*Hann et, al.2003*). FRCC 1, 2 and 3 rank the degree of departure from the historic range of variability.

Table 34: Fire Regime Condition Class Definitions

FRCC	Departure of Fire Regime from Historic Range	Risk of losing key ecosystem components	Alteration of vegetation attributes from historic range
1	Near historic range (*departure is not more than one return interval*)	Low	Functioning within the historic range
2	Moderately altered; moderate change in size and intensity has resulted	Moderate	Moderately altered
3	Significantly altered; dramatic changes in fire size and severity has resulted	Severe	Significantly altered

Much of Quartzville LSR Thin can be described as FRCC 1 which means the fire interval for the area is not outside of the historical range of variability, or that the departure from the historic range is not more than one return interval outside the range. However, the susceptibility of the project area to fire should be tempered with the current fuel profile. An elevated risk of high-severity fire due to the continuity of vertical and horizontal fuels exists across the landscape. Continuous canopy closure and increased fuel due to fire suppression create the potential for a large, severe fire. FRCC 1 may understate the potential for loss of vegetation attributes due to large fires.

Although current fuel conditions point to the potential for a stand-replacing fire, analysis of historical fires describe the Fire Regime here as *Average, low-frequency for stand replacing fires (>200 years*) and Average, *moderate-frequency for Partial Burns(80-100 years)*. Analysis of fuel and historical weather conditions indicate a moderate Fire Behavior Risk in this area. Finally, the Fire Occurrence Risk for the area is generally moderate with potential ignition sources such as humans, lightning, and railroads. These moderate risk areas are interspersed with occasional high-risk areas near population centers, lightning-prone areas and high-use recreation areas.

Fuel Models: There are two major Fire Behavior Prediction System Fuel Models (FM) represented within this project planning area. Fuel Model 8 constitutes 90% of the area. This profile can be found in stands that were, or were not, previously harvested.

Fires in the Quartzville Thin LSR are typically slow-spreading with low flame lengths and are more extreme in scattered areas where the downed woody material is concentrated and extensive ladder fuels are present. Only under severe weather conditions involving high temperatures, low humidity's, and high winds do the fuels pose fire hazards. About 10% of the acres are a Fuel Model 10 represented by the mixed conifer stand with a heavy concentration of down and standing woody component. Ground fire behavior is higher in intensity than Fuel Model 8 because of the heavier fuel loading. Torching trees (fires in the crowns of trees) occurs more frequently.

Desired Future Conditions: The desired condition is to promote sustainable, late-successional vegetative structure and species composition that correlates with the natural fire regime and reduces the fuel loadings to support low-intensity fires rather than high-intensity, stand-replacing events. In forests that have not experienced fire for many decades, multiple fuel treatments such as decreasing stand density, reducing surface fuel and removing ladder fuels may be required to significantly reduce the probability that extreme fire behavior would occur. Fuel treatments can be designed to restore forest conditions to more resilient conditions than currently exist.

Analysis Methods: Fuel Profile analysis was completed using ocular and photo series interpretation methods (*Maxwell et, al. 1980*). Values were then referenced to the Fire Behavior Prediction Systems Fuel Models 1-13 (*Anderson, 1982*).

The predicted fuel loading from harvest activities was generated using fuel prediction tables (*Brown, etal.1977, 1980*). Stand exam data and estimated tree removal volume was used to predict the 0-3 inch diameter fuel loading per ton.

Prescribed fire smoke emissions were calculated using First Order Fire Effects Model (FOFEM) version 5.0. FOFEM calculates particulate matter in both the 2.5 and 10 micron size class (PM 2.5 and PM 10). The Oregon State Implementation Plan regulates PM 2.5 and PM 10 levels in special Protection zones or Class I Airsheds and are highly regulated.

Environmental Consequences

Direct and Indirect Effects – Fire and Fuels

Alternative 1 (No Action): No fuels would be generated and forested stands in the area would continue on a path of natural succession. Stands that were previously managed and are currently in an overstocked condition would develop relatively slowly into diversified forests. Slow-growing and weakened trees would die and contribute to the fuel buildup on the forest floor. A fairly healthy stand would be vulnerable to a change in fuel model due to overstocking and encroachment. Forest fuel loadings would continue to increase due to insect and disease-caused tree mortality and forest succession, including further in-growth of understory trees and vegetation. The No Action Alternative does not include any treatments to improve the stand health. Fire suppression would also continue. In the absence of management-ignited prescribed fire, ladder fuels and canopy closure would continue to be high, thus providing propellants for severe, high intensity wildfires.

Alternatives 2 and 3: The proposed thinning would open up tree canopies thereby creating conditions that are less susceptible to sustaining crown fires. Ladder fuels would be reduced as harvest operations remove the vertical fuel continuity.

Increased fuel loads generated by logging slash can affect wildfire behavior by increasing the rate of fire spread and the risk of the fire becoming larger should an ignition occur. Light to heavy levels of logging slash would be generated in harvest units depending on the amount of thinning that takes place in a stand Some fuel loads would be reduced in units that use ground-based logging systems by having the tops yarded or crushed by ground-based yarding equipment, such as a processor-forwarder, during logging. In the thinned units, which are located on slopes too steep to for ground-based logging, (where helicopter or cable systems are used) fuels would not be treated other than handpiling and burning, in high-risk areas, along roads.

All stands would receive some sort of fuel treatment, be it yarding tops attached, burning landings or handpiling near roads, but portions of most thinned units would not be treated for fuels. These untreated areas would be within maximum acceptable fuel loadings as outlined in the *Willamette Forest Plan* (*USDA, 1990*) but would be toward the upper level of acceptable fuel loadings: 11, 12 and 20 tons per acre for 0-3," 3-8.9" and 9-16" diameter material, respectively.

The thinning would occur over a period of years and the total fuel would not be on the ground all at once; therefore, untreated fuels would be in varied stages of height and decomposition.

Moderate to heavy precipitation in the Western Cascades Mountains accelerates the decomposition processes and, over time, reduces the risk of large fire growth associated with untreated fuel buildup. With no fuel treatments after 3 years the 0-3 inch fuel would reduce as the needles drop off and the snow crushes the fuel closer to the ground, accelerating the fuel decomposition. Acceptable levels for fire crews to suppress wildfires and build handline under normal summer conditions would result in flame lengths dropping to 4 feet or less. This is attributed to the varied stages of height and decomposition of the residual fuels.

The following table displays the acres of harvest and fuel treatments for each of the action alternatives. More than one type of fuel treatment can be applied to any given area; therefore, the total acres of treated and untreated may vary and not be equal to the total amount of stand acres.

Table 35: Fuel Treatments for the Action Alternatives

Fuels Treatment	Alt 2 Acres	Alt 3 acres
Thinning	828	557
Acres of Treated	268	234
Acres of Untreated	560	332

Cumulative Effects – Fire and Fuels

The area considered for cumulative effects analysis was the project area. Past management activities, fire suppression and lack of management in some areas has changed the forest stand characteristics, landscape structure and fuel loadings by removing the principal agents of change and renewal. Both action alternatives result in an increase in fuel loadings that are generated by logging slash, which would decrease over time. The biomass fuel loads would decrease with the proposed actions through reduced stand density. Future management activities that may contribute to higher fuel loads would include pre-commercial thinning. Typically, the thinning slash is pulled back from the roads and allowed to decompose on site minimizing the overall risk of human ignition. Other future activities may include salvage logging within forested areas or hazard tree removal along the roadsides. The removal of dead and dying trees would reduce the risk of a large fire from developing.

Canal, Galena and Upper Quartzville subwatersheds are about 41,629 acres. Of these, about 80% fall under Forest Service jurisdiction. This analysis focuses on three of the 6th field subwatersheds because these comprise the topographic basin around the fire area.

Risk and Role of Fire in the Watershed: Large fire events occurred in the watershed when a combination of weather and fuel factors created optimum conditions for fire intensity and spread. The watershed experienced infrequent severe crown and surface fires that often resulted in total tree mortality. These large fires have often occurred in drought years, ignited by lightning and driven by east winds. Present forestry practices have probably had a dampening effect on the fire regime in the Quartzville Watershed. The large numbers of roads and managed stands has increased accessibility for fire suppression efforts, and have provided fuel breaks through much of the area. The size of smaller patch fires has been kept artificially low, and the opportunity for these fires to become large stand replacing fires under certain environmental conditions (high temperatures, east winds etc.) has been greatly reduced.

Conversely, management has increased the frequency of patch fires in specific areas due to escaped slash burns and increased access to the public, which has resulted in more frequent human caused fires.

The current, fragmented landscape supports various fire intensities as the decrease or increase of vegetation responds differentially to fire. The resulting condition probably reflects an alteration in the distribution, composition and extent of plant communities that had adapted to the pre-management fire regime.

Fuel profiles in the Quartzville Watershed are affected by three elements: silvicultural treatments, stochastic events and time. All three have played a role in the present fuels profile associated with the watershed. About 1/3 of the analysis area has had silvicultural treatments (i.e. thinning and planting). Stochastic events (such as large wildfires) have played a major role in this watershed, and would most likely continue to do so.

Past and Present Projects: The Quartzville Watershed is one of the most intensely managed areas on the Sweet Home Ranger District. The first commercial timber entry was in the1950's. Approximately 1/3 of the analysis area has been harvested between the 1950's and the present.

An era of intensive road construction and timber harvest occurred across the landscape during the 1940's through the early 1980's. The harvest rate averaged about 6 to 10% of the watershed per decade, but has declined in recent years.

All present and proposed activities in the foreseeable future would have some measure of fuel treatments, resulting in a Fuel Model 8 (both spread and intensity) after treatment.

The cumulative effects of the fuel treatments in any of the proposed actions alternatives would be minimal at the subwatershed scale. Alternative 2 treats about 2.4% of the 6^{th} field watersheds and Alternative 3 treats about 1.6% of the 6^{th} field watersheds in the cumulative effects analysis area. Over the next five decades, Alternative 1- No Action would result in fuel models that increase fire intensities and are arranged in large contiguous patches which increase resistant to control within the project area. The No Action alternative would increase the risk of fire spreading outside the project area to adjacent Forest Service lands. The action alternatives would provide a variety of fuels treatments, which reduce fire intensities within the project area. By varying the spatial patterns of fuels there is less resistance to control thereby lowering the risk of fire spreading outside the project area. Alternative 3 proposes the least amount of silvicultural treatments by eliminating most of the harvest within Riparian Reserves. This would also lessen the amount of activity-generated fuels and the need for fuel treatment. The fuel models in these units would not change and the fire behaviors would continue to increase in intensity. Location of fuel treatments is an important aspect in the prevention of fires spreading outside the project area.

Air Quality

The State of Oregon has delegated authority for attainment standards set by the 1990 Clean Air Act and the 1977 Clean Air Act and its amendments. To do this, the state developed the Oregon Smoke Management Plan. The Forest Service has adopted this plan for National Forest lands in Oregon.

The Oregon Smoke Management Plan establishes designated areas that are principal population centers and Class I Airsheds, including wildernesses and other sensitive airsheds. One purpose of the Smoke Management Plan is to protect air quality in these high priority areas. For the 828 acre Quartzville Thin LSR Project Area, the closet designated area is the Willamette Valley (Eugene, Salem 60 miles respectively). The closet Class I airsheds are the Middle Santiam Wilderness and Mt Jefferson Wilderness (2, 15 miles respectively).

Environmental Consequences

Direct and Indirect Effects – Air Quality

Alternative 1 (No Action): There are no impacts to air quality in the No Action Alternative, however, the stands would continue to store more biomass as they grow and postpone the release of smoke to the driest time of the year when the impact to people is the greatest. In the event of a wildfire, air quality impacts are considerably higher than management-ignited prescribed fire. Table 36 below demonstrates the differences. Smoke emissions are not short term and can last for months, as witnessed by the B&B Fire in 2003. Smoke could blanket the adjacent wildernesses with significant negative effects on air quality and visibility, or intrude on at least one of the designated areas. The most likely time for a large wildfire to occur is between July 1 and September 15, which coincides with outdoor recreation activities and high public use of the National Forests.

Alternatives 2 and 3: Air quality in the designated areas could be affected by forest-land fuel treatments, such as the application of fire to reduce fuels by burning hand, grapple or landing piles.

The following table illustrates the estimated total particulate matter emissions for a wildfire in Alternative 1 compared to handpile burning in the two action alternatives. The calculations are based on the pounds of particulate matter per ton of slash for prescribed burning in the Western Cascades fuel types. Average tons per acre (TPA) burned do not include landing piles due to the wide variability in landing pile characteristics, primarily size and shape.

Smoke emissions were predicted using the estimates from the debris prediction tables and FOFEM (First Order Fire Effects Model version 5.0). This model calculates particulate matter emitted based on the amount of fuel consumed. Fuel inputs were from the predicted post-harvest data and based on a percentage of fuels that would most likely be consumed given the prescribed fire window. That is, weather and fuels dryness would be measured to achieve the objective of reducing the fuel profile across the unit. On average, 80% of the fine fuels (0-1inch diameter) would be consumed, 60% of the 1-3 inch diameter fuels would be consumed, and only about 20% of the 3 inch and greater fuels would be consumed.

Table 36: Summary of Potential Particulate Matter Emissions by Alternative

Particulate Matter (PM) (diameter - measured in microns)	Alternative 1 No Action-Wildfire	Alternative 2	Alternative 3
PM 2.5	2229 tons	412 tons	284 tons
PM 10	2630 tons	486 tons	334 tons

It is important to note these emission levels do not occur all at one time. Usually prescribed fire operations occur one unit at a time (in one day). For example, 3 acres of handpiling along a roadside is predicted to have 6 tons/acre of 0-3 inch diameter fuel post harvest and may emit particulate matter in the range of 3.0 tons/unit of PM 10 and 2.8 tons/unit of PM 2.5.

The significance of emission level changes is based on the weather. During periods of atmospheric stability (inversions), particulate matter is not dispersed and debris burning would not occur. However, during atmospheric instability, vertical mixing allows particulate matter to disseminate and the emissions from debris burning are readily dispersed. Typically prescribed broadcast burning would occur in the spring when the snow has melted off and fuels are dry enough to burn and may last through July 1st. Burning resumes September 15th and after dry, east winds events have ended. Generally, both handpiles and landing pile burning occurs in the fall when the seasonal rains control and extinguish the burning.

Public use of the wilderness is highest between July 1 and September 15, not during the prescribed fire season. The affects of prescribed burning on air quality would therefore be of minimal impact to the public and meet air quality standards.

The Oregon Smoke Management Plan and the Oregon Visibility State Implementation Plan (SIP) also have a number of requirements designed to meet the Clean Air Act standards, reduce the amount of smoke produced, and reduce the impact on the designated and wilderness areas. All burning operations would comply with the SIP, and be planned through the Oregon Smoke Management System, FASTRACS.

Cumulative Effects – Air Quality

The area considered for cumulative effects was the critical airsheds which contain the planning area. No adverse effects on the air quality would result from the proposed fuel treatments. Smoke emissions would be short duration and mitigation measures would reduce the quantity of emissions during prescribed burns. Past management activities do not cumulatively add to air quality impacts from the proposed treatments. No foreseeable management activities are scheduled to occur in the Quartzville Thin LSR Project Area.

Soils and Geology

Introduction : The Quartzville LSR Thin project area sits squarely within the Western Cascades physiographic province. Rocks, often included in the Little Butte Volcanic Series, are primarily andesitic tuffs and breccias of volcanic origin and are generally Eocene or Oligocene in age (around 32 to 17 million years) (*Walker and Duncan, 1989*). Topographically, the area can be divided into two distinct regions: (1) the western side with sharp relief on steep, shallow-soiled, highly dissected side slopes, and (2) an eastern side with more rolling terrain and large expanses of gently sloping ground separated by sharp slope breaks. For a more complete description of this area, refer to the soils report in Appendix K.

Analysis Area: Reconnaissance was completed on potential harvest units and surrounding areas by the District Geologist.

Analysis Methods: On scattered field days throughout the 2000 to 2003 field season and April 5 and 7, May 4, 5, 24, 25, and 28, and July 15 and 16 in 2004, the District Geologist conducted a field reconnaissance of potential harvest units and surrounding areas for Quartzville LSR Thin.

The primary purpose of the field investigation was to: (1) verify the SRI land type boundaries in each unit; (2) determine appropriate logging systems; (3) evaluate the potential soil and watershed effects of the proposal; and if needed, (4) propose additional mitigation efforts to protect the soil and water resource.

Field investigation standards: A major portion of this aspect of the field investigation was directed at distinguishing the various identifiable landtype components within the study area and mapping them on the photo overlays. Some of the landtype analysis referenced in this report was originally conducted for previous watershed analysis or timber sale planning activities. Much of that earlier work was reevaluated and updated with this project. The information was then transferred to registered overlays in order to represent the data on a standard map base. The data has not yet been digitized, and only hard copy maps are available. Too large to be included with this report at a meaningful scale, a complete copy of the remapped SRI landtypes for this particular project area is being incorporated by reference and is on file and available for public review at the Sweet Home Ranger District.

In general, the field investigation confirmed some of the original 1973 SRI designations and much of the previously mapped work. However, considerable refinement and subdivision of the various boundaries were noted because of the in-depth field reconnaissance with this project. Many of the landtypes have several components that were not separated initially because of the mapping scale that was utilized. Field investigation of landtypes and their specific attributes formed the basis for the site-specific recommendations and mitigations that follow in this report.

In summary, several units border or contain areas of unsuited land. Larger areas of unsuited, unregenerable terrain have been designated and would be avoided with unit layout. Also, two small areas of unstable terrain would be excluded from proposed harvest units. Some units may contain small areas of rocks, talus or cliffs (generally less than one quarter acre) that may be thinned through. Almost all the acreage in the proposed units is located on Soil Resource Inventory (SRI) Landtypes that are considered stable and productive.

Existing Condition: Several proposed harvest units border or contain areas of unsuited land. Larger areas of unsuited, unregenerable terrain and two small areas of unstable terrain were identified and avoided through unit design. Some units may contain small areas of rocks, talus or cliffs (generally less than one quarter acre) that may be thinned through. Almost all the acreage in the proposed harvest units is located on Soil Resource Inventory (SRI) Landtypes that are considered stable and productive.

Several road-related debris chutes were noted in this general area after intense rainstorms between 1996 and 2000. Recent failures tracts are present in proposed units 19, 21, 22, and 24. Older sidecast failure scars are evident in Units 1, 4, 16, 18, 23, and 25.

All of the proposed harvest units are managed plantations which originated as clear cuts. Nearly all of these units were harvested with cable or skyline logging systems, with the exception of Units 5, 6, 10, 11, 12 and 27. Aside from very few cases, skyline or cable corridors are no longer visible. A few old logging spurs and tractor fire lines are still evident on the main ridges, and some well-used skid roads are still visible in the ground-based units. However for the most part, even these heavily disturbed areas have extensively revegetated with conifer and brush. Old landings often contain piles of decomposing logs that provide habitat for a host of species. Considerable brush and regeneration now cover most of these units, and almost no exposed soil remains. Disturbance and erosion from the logging and burning are no longer a concern.

For the most part, compaction from the ground-based equipment logging equipment was limited in extent because of the steep sideslopes. Portions or all of Units 5, 6, 10, 11, 12 and 27 were harvested with ground-based systems. Areas of these units may have been at the upper limit or exceeded Regional and current Forest standards at one time. Transects were run in Units 6, 10, 11 and 12 which were the most extensively logged with ground-based systems. They currently show compaction levels of 10%, 7-10%, 14%, and 8%, respectively. Some of that compaction has been naturally ameliorated over time by root growth, animal borrowing, and freeze/thaw; some likely remains, although finding it is difficult. Cumulative adverse effects from excessive compaction are not now considered a concern here.

Environmental Consequences

Direct and Indirect Effects – Soils and Geology

Introduction: The major short-term impacts to soil productivity from harvest activity, as discussed in the *Willamette Forest Plan* (1990), include displacement, compaction, nutrient loss, and instability. In most situations, preventing soil impacts is the most effective and feasible way of ensuring long-term soil productivity. The following sections discuss in more detail (1) how the proposed action may affect the soil resource or (2) mitigations that can be utilized to avoid potentially undesirable effects. In summary, the direct effects by any action alternative on the soils resource are limited in scope. Concerns from a cumulative effect standpoint are excessive compaction and increased slope instability, and mitigations are in place to ensure that that does not occur.

Alternative 1- No Action Alternative: With bio-turbation and freeze/thaw, existing soil compaction would slowly be reduced. Sidecast soils from past road construction practices would continue to become more stable as plantation trees increase in size, and storm-proofing efforts are maintained. Short-term effects from harvest, such as soil disturbance, dust, noise and slash accumulation, would not occur.

Alternatives 2 and 3: Both action alternatives were designed to reduce tree stem density and encourage growth on the leave trees. On a per acre basis, where an activity is proposed, both action alternatives require the use of the existing road and landing system, and the effects to the soils are considered nearly identical.

Displacement: No disturbance or displacement in excess of *Willamette Forest Plan* standards and guidelines is expected in either action alternative. *Willamette Forest Plan* logging suspension requirements are met or exceeded on all proposed units which would protect the soil from excessive disturbance or displacement (*for further details, see Soils Report, Appendix* K).

Compaction*:* For ground-based yarding areas, the use of pre-designated skid roads or the use of a processor/forwarder, where skid roads are closer together but the number of trips for each individual road are substantially less than with skidding, would both meet *Willamette Forest Plan* standards and guidelines for minimizing soil compaction.

Monitoring has shown that when designated skid roads are properly utilized in conjunction with line pulling and directional falling, compaction from ground-based tractor operations generally remains at about 9 to 12%, well within *Willamette Forest Plan* standards and guidelines.

Both skyline and helicopter yarding in thinning units with small wood results in much less compaction than ground-based systems and is well within *Willamette Forest Plan* standards and guidelines.

Residual compaction from the original harvest of Units 5, 6, 10, 11, 12 and 27 needs to be considered. The evident skid roads would be reutilized in these units. For the most part, few new skid roads would be required. Consequently, compaction is not considered a cumulative concern.

Finally, at the completion of harvest activities, selected, heavily-used tractor skid roads and landings (*existing or created*) that are not part of the dedicated transportation system, would be subsoiled with a winged ripper or equivalent equipment in order to reduce compaction and return the site to near original productivity. Subsoiling is intended to lift and separate the compacted layers, while minimizing the disruption to the soil horizons or burying organic material. Compacted skid roads often show overland flow during periods of high rainfall and snowmelt. Subsoiling greatly enhances water infiltration into the soil, and reduces the potential for overland flow and subsequent erosion. Subsoiling may be curtailed in areas of (1) heavy regeneration in order to prevent excessive root pruning, or (2) in areas with extensive slash and brush already on the ground, to reduce unnecessary disturbance.

Nutrient Loss: Retention of existing concentrations of large down woody material and additional trees that would be felled to meet wildlife needs would help ensure adequate nutrient cycling over time (*FW-085*). In addition duff retention requirements in proposed harvest units would help minimize nutrient loss, and would protect against erosion.

Some hand piling would occur along the primary system roads in each alternative. On typical thinning, hand piles number about 40 per acre and occupy about 20 square feet per pile for a total of about 800 square feet per acre or about 1.8% per acre. Burning the piled slash may develop sufficient heat to affect the underlying soil. However, pile burning is usually done in the spring or winter months when duff and soil moistures are higher, and this helps reduce the heat effects to the soil. Consequently, burning in this manner is considered a minor effect when considering the limited overall acreage involved.

Instability*:* Debris-chute-type slope instability is an active agent in the down slope movement of soil in most of the analysis area. Several small debris-chute-type soil failures were noted in this general area with the recent intense rainstorms from 1996 to 2000. Field reconnaissance also indicated the presence of several older debris chute scars, likely the result of intensive rainstorms in the 1960s. Almost all this debris chute activity is related to road drainage problems or road fill failures, primarily from sidecast construction techniques. Potentially unstable zones or actively unstable terrain, not associated with road construction or drainage, were not noted in any unit for this thinning proposal, except Units 5, 9 and 11.

Consequently thinning is not anticipated to increase the risk of slope instability. Thinning promotes tree growth. Crowns increase in size; root systems expand; and evapotranspiration rates increase. These factors all promote greater slope stability. Field review of previously thinned units has shown no increase in slope instability in either the uplands or Riparian Reserves. Thinning within and through Riparian Reserves improves long-term slope stability as stand conditions change with release and increased tree growth. Thinning should emphasize the retention of a well-distributed stand of larger trees, both conifer and hard wood. These larger trees also provide the stream, as well as the entire unit, the opportunity to better withstand the assaults of windstorms and floods over time.

Many old roads constructed through the proposed thinning units were constructed with sidecast methods. A mantle of sidecast soil and rock now blankets the slopes below most of the road cuts for a slope distance of one or two chains. Extensive conifer regeneration has occurred in this belt, and root strength now plays an important role in limiting ravel and maintaining slope stability. Excessive timber harvest could adversely affect that situation. On the other hand, not harvesting is not prudent either. Caution needs to be exercised. Several road-related debris chutes were noted in this general area with the intense rainstorms from 1996 to 2000, and recent failures tracts are present in proposed units 19, 21, 22, and 24. Older sidecast failure scars are evident in Units 1, 4, 16, 18, 23 and 25. Consequently, for one to two chains below roads in these Units, leave trees would be designated such that the larger trees with extensive root mats, and especially those trees with pistol butt trunks (indicative of sidecast creep) would be maintained. As was mentioned before, it is essential for long term slope stability, that thinning emphasize the retention of a well-distributed stand of larger trees, both conifer and hardwood.

In-unit slope instability was mapped in Units 5, 9, and 11. With Units 9 and 11, the potentially unstable area involves less than an acre and involves steeper slopes directly above Quartzville Creek or a major tributary. Both of these areas were deleted from their respective units. With Unit 5, the area is a band of a couple of acres of steeper soils within the central part of the plantation. The failures here are shallow debris chutes, and root strength plays an important role in maintaining long term slope stability. Consequently, it is recommended that this area be thinned through at the same prescription as the rest of the unit in order to promote tree growth.

Transportation system: Reconstruction and utilization of the existing transportation system for this sale would maintain or improve slope stability, would produce little or no off site erosion, and would provide options to rehabilitate or remove old road courses.

Cumulative Effects – Soils and Geology

The individual harvest unit was the area considered for cumulative effects. The effects of the action alternatives on the soils resource are very limited in scope. Experience indicates that the potential impacts on soils are best evaluated on a site specific, project-by-project basis. The major soils concerns, compaction, nutrient loss, displacement, and instability, are most effectively evaluated for both short, long term and cumulative effects, at the project level. With proper project implementation, as specified by soils recommendations (*see Mitigation Measures, Table 14*), unacceptable cumulative effects on the soils resource are not anticipated from any action alternative. Consequently, the utilization of soil protection measures and Best Management Practices as defined in the Soils Report in Appendix K, would generally preclude the need for additional cumulative effects analysis. Deviations from the standards and guidelines would be the primary trigger for additional cumulative effects review, and no deviations are planned.

Conclusions: The design of proposed harvest units took into account most soils-related concerns. The proposed units are generally located on stable, productive terrain. However, debris chute failures from old road sidecast road construction and other road-related drainage problems are common in most units so the potential for additional management induced slope instability is possible if adequate root strength is not maintained as prescribed.

The field review indicated that previous adverse impacts of harvest from compaction are present in a few units. There is a potential for cumulative significant adverse effects from ground-based systems with this proposed entry if standards and guidelines are not followed.

Evidence of adverse impacts from previous cable and skyline yarding was not apparent. The potential for cumulative significant adverse impact from additional skyline yarding, since it affects less than 1% of the ground, is not a concern.

All units show considerable regeneration of conifer and brush. Given the retention of a live intact root mat with thinning and standard mitigation measures, the potential for excessive disturbance and off site erosion from logging and harvest is not a concern.

This entry would also provide the opportunity to replace, reconstruct or remove drainage structures or road fills and to rehabilitate areas adversely affected by the previous road sidecast construction techniques.

Overall the proposed action alternatives have no significant concerns for the protection of the soils and geology resource. The potential for management-related slope instability is present in the analysis area, but actions such as unit design, yarding suspension requirements, etc. have been designed to reduce the risk or eliminate that hazard. With the recommended soil protection measures and mitigations, all appropriate standards and guides can be met.

Prescriptions for soil protection, watershed considerations and riparian needs of the sub-basin take into account past and predicted future land management activities. The soil mitigation measures, as well as the streamside management zones, are designed to provide a level of riparian habitat protection and erosion control that is consistent with the standards and guidelines of the *Willamette Forest Plan*. On-site sedimentation is anticipated to be within National Forest and Oregon State Guidelines. All prescriptions or mitigation measures discussed in the Soils Report in Appendix K are designed to meet or exceed the requirements outlined in the General Water Quality Best Management Practices Handbook (*Pacific Northwest Region, November 1988*). Standard contract language should provide for sufficient erosion control measures during timber sale operations (*BMP T-13*). Revegetation of areas disturbed by harvest activities (such as landings, temporary roads, and equipment storage areas) is required with an appropriate grass seed mix (*BMP T-14, T-15, and T-16*).

Monitoring Requirements: Other applicable Standards and Guides and/or Best Management Practices may exist which were not directly referenced in this document. Their exclusion does not indicate that they were overlooked or are inapplicable. As project development proceeds, appropriate constraints or mitigations may be added or changed in order to better meet the intent of adequate resource protection or enhancement as directed in the *Willamette Forest Plan*. As the proposed project is initiated, it would be monitored to evaluate implementation efficiency, prescription adequacy, and to update sale area rehabilitation needs or protection.

The Timber Sale Officer would conduct implementation monitoring at the contract administration phase of the project. The logger would be required to maintain adequate suspension during the harvest process. In addition, numerous other contract requirements dealing with such items as erosion control, hazardous material use, fire restrictions, etc. would be enforced. Duff retention would be monitored as part of any post sale activity that affects the soil resource.

Irreversible or Irretrievable Commitment of Resources: No irreversible and /or irretrievable use of the soils or geology resource is anticipated, beyond that which has been previously identified in the *Willamette Forest Plan*, as amended.

Social Resources

Infrastructure – Roading and Road Densities

Introduction: There is a relatively extensive road system in the analysis area that was developed over a period of several decades, mostly to provide access for timber harvest. Current road densities here are 2.6, 2.4 and 1.9 miles per square mile in Upper Quartzville, Canal and Galena subwatersheds, respectively. These roads were generally funded through timber sale revenues which paid for most of the road development and maintenance costs.

Management direction for this area has changed since it was allocated to the *Quartzville LSR* in 1994. The road system here exceeds desired road densities which can negatively impact the function and usability of habitat in the LSR. For example, roads can limit dispersal of some species, reduce habitat usability from human disturbance, spread non-native species and reduce snag and down wood habitat adjacent to roads because of safety concerns for human travelers.

In addition, there is limited funding available to maintain the existing road system since timber harvest has been greatly reduced in this area.

One of the purposes of the proposed action is to improve function and usability of Late-Successional Reserve (LSR) habitat so the road density issue was addressed by analyzing the road system and looking for opportunities to reduce road densities in the LSR.

From comments received during public scoping for the *Quartzville Watershed Analysis*, many members of the public prefer that roads remain open for motorized recreation such as ORV riding and general access by motor vehicles. *(USDA and USDI. 2002, pg. C-1)*. Contrary to this concern, but in order to minimize disturbance to species dependent on late-successional/ old growth habitat for which this land allocation was established, a recommendation in the *Quartzville Watershed Analysis (USDA and USDI, 2002, Ch 7, pg. 1*2) was to "Reduce disturbance effects to wildlife by reclaiming/ decommissioning unnecessary roads to reduce road densities in the watershed. Where roads cannot be decommissioned, close and storm proof unnecessary roads." Additionally, the *Mid Willamette LSR Assessment (USDA and USDI, 1998b, pg. 63)* states: "Much restoration of late-successional forest conditions from past effects of roads may be needed in Quartzville and Fall Creek, due to their relatively large size and high overall road density."

Indicators for measuring or interpreting conditions for Road Density Issues: Open road miles per square mile.

Analysis Area: A field review was done by an engineer and wildlife biologist to address road densities within the analysis area. Road densities were evaluated at the watershed and subwatershed scale by the interdisciplinary team. In addition, individual roads or road segments were evaluated.

*Analysis Methods***:** Using the 2003 *Willamette National Forest Roads Analysis Update* and *Willamette Forest Plan* guidance, roads were analyzed to achieve the goal of "a network of Key Roads to provide sustainable access to National Forest System lands for administration, protection and utilization in a manner consistent with Forest Plan guidance and within the limits of current and likely funding levels." Road densities were calculated using miles of open roads per square mile of land within a subwatershed and within the entire watershed.

Desired Conditions: The desired condition within the LSR is to reduce road densities below 2.0 miles per square mile to improve habitat function and usability within the LSR.

Existing conditions: The system roads in the Quartzville LSR Thin analysis area are in three subwatersheds: Upper Quartzville, Canal, and Galena. Current road densities are 2.6 mi/mi^2, 2.4 mi/mi^2 and 1.9 mi/mi^2 respectively. These figures are lower than the average road density for the entire Quartzville LSR, which is 3.3 miles of road per square mile, but near or above the 2 mi/mi^2 threshold considered to be detrimental to habitat function.

Five of the roads in the subwatersheds are identified as Key Forest Roads to provide sustainable access to National Forest System lands for administration, protection, and utilization. The Key Forest Roads are the first 2.6 miles of Road 1131, the first 2.1 miles of Road 1131-101, Road 11, Road 1133 and Road 1152.

Environmental Consequences

Direct and Indirect Effects – Roads

Alternative 1 – No Action: Road densities would remain unchanged for Upper Quartzville, Canal and Galena subwatersheds which are currently 2.6 mi/mi^2, 2.4 mi/mi^2 and 1.9 mi/mi^2 respectively. Since no harvest would take place, there would be no funding available to close spurs and unmaintained roads that may be contributing to fewer forested acres, increased peak flows, wildlife disturbance and noxious weed spread. Drivable roads would decrease due to a decline in funding sources for road maintenance. In addition, there would be no funding to improve the five identified key forest roads in this area. These roads are intended to provide sustainable access for administration, protection, and utilization consistent with *Willamette Forest Plan* guidance and within the limits of funding.

Alternatives 2 and 3: The Key Forest Roads would be improved for timber haul under both action alternatives which would also contribute to improved public safety by removing rocks and debris and grading the roads to reduce potholes and washboard conditions.

Both action alternatives would result in the closure of seven roads, totaling a little over 14 miles. The table below shows the roads to be closed and the maps in Appendix G show the location of proposed closures.

Table 37: Proposed Road Closures

Road Number	Closure Type	Road Closure Miles	Comments
1131120	Gate	1.18	Decommission (storm proof)
1131202	Gate	7.98	Decommission
1100720	Berm	1.61	(storm proof)
1145000	Berm	0.59	Decommission
1100811	Berm	0.17	(storm proof)
1100737	Berm	1.00	Decommission
1100743	Berm	0.56	(storm proof)
1145387	Gate	1.33	Access through gate
	Totals	**14.42**	

After road closures, the new calculated road densities for the Upper Quartzville, Canal and Galena subwatersheds would be 2.0 1.7, and 1.7, respectively. The direct effects of closing roads include reduced maintenance costs and reduced wildlife disturbance. Indirect effects include a decrease in the risk of noxious weed establishment due to the lack of vehicular traffic and the potential for forest trees to become established in the road prism. Approximately 101 miles of roads in these subwatersheds would remain open.

Table 38: Comparison of road densities before and after road closures

Subwatershed	Road Densities Before Road Closures	Road Densities After Road Closures
Upper Quartzville	2.6 mi/mi^2	2.0 mi/mi^2
Canal	2.4 mi/mi^2	1.7 mi/mi^2
Galena	1.9 mi/mi^2	1.7 mi/mi^2

Cumulative Effects - Roads

The area of consideration for cumulative effects was the analysis area**.** An additional 15+ miles of roads have been identified for closure as funds become available. *(Table 39 lists additional roads to be closed as funding becomes available. Refer to Appendix G for maps of the proposed road closure locations).* The immediate closure of over 14 miles of road and the eventual closure of another 15+ miles of road in the LSR would improve habitat quality and usability in the LSR. These improved conditions have been evaluated at the Forest scale in

Chapter VIII of the Forest Roads Analysis. The following table lists the 15+ miles of additional proposed road closures.

Table 39: Roads to be closed as money becomes available

Road #	Closure Type	Road Closure Miles	Comments
1131000	Berm	0.62	Close 1131 at saddle
1133330	Berm	1.24	Decommission (storm proof)
1100745	Gate	0.68	Fix gate; access through gate
1100746	With 745	0.15	No drainage features
Spur	Berm	0.15	Off 1100855
Spur	Berm	0.15	Off 1100855
1100858	Berm	0.33	Storm proof
1133425	Berm	0.54	No drainage features
1133437	Boulders	0.39	Block with boulders only
1133438	Boulders	0.73	Block with boulders only
1133445	Berm	0.30	No drainage features
1133450	Berm	0.29	No drainage features
1133454	Berm	0.42	No drainage features
1133464	Berm	0.72	No drainage features
1133474	Berm	0.21	Decommission (storm proof)
1133482	Berm	0.23	No drainage features
1133487	Berm	0.15	No drainage features
1152540	Berm	1.17	Access through gate
1152545	Berm	0.61	Access through gate
1152546	With 545	0.30	No drainage features
1152547	With 545	0.15	No drainage features
1152550	Berm	1.04	Decommission (storm proof)
1152572	Berm	0.27	No drainage features
1155555	Gate	2.96	Access through gate
1155559	With 555	0.59	Access through gate
1155576	Berm	0.48	No drainage features
1155577	Berm	0.20	No drainage features
1155681	Berm	0.23	No drainage features
	Totals	**15.3**	

Mining

Introduction*:* Mineralization was discovered in the Quartzville District in 1863, and gold mining began in earnest in 1864. Through intermittent periods from 1864 to about 1923, various mines were in operation in the Quartzville area, and several hundred thousand dollars of gold and silver was removed from the various adits and shafts. Minerialization occurs as both disseminated and fracture filling deposits in classic mesothermal and epithermal type hydrothermal deposits that strike generally northwest. Recognizable minerals include pyrite, calcopyrite, galena, and sphalerite.

Analysis Area: The analysis area for mining effects is limited to known mining claims that could potentially be affected by the proposed action.

Analysis Methods: Pre-field review of the proposed harvest units in relationship to mining claims and field review of potentially-affected mining claims.

Existing Condition: The Quartzville subwatershed is rich with mining history and continues to provide for recreational mining. Mining claims for placer and load mines are abundant in the lower reaches of Quartzville Creek and its tributaries. Several mining claims are within or adjacent to proposed thinning units. The most notable is the large complex of patented mines in the western portion of the analysis area in T 11S, R4E, Sections 15, 16, 22, 23 and 24.

Environmental Consequences

Direct and Indirect Effects - Mining

Alternative 1- No Action: The No Action alternative would not have any impacts on mining.

Alternatives 2 and 3*:* Harvest units are similar in both action alternatives so effects on mining are similar as well. Access to mining areas may be affected during timber harvest operations. By regulation, the Forest Service maintains all surface rights on non-patented, active claims and the related ability to manage those resources. However, those same rules require the Forest Service to provide reasonable access for valid claimants to get to their claims. The action alternatives for Quartzville LSR Thin may temporarily close off units or access routes because of placement of landings, skyline corridors or road work. Reasonable accommodation would be made within the timber sale contract to maintain ingress and egress for valid claimants on active claims. Road routes that access claims may be reconstructed or storm proofed, but they would not be closed with this action.

Recreation

Introduction: The Quartzville Creek area is popular for a variety of dispersed recreational activities including camping, hunting, fishing, hiking, and scenic driving. Quartzville Creek has been deemed eligible as a potential candidate for Wild and Scenic River status with a "Recreation" designation. In addition, the Middle Santiam Roadless Area is located within the analysis area. A portion of the original roadless area became the Middle Santiam Wilderness, which is located to the south of the analysis area about two miles from the nearest proposed harvest unit.

Analysis Area: The area analyzed includes proposed harvest units, dispersed recreation use areas in the vicinity of harvest units and transportation routes

Analysis Methods: The following assessment of project effects on recreation visitors and opportunities is drawn from 15 years of managing recreation use in the Quartzville Creek corridor, and recognition that other resource issues could force logging activities to occur during the summer recreation or autumn hunting seasons. Given the small scale of potential project effects on recreation visitors and resources, no field data specific to this project was collected to support this assessment.

Existing Condition: Dispersed Recreation Use: The Quartzville Creek area is a popular recreation corridor for dispersed recreation with most recreation occurring close to water. Many dispersed camping sites, accessible by vehicle, have been created directly off Forest Road 11 and its major collector roads, most typically where these roads run close to Quartzville Creek or large tributaries and terrain is flat. These dispersed sites are used throughout the hottest months of summer, particularly on weekends, and many sites are briefly occupied by hard-rock miners in the spring time. Sites also are used by visitors during the big game hunting seasons, though the frequency of hunter use is much lower than other uses during the summer. Unlike most summer-time users camping close to main waterways, big game hunters can also be found camping at dispersed sites throughout the rest of Quartzville watershed, not just near water like many other users. Such hunting camps are often located off local spurs of Forest Road 11 and its collector roads (*e.g. 1133*). Dispersed sites selected by hunters are little more than old landings from past harvest activities, though some sites have been created by the District.

Travel: During summer months, recreation traffic on Forest Road 11 is low to moderate (*less than 500 vehicles per day*); with most traffic occurring on weekends. Recreation traffic can get briefly higher during one or two late-summer weekends. Over the past ten years, Forest Road 11 has been discovered as a scenic drive between Highways 20 and 22, partly because segments west of the Forest boundary have been designated and promoted as a Scenic Tour Route. Groups of touring motorcyclists or bicyclists have become more common along this route over the last five years. Recreation traffic on Forest Road 11 gets more complicated when the road surface changes from double-lane to single-lane with periodic turnouts on the National Forest. Forest Road 11 receives very little commercial traffic beyond vehicles involved with timber harvest or road maintenance.

ATV Use: Local spur roads in the watershed have experienced more consistent all-terrain vehicle (ATV) traffic over that last five years, as this recreational activity has become more popular throughout the state. Current ATV use levels in the watershed are still low. ATV traffic in the drainage was previously composed of hunters during autumn months.

Scenic Resources: Forest Road 11 travels through a mosaic of managed and natural stands covering a deeply incised Cascades watershed. Scenery for visitors in this travel corridor is dominated by foreground geology and vegetation, except for a handful of locations in the upper reaches of the watershed that offer brief middleground views of local ridgelines. Foreground vegetation along Forest Road 11 had been noticeably modified by harvest activities, with older harvest units (*greater than 20 years*) having completely recovered visually. For the sections of Forest Road 11 on the National Forest, salvage of roadside blowdown has been the only harvest activity occurring within the foreground views of Forest Road 11 over the past 10 years. Evidence of more recent harvest activity on private and BLM-managed lands west of the National Forest boundary can be seen by travelers of this road. In essence, travelers on Forest Road 11 can expect to see a mosaic of vegetation conditions produced by a long history of timber harvest activities. Thinning units proposed in this project would contribute further change to the vegetative mosaic that travelers currently experience in foreground views.

Trails: Unit 18 of this project includes portions of the McQuade Creek trail and its trailhead off Forest Road 1142. This trail receives light use (*less than 200 visitors per year*) by visitors looking to access Chimney Peak or the Middle Santiam Wilderness. Many trail users are likely people camping along Quartzville Creek. The trailhead has capacity for up to 4-5 vehicles and the spur road to the parking area is rough and narrow.

Wild and Scenic Rivers: Quartzville Creek was recognized in the *Willamette Forest Plan* as a potential candidate for Wild and Scenic River (WSR) designation. It was determined eligible for a "Recreation" designation based on its scenic and recreation qualities.

Roadless Area: The Middle Santiam Roadless Area is an inventoried Roadless Area and is located in the southern portion of the analysis area. These roadless areas are planning vestiges from the Roadless Area Review and Evaluation (RARE) process used in the 1970's to consider candidate areas for wilderness designation. The Roadless Areas recognized in the Willamette Forest Plan were those candidate areas (*or portions thereof*) considered but not designated as wilderness by the 1984 Oregon Omnibus Wilderness Act.

Environmental Consequences

Direct and Indirect Effects - Recreation

Alternative 1 – No Action

Under this alternative, recreation visitors and opportunities would not be directly affected by this project. In addition, the Outstandingly Remarkable Values (*scenic and recreation quality*) that support Quartzville Creek's eligibility as a potential candidate for Wild and Scenic River designation would not be affected under this alternative. No roads or other activities would occur in the Middle Santiam Roadless Area.

This alternative would not generate timber sale revenue that has been typically used to help maintain the forest road system to the national standards that recreation visitors have come to expect. Visitors to the project area may over time see deterioration in the paved surface of Forest Road 11 and rougher conditions on gravel roads coming off Forest Road 11. Under this alternative and the available road maintenance funding, visitors would have fewer open roads to travel in the project area over the next 5-10 years due to the Forest's reduced ability to meet road maintenance standards. As local spurs naturally grow shut through lack of maintenance, this alternative would likely reduce dispersed campsite opportunities on local spurs, particularly for hunters.

Alternative 2 – Proposed Action

Both action alternatives proposed for this project treated the Wild and Scenic River issue similarly. Neither alternative included new road construction within the river corridor that could degrade Outstandingly Remarkable Values (ORV's). Operational skid trails within the river corridor would be ripped and seeded with native species whenever needed and closed to motorized use after the thinning is completed. Thinning prescriptions in Alternative 2 are designed to maintain visual quality consistent within the Wild and Scenic River corridors and protect ORV's.

Noise and dust from logging operations would displace campers from dispersed sites in or near proposed thinning units. Such effects would also displace hunters from areas where operations are occurring during hunting seasons. These effects would last only while harvest operations occur.

Log haul traffic from harvest operations would directly compete with recreation traffic on Forest Road 11 and its major collectors during the summer and autumn hunting seasons. Conflicts between commercial and recreation traffic would be highest during summer weekends and the one-week of *West Cascades* elk season. Log-haul traffic would discourage some visitors from visiting the Quartzville Creek corridor during operations due to safety concerns over sharing a narrow road with large trucks. Concerns over road safety in the project area would last only while harvest operations occur. To lessen conflicts between recreation traffic and operations traffic, timber harvest activities would be prohibited during weekends between the Memorial Day and Labor Day holidays. Prohibiting harvest activities on summer weekends would also reduce any displacement effects on recreating visitors. Weekends are defined as starting at 12pm on Friday and ending at midnight on the following Sunday. Timber harvest activities would also be prohibited during the one-week *West Cascades* Elk season.

The proposed closure of just over 14 miles of local spur roads as mitigation for wildlife harassment concerns would reduce dispersed camping opportunities, most notably for fall hunters. Road closures either displace hunters to other areas on the Forest or increase the density of hunting camps on the remaining open road system. The proposed action would also damage two or three dispersed sites located directly within thinning units. Dispersed sites within harvest units frequently become landing areas during logging operations. To mitigate site damage from operations, funding would be collected from the sale to repair dispersed sites and sites cut off by road closures would be relocated to suitable locations in the sale area.

Alternative 2 would close the McQuade Creek trail to hikers during harvest operations. Harvest operations would also modify the scenic qualities of foreground views from the McQuade Creek trailhead and trail by reducing tree stocking, crushing understory vegetation, and creating soil disturbance in yarding corridors. Impacts to scenic qualities are expected to remain evident by road travelers for at least 5 years, but less than 10 years. Alternative 2 would have similar effects to scenic qualities of foreground views along approximately 2 miles of Forest Road 11. To mitigate these effects, funding would be collected from the sale would be used to rehabilitate the affected area.

Unit 3 is 17 acres in size and is located along the northern edge of the Middle Santiam Roadless Area. This managed stand, which was clearcut and burned in 1960, would be thinned using a helicopter logging system. Harvest unit 3 here would not create additional permanent or temporary roads or increase the number of managed acres within this Roadless Area. Unit 3 abuts the main access road into this area. Thinning Unit 3 is not expected to preclude future wilderness designation for the Middle Santiam Roadless Area.

By displacing recreation visitors from dispersed sites and the Forest Road 11 corridor during harvest operations, Alternative 2 would increase competition for recreation sites in other parts of this recreation corridor or in other parts of the Forest. Increased site competition would be most heavily felt at dispersed sites along Quartzville Creek on BLM and Corps of Engineers managed lands west of the National Forest boundary. Visitor displacement would largely be confined to short periods of harvest operations. Few disperse sites would be eliminated under this project, however those site losses would create the displacement of recreation visitors to other dispersed sites in the watershed.

This proposed action would ultimately make access by recreation visitors more enjoyable by creating revenue for road maintenance in the planning area. Alternative 2 would particularly improve road conditions to the McQuade Creek trailhead located in Unit 18.

Alternative 3

Alternative 3 would not construct new roads within the river corridor that could degrade Outstandingly Remarkable Values. Skid trails within the river corridor would be ripped and seeded with native species where needed and closed to motorized use after the thinning is completed. Thinning prescriptions in Alternative 3 are designed to maintain visual quality consistent with the Wild and Scenic River corridors

Effects to recreation visitors and resources under this alternative would be similar to those described under Alternative 2. Effects differences between Alternatives 2 and 3 would occur through variations in harvest acres, the length of time needed for harvest operations, and subsequent revenue created and used for road maintenance. Alternative 3 would have a smaller affect on scenic qualities along Forest Road 11 than Alternative 2 by harvesting along only 1.5 miles of this road.

Under Alternative 3, Unit 3 is 11 acres and located along the northern edge of the Middle Santiam Roadless Area. This unit would be thinned using a helicopter logging system and would not create additional roads within the Roadless Area. This unit was designed to improve habitat for late-successionally, dependent species and is not expected to preclude potential wilderness designation for the Middle Santiam Roadless Area.

Cumulative effects – Recreation

The project area was used in considering cumulative effects. The upper Quartzville Creek drainage has experienced years of road construction and timber harvest. These activities have had disturbing impacts to recreation visitors whenever operations occurred during the summer or hunting seasons. Such activities also contributed substantial funding for creating and maintaining road access for visitors in the Quartzville drainage. Increased road access ultimately increased dispersed recreation opportunities for forest visitors.

However, timber harvest activities have not occurred in the project area since the mid-1990’s, except for the occasional salvaging of downed timber across roadways. The lack of harvest activities over the last 10 years has reduced funding for maintaining road access for visitors and consequently created poorer road conditions. Conversely, the lack of harvest activities over the last 10 years has reduced road conflicts between large trucks and recreation vehicles. This project would cumulatively increase competing road traffic and improve road conditions through road maintenance funding. This project would also incrementally increase disturbance and displacement of dispersed campers during logging operations.

Past harvest activities focused on regeneration harvesting have reduced the scenic qualities of foreground views along Forest Road 11. Tree growth in past harvest units over the past 10 years have improved scenic qualities. Alternative 2 would cumulatively reduce scenic qualities in foreground views along Forest Road 11 through thinning operations and damage to brush and other vegetation caused by felled trees and yarding within proposed units. Thinning effects on scenic qualities along this travel corridor would be short-lived, with vegetative recovery occurring within 5-10 years.

Cumulative Effects from implementing Alternative 3 would be the similar as those described under Alternative 2. Cumulative effects on recreation sites and visitors vary between Alternatives 2 and 3 based only on total harvest acres, the duration of harvest activities, and revenue created to maintain or close roads.

Conclusions and rationale for those conclusions – Alternatives 2 and 3 remain consistent with standards and guidelines for recreation resources as defined by the *Willamette Forest Plan*. Effects from this project are expected to be minimal in time and space, considering the history of timber harvest activities within this recreational corridor. Road closures proposed under this project would create no significant changes to recreation use patterns within the watershed.

Heritage Resources

*Introduction***:** Ethonographic evidence indicates that aboriginal groups, possibly the Kalapuya, Molala and others, used this area mainly for seasonal hunting, fishing, and gathering wild plants. Site location analysis (*Winkler, 1984*) suggests that the major ridgelines served as aboriginal travelways. Enthnohistories given for this area suggest that this area was used extensively for both hunting and the collecting of plant resources such as huckleberries. Prehistoric travelways were probably located along ridgelines, which is also said to have been the locations where strategically lighted fires were set to manage large tracts of land. Fire was used as a tool to control understory growth and encourage the development of fire-resistant trees, to keep the area's abundant huckleberry population as well as large game forage thriving, in order to improve hunting.

Obsidian analyzed from sites in the western Cascades show widely dispersed sources attesting to the mobility and importance of trade networks to the region's inhabitants. Evidence from a few rock shelters that have been excavated indicate that the western Cascades have been inhabited aboriginally since about 8,000 years BP (*Newman 1966*).

Analysis Area: The areas of potential effect to heritage resource within the undertaking which could, or were likely, to cause a discovery were analyzed. This includes roads, landings, staging areas, rock sources, harvest units, etc.

Analysis Methods: Prior to a field survey, district cultural resource files, maps and relevant literature was reviewed by the district archaeologist for recorded or potential cultural resources within or near the proposed project area. On the basis of research conducted, the Quartzville LSR Thin project area is of moderately-low probability for the discovery of cultural resources because the proposed thinning units contain a mix of slopes, aspects and probability possibilities and because no sites are known to exist within any of the proposed harvest units. According to the district records, the area has never received a "broad-area" survey but there have been nine previous harvest unit surveys in the vicinity between 1979 and 1992. During these surveys 14 sites and 4 isolated finds were documented in or near the planning area.

A survey design was developed by District Archaeologist Tony Farque, based on information from site records, the Forest Inventory Plan (*Davis 1988*), pre-field research, and knowledge of the project area from 25 years of past field experience.

This project survey was designed as a unit-specific, stratified survey to include 100% coverage of the high probability areas and at least 20% coverage of the low probability areas (*slopes>30%)* to be selected by opportunistic encounter while traversing between areas of high probability. Special attention was given to areas of previous disturbance such as road cut banks, turnarounds, landings, firelines, and root wad soil exposures. Field methods utilized in surveying the project area were consistent throughout.

Survey strategy consisted of mineral soil exposure through scalping with entrenching tools and trowels following natural contours of the land, stopping to clear duff and debris to expose one square meter of the mineral ground surface. This procedure was performed at intervals from 10 to 20 meters or by taking advantage of natural or human-caused ground disturbance. The project area was surveyed over a period of 57 days during the 2003 and 2004 field seasons by Archaeologist Tony Farque and Cultural Resource Technician trainee, Ken Loree. Expected results include lithic scatters sites and areas containing historic mining debris and features.

Areas where there was a high probability of discovering cultural resources were intensely surveyed in this project area and include all slopes 30% or less, ridgetops, meadows, rock outcrops (*some on steep slopes >30%)*, and level streamside areas. The survey included portions of units 5, 6, 7, 9, 10, 11, 18 and 20. A total of 131 acres of high probability ground was surveyed, or 16% of the total project acres. No sites were found in this zone.

The remaining 700 acres, or 84% of the total project acres, was defined as low probability for discovery of cultural resources and mainly consisted of slopes greater than 30%. A total of 147 low probability acres, or 21% of the total project acres were surveyed. This includes low probability portions of all units. No sites were found in this zone.

The survey was conducted following State Historic Preservation Office (SHPO) survey and report writing standards and the Willamette National Forest Inventory Plan. The District received SHPO concurrence in October, 2005 for a "No Effect" finding on cultural resources.

Existing Condition: Sites recorded so far indicate that small groups seasonally occupied base camps along the broader sections of the floodplains as well as task-specific campsites in the adjacent uplands and seasonal base camps at high elevation meadows. In this area lithic scatters have been recorded along ridgetops and riverine terraces, and historic mining locations have been recorded along streamsides and ridges.

Previous impacts to that area have included road building, logging, and the construction of forest service trails. The following timber sales occurred in the vicinity and were surveyed for cultural resources: Freezeout Salvage (1979), Minni Green (1979), Bruler Divide (1980) , Bruler Boundary (1981) , Freezeout Quartz (1982), Bruler Blowdown (1990), Minni Gold (1990), Minni Boundary (1991), Bruler Blowdown Addendum (1992).

Environmental Consequences

Direct and Indirect Effects – Heritage Resources

Environmental consequences were considered assuming implementation of the following mitigation measures:

- Changes to the current unit configurations and/or the addition of any new units, would require consultation with the District Archaeologist in order to protect known and unknown heritage resources.
- Project activities planned outside of the area defined in the heritage resource inventory schema must be coordinated with the district archaeologist prior to initiation. This includes the establishment of harvest landings, helicopter landings, guy-line equipment anchors, slash burning and silvicultural treatments.
- Prior to cultivating skid roads after harvest activities, a re-entry survey must be conducted in those areas deemed high probability for the occurrence of heritage resources.

Coordination with the district archaeologist is essential to ensure the protection of heritage resources.

- In order to extend protection to heritage resources which have not yet been discovered, but which may be uncovered during the course of project activities, contract clause CT6.24 or a similar clause must be included in all project prospecti and contracts. The contract clause outlines the procedures to follow in the event heritage resources are inadvertently discovered or disturbed during project activities. Basically, if material is inadvertently discovered, suspend operations and consult the District Archaeologist.

No cultural sites or isolates were located during the course of the field survey for the Quartzville LSR Thin Timber Sale. Given that much of the project area is in low probability ground and sites that have been previously documented in high probability areas were much closer to water than most of the units in this project, those results were understandable.

Alternative 1(No Action): Implementation of the No Action alternative would not directly or indirectly affect heritage resources since there would be no change to the integrity of heritage resource sites.

Alternatives 2 (Proposed Action) and Alternative 3*:* Implementation of Alternatives 2 and 3 would not directly or indirectly affect heritage resources.

Cumulative Effects – Heritage Resources

The areas of potential effect to heritage resources within the project area which could, or are likely, to cause a discovery were analyzed. This includes roads, landings, staging areas, rock sources, harvest units, and other areas potentially subject to ground disturbance as a result of this activity. It is not anticipated that there would be cumulative effects from any of the proposed activities proposed for Quartzville LSR Thin as no sites were located during the course of the field survey for this project.

Consistency with Direction and Regulations: Under the Programmatic agreement the Forest Heritage Specialist has project review authority, and certifies that the project complies with Section 106 of the National Historic Preservation Act. That certification of the project as "No Historic Properties Affected" was completed on November 15, 2005.

Economics

Introduction: The viability of a timber sale proposal is predicated on having an economically efficient proposal that contractors would want to purchase. Sale design and thinning prescription implementation requirements all must be taken into consideration in determining the economic viability of a project. A below cost (deficit) sale or a package which generates no bidder interest is not desirable because it does not accomplish the desired silvicultural treatments to achieve wildlife habitat objectives. It provides no wood or work for the community. However, managing the Quartzville LSR to increase diversity and complexity may cost additional money. All proposed action alternatives for the Quartzville LSR Thin EA show a positive return to the treasury. Short-term dollar costs and incomes have been used to provide relative economic values associated with each alternative. Values are not meant to be comprehensive because of the difficulty of assigning values to resource benefits. Timber values from a recent commercial thinning timber sale of comparable timber were used for this comparison. All acreage and costs used are estimates. Both action alternatives provide a two to one return on investment. (*Refer to Appendix C for more details concerning the Economic Analysis*).

Table 40: Economic Summary

	Alternative 2	Alternative 3
Gross Value ($500/MBF)	8,280 MBF * $500 = $4,140,000	5,570 MBF * $500 = $2,785,000
Associated Costs	$1,866,585	$1,387,880
Cost/Benefit Ratio	2.2	2.0
Present Value	$2,273,415	$1,397,120

Irreversible and Irretrievable Commitment of Resources

It is not anticipated that there would be any irreversible and irretrievable commitments of resources outside of the range discussed in the Willamette Forest Plan. The protection measures identified in the Forest Plan Standards and Guidelines, Mitigation and Design Measures in Chapter 2, and Best Management Practices are designed to avoid or minimize the potential for irreversible losses from the proposed management practices.

Compliance with Other Laws, Regulations, and Policies

This section describes how the action alternatives comply with applicable State and Federal laws, regulations and policies.

The Endangered Species Act (ESA), December 197*3*: The ESA establishes a policy that all federal agencies conserve endangered and threatened species of fish, wildlife and plants. Biological Evaluations for plants and wildlife have been prepared, which describes possible effects of the proposed action on sensitive, and other species of concern that may be present in the project area. A Biological Assessment (BA) was prepared for the northern spotted owl.

Federal Mine Safety and Health Act of 1977, Public Law 91-173, as amended by Public Law 95-164: Development of rock pits would conform to the requirements of the act, which sets forth mandatory safety and health standards for each surface metal or non-metal mine. The purpose for the standards is to protect life by preventing accidents and promoting health and safety.

Magnuson-Stevens Fishery Conservation and Management Act, 1976 (MSA): The Quartzville LSR Thin project area is in the Quartzville drainage of the Santiam River basin. The project area is located up stream from Green Peter and Foster Reservoirs in an area that is not listed as Essential Fish Habitat (EFH) for spring chinook salmon or winter steelhead.

Executive Order 13186: Neotropical Migratory Birds: There are 85 bird species recognized as neotropical migrants on the Willamette National Forest. Thirty-five of these species found on the Willamette have been identified as species of concern (Sharp 1992). A Memorandum of Understanding was signed between the USFS and USFWS to complement the January 2001 Executive Order.

The Quartzville LSR Thin Project Area contains populations of migratory land birds typical of the western Cascades. See the Neotropical Migrant Bird section in the Wildlife discussion in Chapter 3 for effects of this project on these bird species.

Executive Orders 11988 and 11990: Floodplains and Wetlands – Executive Order 11988 requires government agencies to take actions that reduce the risk of loss due to floods, to minimize the impact of floods on human health and welfare, and to restore and preserve the natural and beneficial values served by floodplains. Floodplains occur within the planning area. No activities would occur on within flood plains due to no-harvest stream buffers. Wet areas would be protected on an individual basis under the stand-specific recommendations and wetland areas less than 1/4 acre would be treated as special habitat areas (FW-211).

Executive Order 11990 requires government agencies to take actions that minimize the destruction, loss, or degradation of wetlands. Streamside Riparian Reserves, seeps, and other wet habitats exist in the Quartzville LSR Thin Project Area. These areas would be either avoided or managed according to Riparian Reserve Management Guidelines in Chapter 2 to comply with amended Willamette Forest Plan Standards and Guidelines. Riparian reserves would also be protected with Mitigation Measures also detailed in Chapter 2. As a result, proposed harvest treatments would be consistent with Executive Orders 11988 and 11990.

Environmental Justice in Minority Populations and Low Income Populations (Executive Order 12898): agencies are directed to address effects accruing in a disproportionate way to minority and low-income populations; the closest population or habitation to the project area is the City of Sweet Home, (population 8200) some thirty miles west of the project area. Sweet Home is within Linn County considered a non-metropolitan county located by its western boundary along Interstate 5 and ranging east along the Western Cascades. Linn County's per capita income ranked 25th out of 36 counties in the state in 1993. In 1999 percent of persons below poverty is 11.4% from the U.S. Census Bureau 1990 and 2000 data. The State of Oregon Employment Department for Sweet Home has an unemployment rate of 11.6 percent in 2002. Minority populations in Linn County are 6.8 percent which include Native Americans, Asians, African Americans, and Hispanic.

From Federal and State data this community contains low-income people and minority persons. Implementation of an alternative that provides the opportunity for employment may positively affect low-income families who are either unemployed or underemployed. No disproportionate impacts to the citizens of Sweet Home are anticipated upon the implementation of an alternative. All contracts offered by the Forest Service contain Equal Employment Opportunity requirements. 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. The proposed thinning has the potential to contribute to the supply of special forest products (SFP) available within the area, such as salal and beargrass.

The National Environmental Policy Act (NEPA), 1969 – NEPA establishes the format and content requirements of environmental analysis and documentation. Preparation of the Quartzville LSR Thin Project EA was done in full compliance with these requirements.

The National Forest Management Act (NFMA), 1976 – All proposed harvest units are planned on suitable land, and would be capable of restocking within 5 years of harvest by either natural or artificial means. Proposed commercial thinning would increase the rate of growth of remaining trees, and would favor species or age classes most valuable to wildlife. The resultant reduced stress on residual trees would make treated stands less susceptible to pest-caused damage. Mitigation has been identified to protect site productivity, soils, and water quality.

The burning of activity fuels would reduce long-lasting hazards from wildfire over the project area as a whole, while air quality would be maintained at a level that would meet or exceed applicable Federal, State, and local standards. All proposed activities would provide sufficient habitat to maintain viable populations of fish and wildlife, and critical habitat for threatened or endangered species would be protected. Proposed activities are designed to accelerate development of forest habitats that are currently deficient within the analysis area, enhancing the diversity of plant and animal communities in the long-term. See discussions under the applicable resource sections above, for further support that proposed activities would comply with the seven requirements associated with vegetative manipulation (36 CFR 219.27(b)), riparian areas (36 CFR 219.27(e)), and soil and water (36 CFR 219.27(f)).

Energy Requirements and Conservation Potential – Some form of energy would be necessary for proposed projects requiring use of mechanized equipment: Commercial thinning would involve small machines, while projects such as road reconstruction and maintenance could require heavy machinery for a small amount of time. Both possibilities would result in minor energy requirements. Alternatives that harvest trees could create supplies of firewood as a by-product, which would contribute to the local supply of energy for home space heating.

Prime Farmland, Rangeland, and Forestland – No prime farmland, rangeland, or forestland occurs within the analysis area.

Consultation and Coordination

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:

ID TEAM MEMBERS: The following lists members of the IDT responsible for coordinating, conducting and contributing to the environmental analysis.

Noel Bacheller, Botanist
B.A. General Science & Biology

Nanci Curtis, Asst. Fire Management Officer

Dean Devlin, GIS Coordinator

Tony Farque′, Archaeologist
A.A. Forestry
B.S. Anthropology

David Halemeier, Hydrologist
B.S. Resource Planning/Interpretation
M.S. Natural Resources/Watershed Management

Marilyn Hubbard, Transportation Planner
B.S. Civil Engineering

Anita Leach, Resource Planner
B.S. Forest Resource Management

Ken Loree, Team Leader, Forestry Technician
Logging Systems Program at OSU Forest Engineering Institute

Brian McGinley, Recreation Planner
B.S. Forest Resources Management
MS Forest Management

Virgil Morris, Wildlife Biologist
B.S. Fish and Wildlife Biology

Mike Rassbach, District Ranger
B.S. Forest Resources Management

Suzanne Schindler, Resource Planner, Certified Silviculturist
B.S. Forest Resources Management

Doug Shank, Geologist
B.S. Geology
M.S. Geology

Donna Short, Supervisory Forester
B.S. Forest & Resource Management

Alice Smith, Botanist
B.S. Botany/Plant Pathology
M.S. Botany/Plant Ecology

Wayne Somes, Fisheries Biologist
B.S. Fisheries

Daren Utley, Timber Sale Administrator

FEDERAL, STATE, AND LOCAL AGENCIES; TRIBES and OTHERS:

The Sweet Home Ranger District prepared a Project Initiation Letter dated February 9, 2004 detailing the proposed actions and issues and mailed it to over 90 people, agencies and organizations who either have expressed an interest in the area or project, or who might be interested. Recipients included Confederated Tribes of Grand Ronde Community, Confederated Tribes of Siletz Indians, Santiam Wilderness Committee, Oregon Natural Resources Council, Oregon Department of Fish and Wildlife and the City Manager of Sweet Home among others. In response we received correspondence from Oregon Natural Resource Committee (see Public Involvement section in Chapter 1).

All correspondence and full text of the letters are available at the Sweet Home District Office.

Consultation: Government-to-government consultation regarding this project was conducted with the Confederated Tribes of Grand Ronde Community on March 10, 2005 and with the Confederated Tribes of Siletz Indians on March 16, 2005. No comments were received regarding this project at either one of these meetings. In addition, during the scoping of issues and concerns, as part of the public participation process, letters were mailed to tribal governments on February 9, 2004. No issues were raised regarding the proposed project as a result of that mailing.

Formal consultation with the U.S. Fish and Wildlife Service, on this project, was completed and a Biological Opinion received (*USDI March 2005*). Their determination was that this project may affect but is not likely to adversely affect spotted owls because operations would occur during the later part of nesting season.

Consultation with US Fish and Wildlife Service for fisheries was not required since no bull trout habitat exists in the analysis area. In addition, consultation with NOAA Fisheries was not necessary due to a no effect determination for listed anadromous fish species

Under the Programmatic agreement the Forest Heritage Specialist has project review authority, and certifies that the project complies with Section 106 of the National Historic Preservation Act. That certification of the project as "No Historic Properties Affected" was completed on November 15, 2005.

Literature Citations

1977 Problems of Archaeological Survey in Heavily Forested Regions: Seeing the Ground and Looking In Likely Places in the Woods of Western Oregon. Contributed paper at the 42nd Annual Meeting of the Society for American Archaeology, New Orleans, Louisiana.

1987 Prehistoric Land Use Patterns in the Central Oregon Cascade Range. Dissertation. University of Oregon, Eugene

Agee, J.K. 1993. Fire Ecology of Pacific Northwest Forest. Island Press. Covelo, CA. p.211

Agee, J. K. a*, Skinner, Carl N. 2005 Basic principles of forest fuel reduction treatments. Seattle, WA: College of Forest Resources. 2-12.

Agee, J.K. 2002 Fire behavior and fire resilient forests. In: Fitzgerald, Stephen A., ed. Fire in Oregon’s forests: Risks, effects, and treatment options. Portland OR: Forest Resource Institute. 119-126.

Amaranthus, M.P. and D.A. Perry. 1994. The functioning of ectomycorrhizal fungi in the field: linkages in space and time. Plant and Soil 159:133-140.

Aukema, J., A. Carey, T.Wilson. 2002. Thinning to induce spatial heterogeneity: One step towards providing multiple values in managed stands. ESA Annual Meeting. [Online article] http://abstracts.co.allenpress.com/pweb/esa2002/document?ID=4312.

Baxter, Paul W. 1986 Archaic Upland Adaptation in the Central Cascades. Ph.D. Dissertation, University of Oregon, Eugene.

Beggs, L.R. 2004. Vegetation Response Following Thinning in Young Douglas-fir Forests of Western Oregon: Can Thinning Accelerate Development of Late-Successional Structure and Composition? MS Thesis, Oregon State University, Corvallis, Oregon.

Brown, James K., Bunnell, David L., Snell, J. A. Kendal. 1977. Handbook for Prediction Slash Weight of Western Conifers. USDA Forest Service. General Technical Report. INT-37.

Bruns, T.D., A.M. Kretzer, T.R. Horton, E. A-D. Stendell, M.I. Bidartondo, T.M. Szaro. 2002. Current Investigations of Fungal Ectomycorrhizal Communities in the Sierra National Forest. USDA Forest Service GTR. PSW-GTR-183.

Buskirk, S. W., L. F. Ruggiero, and C. J. Krebs. 1999. Habitat fragmentation and interspecific competition: implications for lynx conservation. Pages 83-100 In Ruggiero, L. F., K. B. Aubry, S. W. Buskirk, G. M. Koehler, C. J. Krebs, K. S. McKelvey, and J. R. Squires (Tech. Eds.). Ecology and conservation of lynx in the United States. University Press of Colorado. Boulder, CO.

Byrd, K.B. V.T. Parker, D.R. Volger, and K.W. Cullings. 2000. The influence of clear-cutting on ectomycorrhizal fungus diversity in a lodgepole pine (Pinus contorta) stand, Yellowstone National Park, Wyoming, and Gallatin National Forest, Montana. Canadian Journal of Botany 78:149-156.

Carey, A.B. 2003. Biocomplexity and restoration 0f biodiversity in temperate coniferous forest: inducing spatial heterogeneity with variable-density thinning. Forestry, Vol. 76, No.2, 2003

Castellano M.A. and T.E. O'Dell. 1997. Management Recommendations for Survey and Manage Fungi. USDA, Forest Service, Regional Ecosystem Office, Portland OR.

Christner, J.1982. Water Resource Documentation for Controlling the Amount of Timber Harvest in a Subdrainage. U.S. Department of Agriculture, Forest Service. Eugene OR.

Csuti, Blair, et al. 1997. Atlas of Oregon Wildlife. Oregon State University Press. Corvallis, Oregon.

Davis, Carl M. 1988 Willamette National Forest Cultural Resource Inventory Plan. U.S. Forest Service, Pacific Northwest Region.

Detroit Ranger District Cultural Resource files and maps.

Drew, T.J. and J. Flewelling, 1979. Stand Density Management: an Alternative Approach and its Application to Douglas-fir Plantations. Forest Science 25:518-532.

Durell, D.M., M.D Jones, E.F. Wright, P. Kroeger and K.D. Coates. 1999. Species richness of ectomycorrhizal fungi in cutblocks of different sizes in the Interior Cedar-Hemlock forests of northwestern British Columbia: sporocarps and ectomycorrhizae. Canadian Journal of Forestry 29:1322-1332.

Exotic Plant Invasion along Roads and Streams in the H.J. Andrews Experimental Forest, Oregon. Conservation Biology 14(1):64-75.

Federal Register, Volume 40, No 230 November 28, 1975

FEMAT; Forest Ecosystem Management: An Ecological, Economic, and Social Assessment, Report to the Forest Ecosystem Management Assessment Team; July 1993; USDA; USDI; NOAA; EPA.

Flenniken, J. Jeffrey 1987 The Lithic Technology of the East Lake Site, Newberry Crater, Oregon. Department of Agriculture, Deschutes National Forest.

Franklin, J.F., et al. 1986. Interim Definitions for Old-Growth Douglas-fir and Mixed-Conifers Forest in the Pacific Northwest and California. USDA Forest Service PNW-447

Franklin, J.F. Keynote Comments by Jerry F. Franklin Managing Young Stands to Meet LSR and Riparian Objectives. [Online article] http://www.reo.gov/ama/franklin2001.htm

Graham, Russell T., McCaffrey, Sarah & Jain, Theresa B. 2004 Science Basis for Changing Forest Structure to Modify Wildfire Behavior and Severity. USDA Forest Service. General Technical Report RMRS-GTR-120.

Grant, Gordon. 2004. Personal communication.

Hager, J.C., and S. Howlin. 2001. Songbird Community Response to Thinning Young Douglas-fir Stands in the Oregon Cascades – Third Year Post-treatment Results for the Willamette National Forest, Young Stand Thinning and Diversity Study. Report prepared for USDA Forest Service, Willamette National Forest.

Hann, Wendel, Havlina, Doug Shilisky, Ayn, et,al. 2003. Interagency and The nature Conservancy fire regime condition class website.USDA Forest Service, US Department of Interior, The Nature Conservancy, and the Systems for Environmental Management [frcc.gov]

Harr, R.D. 1986. Effects of Clearcutting on Rain-on-Snow Runoff in Western Oregon: A New Look at Old Studies. Water Resources Bulletin 22:1095-1100

Harr, Dennis R: Some Characteristics and Consequences of Snowmelt During Rainfall in Western Oregon; Journal of Hydrology, 53; 1981 (pg 277-304).

Harrington, C.A., S. D. Roberts, L. C. Brodie. Tree and Understory Responses to Variable-Density Thinning in Western Washington.

Hayes, J.P., J. Weikel, and M. Huso. 2002. Research Synthesis: Response of Birds to Thinning Young Douglas-fir Forests. Department of Forest science, Oregon State University, Corvallis.

Hemstrom, M., Logan, S., Pavlat, W., 1987. Plant Association and Management Guide, Willamette National Forest. Eugene, OR.

Hickman, J.C. 1976. Non-forest vegetation of the central western Cascade Mountains of Oregon. Northwest Science 50: 145-155.

Hobbs, Stephen D., et al. 1992. Reforestation Practices in Southwestern Oregon and Northern California. Forest Research Laboratory, Oregon State University. Corvallis OR. p.351

http:// pnwin.nbii.gov/nwfp/FEMAT/Chapter_4/4_3.htm Ecological Principles For Management of Late- Successional Forests

Jones, Julia A and Grant, Gordon E; Comment of "Peak flow responses to clear-cutting and roads in small and large basins, western Cascades, Oregon: A second opinion" by R.B. Thomas and W.F. Megahan; Water Resources Research, Vol. 37, No 1 (pages 175-178, January 2001.

Kelly, Cara McCulley 2001 The Prehistory of the North Santiam Subbasin, on the Western Slopes of the Oregon Cascades.

Kertis, Jane, 2004. Fire Regimes of Northwest Oregon. Documentation to support NW Oregon FRCC mapping.

Koehler, G. M. and K. B. Aubrey. 1994. Pages 74-98. The scientific basis for conserving forest carnivores: American marten, fisher, lynx and wolverine in the western United States. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. General Technical Report RM-254.

Koehler, G. M. and J. D. Brittell. 1990. Managing spruce-fir habitat for lynx and snowshoe hares. J. Forestry 88: 10-14.

Kohm, K. A. and Franklin, J.F.. 1997. Creating a Forestry for the 21st Century. Island Press. Covelo, CA. p.111-139.

Kranabetter, J.M. and T. Wylie. 1998. Ectomycorrhizal community structure across forest openings on naturally regenerated western hemlock seedlings. Canadian Journal of Botany 78: 189-196.

Legard, Harold A. and LeRoy C. Meyer. 1973. Willamette National Forest Soil Resource Inventory. USDA Forest Service. Portland, OR.

Lesher, Robin, Chiska Derr, and Linda Geiser. 2000. Management Recommendations for Survey and Manage Lichens, Version 2.0. USDA Forest Service, Regional Ecosystem Office, Portland OR.

Lindh, B.C. and P.S. Muir. 2004. Understory vegetation in young Douglas-fir forests: does thinning help restore old-growth composition? Forest Ecology and Management 192: 285-296.

Lyng, Richard V. 1989. Northwest Coalition for Alternatives to Pesticides, USDA. Civil No. 83-6772-E-BU. Oregon District, US District Court.

Marcot, Bruce G., Kim Mellen, Janet L. Ohmann, Karen L. Waddell, Elizabeth A. Wouldhite, Bruce B. Hostetler, Susan A. Livingston, Catherine Ogden, and Tina Dreisbach. 2002. The DecAID repository: background information for DecAID, the decayed wood advisor for managing snags, partially dead trees, and down wood for biodiversity in forests of Washington and Oregon. USDA Forest Service, Pacific Northwest Research Station and Pacific Northwest Region, Portland, Oregon. Available on-line at: http://www.fs.fed.us/wildecology/decaid/decaid_background/decaid_home.htm

Maxwell,Wayne G. Ward,Franklin R., 1980. Photo Series for Quantifying Natural Forest Residues in Common Vegetation Types of the Pacific Northwest.USDA Forest Service General Technical Report PNW 105.

Morrison, P., and F.J. Swanson. 1990. Fire History and Pattern in a Cascade Range Landscape. USDA For. Serv. Gen. Tech. Rep. PNW-GTR-254.

Muir, P.S., Mattingly, R. L., Tappeiner, J. C., Bailey, J. D., Elliott, W. E., Hagar, J. C., Miller, J. C., Peterson, E. B., and Starkey, E. E. 2002. Managing for biodiversity in young Douglas-fir forests of western Oregon. U.S. Geological Survey, Biological Resources Division, Biological Science Report USGS/BRD/BSR-2002-0006. 76pp.

Oliver, C.D. and B.C. Larson, 1990. Forest Stand Dynamics. Update Edition. John Wiley & Sons, Inc. New York

Oregon Department of Environmental Quality. 1979. Oregon Visabilty Protection Plan. OAR 340-200-0040.

Oregon Guidelines for Timing of In-water Work to Protect Fish and Wildlife Resources, Portland, OR.

Oregon Department of Forestry.1995. Oregon Smoke Plan. Amended. ORS 477.515.

Parendes, L. A. 1997. Spatial Patterns of Invasion by Exotic Plants in a Forested Landscape. Ph.D. Dissertation. Oregon State University, Corvallis, OR.

Parendes, Laurie A. and Julia A. Jones. 2000. Role of Light Availability and Dispersal in Exotic Plant Invasion along Roads and Streams in the H.J. Andrews Experimental Forest, Oregon. Conservation Biology 14(1):64-75.

Peterson, David L., Johnson, Morris C., Agee, James K., Jain, Theresa B., McKenzie, Donald, & Reinhardt, Elizabeth D., 2004, Fuel planning: science synthesis and integration-forest structure and fire hazard. Gen. Tech. Rep. PNW-GTR xx. Portland, OR: US Dept. of Agriculture, Forest Service, Pacific Northwest Research Station. xx p. 2-21.

Pike, Robin G. and Scherer, Rob; Overview of the potential effects of forest management on low flows in snowmelt-dominated hydrologic regimes. BC Journal of Ecosystem Management, Volume 3, Number 1, 2003.

Pilz, D., et al. 2003. Ecology and management of commercially harvested chanterelle mushrooms. PNW-GTR-576.

Poage, N.J. 2001. Structure and Development of Old-growth Douglas-fir in Central Western Oregon. Ph.D. Thesis, Oregon State University, Corvallis, OR.

Reeves, G.H et al; A Disturbance-Based Ecosystem Approach to maintaining and Restoring Freshwater habitats of Evolutionary Significant Units of Anadromous Salmonids in the Pacific Northwest; American Fisheries Society Symposium 17:334-349, 1995

Rosgen, Dave; Applied River Morphology; Wildland Hydrology Pagosa Springs, Colorado, 1996.

RTI Fact Sheet #24. 2003. The Emerging Consensus for Active Management in Young Forests. Rural Technology Initiative.

Smith, David M., et al. 1997. The Practice of Silviculture: Applied Forest Ecology, Ninth Edition. John Wiley & Sons, Inc. New York

Snyder, Sandra L.

Stephens, Scott L. & Ruth, Lawrence W. 2004 FEDERAL FOREST-FIRE POLICY IN THE UNITED STATES. Ecological Applications 15(2) pp. 532-542.

Stream Survey Contractor???. 1994-2000. Blowout Creek Drainage, Level II Hankins and Reeves Stream Survey for Detroit Ranger District

USDA Forest Service and USDI Bureau of Land Mangement. 2004. Sufficiency Analysis for Stream Temperature Evaluation of the adequacy of the Northwest Forest Plan Riparian Reserves to achieve and maintain stream temperature water quality standards.

USDA Forest Service 1986 Draft of Regional Management Strategy for Identification and Treatment of Lithic Scatters Archaeological Sites on the Deschutes, Fremont, Malheur, Ochoco, Umatilla, Wallowa-Whitman, and Winema National Forests

USDA Forest Service, 1987 Plant Association and Management Guide, Pacific Northwest Region, R6-Ecol 257-B-86.

USDA Forest Service. 1988 Pacific Northwest Region, General Water Quality and Best Management Practices

USDA Forest Service. 1988. Final Environmental Impact Statement for Managing Competing and Unwanted Vegetation. Pacific Northwest Region. Portland, OR.

USDA Forest Service. 1990. Willamette National Forest Land and Resource Management Plan. Eugene, OR.

USDA Forest Service. 1990. Forest Service Manual: FSM 2600-Wildlife, Fish and Sensitive Plant Habitat Management. WO Amendment 2600-90-1 Effective 6/1/90.

USDA Forest Service. 1995. South Santiam Watershed Analysis. Eugene, OR.

USDA Forest Service. 1996. Willamette National Forest Special Habitats Management Guide. Willamette National Forest, Eugene, Oregon.

USDA Forest Service. 1999. Integrated Weed Management Environmental Assessment. Willamette National Forest. Eugene, OR.

USDA Forest Service. 2000. Blowout Watershed Analysis, Willamette National Forest, Detroit Ranger District, Detroit , Oregon.

USDA Forest Service. 2001. Regional Forester's Sensitive Species List. USDA Forest Service Regional Office, Region 6. Portland, OR.

USDA Forest Service. 2001. 1998 Lynx Survey Results. (Memo regarding unverified Lynx locations). USDA Forest Service Regional Office, Region 6. Portland, OR.

USDA Forest Service. 2002. Restoring Complexity: Second-Growth Forests and Habitat Diversity. Pacific Northwest Research Station Science Update. Portland, OR.

USDA Forest Service. 2003. Roads Analysis Report. Willamette National Forest. Eugene, OR.

USDA Forest Service. 2005. Promoting Habitat Complexity in Second-growth Forests. Biodiversity Northwest Home Page. http://www.biodiveristynorthwest.org/Restoration/USFSComplexityMgmt.htm

USDA Forest Service and USDI Bureau of Land Management, May 19, 2003 Final Draft Sufficiency Analysis for Stream Temperature. Portland, OR.

USDA Forest Service. 2004. Gordon Three Thin Environmental Assessment. Sweet Home, OR.

USDA and USDI. 1994. Record of Decision and Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Related Species Within the Range of the Northern Spotted Owl. Portland, OR

USDA and USDI. 1998. Management Recommendations for Bryophytes, Version 2.0. Portland, OR.

USDA and USDI. 1998b. Mid-Willamette LSR Assessment. Eugene, OR.

USDA and USDI. 1999. (Re-issued 2001). Biological Assessment for Programmatic USDA Forest Service and USDI Bureau of Land Management Activities Affecting Upper Willamette Steelhead Trout and Chinook Salmon within the Willamette Province (above Willamette Falls), Oregon. Portland, OR.

USDA and USDI. 2000. Final Supplemental Environmental Impact Statement for Amendment to the Survey and Manage, Protection Buffer, and Other Mitigation Measures Standards and Guidelines.

USDA, USDI 2000. Integrated Natural Fuels Management Strategy. Willamette National Forest, Eugene BLM and portions of the Salem BLM. Unpublished report on file at the Willamette National Forest Supervisors Office.

USDA and USDI 2001. Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and Other Mitigation Measures Standards and Guidelines. Portland, OR.

USDA and USDI. 2002. Quartzville Watershed Analysis. Salem, OR.

USDA, Forest Service, US Department of Interior. 2003. Natural History and Management Considerations for Northwest Forest Plan Survey and Manage Lichens. R6-NR-S&M-TP-03-03.

USDA, Forest Service, US Department of Interior. 2004. Record of Decision To Remove or Modify the Survey and Manage Mitigation Measure Standards and Guidelines.

USDA and USDI. 2004. Record of Decision to Remove or Modify the Survey and Manage Mitigation Measures Standards and Guidelines. Portland, OR.

USDA and USDI. 2004. Record of Decision Amending Resource Management Plans for Seven Bureau of Land Management Districts and Land and Resource Management Plans for Nineteen National Forest Within the Range of the Northern Spotted Owl, Decision to Clarify Provisions Relating to the Aquatic Conservation Strategy. Portland, OR.

USDA Forest Service. 2005. Record of Decision, Pacific Northwest Region Invasive Plant Program, Preventing and Managing Invasive Plants. R6-NR-FHP-PR-0205.

USDI Bureau of Land Management, 1986 Archaeology of Oregon, Oregon State Office.

USDI. 1992. Final Draft Recovery Plan for the Northern Spotted Owl. 2 volumes. US Fish and Wildlife Service. Portland, OR.

USDI Bureau of Land Management, 2002, Quartzville Watershed Analysis, Salem, OR.

USDI Fish and Wildlife Service. 2003. Formal and Informal Consultaion on Fiscal Year 2003-2004 routine habitat modification projects within the Willamette Province (FWS reference 1-7-03-F-0008)

USDI Fish and Wildlife Service. 2005. Biological Opinion and Letter of Concurrence for Effects to Bald Eagles, Northern Spotted Owls and Northern Spotted Owl Critical Habitat from the U.S. Department of the Interior; Bureau of Land Management, Eugene District and Salem District, Mt. Hood National Forest and Willamette National Forest And the Columbia River Gorge National Scenic Area Calendar Years 2005-2006 Habitat Modification Activities within the Willamette Province (FWS Reference Number 1-7-05-F-02228)

Walker, George W. and Robert A. Duncan. 1989. Geologic Map of the Salem 1 (degree) by 2 (degree) Quadrangle, Western Oregon: Miscellaneous Investigations Series. U.S. Geological Survey.

Western Oregon. Ph.D. Thesis, Oregon State University, Corvallis, OR.

Wisdom, M. J., L. R. Bright, C. G. Carey, W. W. Hines, R. J. Pederson, D A. Smithey, J. W. Thomas, and G. W. Witmer. 1986. A Model to Evaluate Elk Habitat in Western Oregon. R6-F&WL-216-1986. U.S. Dept. Agriculture, Forest Service, Pacific Northwest Research Station. Portland, OR.

Zobrist, K.W., T. Hinckley. 2005. A literature review of management practices to support increased biodiversity in intensively managed Douglas-fir plantations. Final Technical Report to the National Commission on Science for Sustainable Forestry (NCSSF). Seattle, WA.

Appendix A: Quartzville LSR Thin Unit Prescriptions

Common to all units:

The purpose of stand treatments is to accelerate development of late-successional stand characteristics in these young, managed stands within the Quartzville LSR. The desired stand characteristics resulting from proposed stand treatments include: 1) development of large diameter trees, 2) creation of a mosaic of varying stand densities interspersed with occasional, small openings to improve stand structure and diversity, 3) establishment of multi-layered stands with well-developed understories, 4) promotion of stand conditions which encourage diverse, native species composition including hardwoods and other minor species, 5) creation of an abundant supply of snags and down woody material of sufficient size and arrangement to meet habitat and ecological needs, 6) improved stand structure and diversity and 7) increased resistance of the LSR to disturbances such as fire and disease.

1. Thinning prescriptions will be done to various canopy closures (40, 50, or 60 %) which equate to approximately 70, 90 and 110 trees per acre, respectively. Numbers from the Forest Vegetation Simulator (FVS) model will be used to determine the exact number of leave trees per acre to achieve the target canopy closures. Target canopy closures are plus or minus 5%. A minimum of 40% canopy closure will be left in all thinning units to comply with requirements of the Critical Habitat Unit (*CHU*) for spotted owls which overlays most of the LSR in the analysis area. The target canopy closure listed is what is desired after snags are created and green trees are felled for down woody material. Species selection in thinning prescriptions will be designed to promote diverse, native species composition including hardwoods and other minor species.

2. Douglas fir, noble fir, Western hemlock and red alder will be thinned using the designate by description diameter and distance prescription (d x d) to leave the target canopy closure. This will retain larger diameter trees using a thin from below prescription. Every effort will be made to retain all trees over 20" DBH since this is an LSR. Occasionally a tree over 20" DBH may need to be felled for yarding corridors or landings. These should be left for down woody material.

3. All other species will be retained. Western redcedar over 10" DBH will be spaced off as a leave tree in the d x d.

4. Dominant Tree Release Prescriptions - In this prescription a large tree is left and most of the remaining trees within a 1/8 to ¼ acre circle surrounding that tree are removed with the exception of the following species: western white pine, western redcedar, Pacific yew, all hardwoods except red alder, and any trees less than 6 inches in diameter. The circle radius surrounding the dominant tree will be 66 feet slope distance. The only exception is Unit 13 where the radius will be 33 feet slope distance. In most units, these openings will be ¼ acre in size with an adjustments for slope, but in Unit 13 they will be 1/8- acre openings.

   Dominant Tree Releases are prescribed to varying densities in proposed treatment areas: 3%, 5%, and 10% of the area of the unit. Specific areas within thinned stands that will have a dominant tree release prescription will come from the alternative tables in the body of the EA. From 0 to 10% of the unit acreage will used to develop the acreage of DTR (dominant tree release) in the thinning units. In units where 10% of the area is prescribed to be in a DTR, there will be four ¼ acre openings per 10 acres of unit size. DTR's will not be located within 172 feet of streams or in units with 40% canopy closure. DTR's will not overlap. The number of DTR's will be reduced if they do not fit within these criteria.

5. Retention areas will be left unharvested in 10% of the original stand that contains the proposed harvest unit as required in the July 9, 1996 Regional Ecosystem Office Letter *RE: Commercial Thinning Projects in LSR's.* The retention areas may include, but are not limited to, buffers to protect sensitive plant species, interior late-successional forest habitat in Landscape Blocks B1 and B2, as well as stream retention buffers, noxious weed buffers and other areas not suitable for commercial harvest.

6. Areas adjacent to old growth that are to be buffered are listed on the unit maps.

7. Stream buffer widths noted are for each side of the stream. The distance will be measured from the nearest conifer tree to the stream channel rather than waters edge. Perennial streams will have buffer widths listed. The intermittent streams that are located during layout or are on the planning maps will have the trees that contribute to stream bank stability left. The intermittent streams can have a boundary placed or be leave-tree marked with orange paint.

8. Areas of protection for sensitive species or to prevent the spread of noxious weeds will be noted on the planning maps.

9. Seasonal Restrictions:

    - Northern spotted owl – March 1 to September 30 if there are owls present. Some units will not be affected. The restriction for disturbance will be 200' for chain saws and ½ mile for helicopter logging.
    - Big game – None
    - Residual tree protection – Seasonal restrictions at less than 2500' elevation are from March 15 to May 15, at greater than 2500' elevation are from April 30 to June 15.
    - Fish/Hydro – No in stream work will be permitted except from June 1 to September 30.
    - Recreation – No weekend log hauling from July 1 to August 30 for public safety.
    - Dry Weather Haul – Native surface spurs in Units 5, 6, 8, 19, 23, and 26 will be restricted from use except for July 1 to October 31.
    - Ground-based yarding operations will be restricted whenever soils are wet and not frozen.

10. Individual unit prescriptions and mitigation measures are listed on the following tables for Alternatives 2 and 3. See individual unit maps for unit-specific information.

Table 1: Alternative 2 Unit Prescriptions

Unit #	Refor. #	Total Acres	Trees Per Acre	Canopy Cover in Thinned Areas	Dominant Tree Release (DTR)	Skyline Acres	Helicopter Acres	Ground-based Acres	Fuel Treatment HP = hand pile 1 chain along roads YTA = yard tops attached
1	Q1	12	110	60%	10% above rd. 720	5	7	0	HP 7ac along 1100 rd
3	Q4	17	90	50%	3%	0	17	0	HP 2ac along 1100 rd
4	Q5	40	110	60%	10%	10	30	0	Pullback 7 acres of slash along 11 rd, end haul to west side of unit & dump for soil stabilization
5	Q6	48	90	50%	3%	15	10	23	YTA 25ac., HP 8ac along 11 and 1155 rds
6	Q7	49	90	50%	10%	18	0	31	HP 8ac 11 and 1155 rds
7	Q8	22	110	60%	3%	22	0	0	YTA 200ft below landings and HP 4ac along 11 and 1155 rds
8	Q11	43	70	40%	No DTR	33	0	10	HP 6ac 1155 rd
9	Q12, Q12A	9	110	60%	3%	9	0	falling only	HP 2ac along1100 rd
10	Q13	31	110	60%	5%	31	0	falling only	HP 5ac along1100 rd
11	Q14, Q14A, Q14B	29	90	50%	10%	29	0	falling only	HP 2ac along 1100 rd.
12	Q41	38	110	60%	3%	0	0	38	HP 6ac along 1155 rd & around perimeter of dispersed site in NW corner
13	Q50, Q50A	22	90	50% west 90% east	10% west, 1/8 ac. openings east	12	10	0	HP 4ac along spurs 805 & 808

Unit #	Refor. #	Total Acres	Trees Per Acre	Canopy Cover in Thinned Areas	Dominant Tree Release (DTR)	Skyline Acres	Helicopter Acres	Ground-based Acres	Fuel Treatment HP = hand pile 1 chain along roads YTA = yard tops attached
14	Q51	15	90	50%	3%	4	11	0	HP 3ac along spur rd 805 & around dispersed site
15	Q70	3	70	40%	No DTR	3	0	0	YTA 3ac
16	Q71	3	70	40%	No DTR	3	0	0	Burn landings only
17	Q72	8	110	60%	5 %	8	0	0	HP 1ac along 1142 rd
18	Q73	65	90	50%	10%	53	12	0	YTA 65ac, HP 8ac along 1142 rd
19	Q102	87	70 110	40% north of 1133 60% south of 1133	No DTR north 3% south	87	0	0	YTA 87ac, HP 11ac along 1133 rd
20	Q115	43	90	50%	3%	33	4	6	No treatment
21	Q201, Q201A	38	110 90	60% north 202 50% in helicopter	3%	28	10	0	Burn landings only
22	Q202	49	110	60%	10%	41	8	0	Burn landings only
23	Q203	54	70 110	40% east of stream 60% west of stream	No DTR east 10% DTR west	54	0	0	Burn landings only
24	Q206	47	90	50%	3%	39	8	0	HP 4ac along 1131 rd
25	Q207	22	90	50%	3%	16	6	0	HP 2ac along 1131 rd
26	Q209	28	90	50%	10%	28	0	0	HP 2ac along 1131 rd
27	Q240	6	110	60%	3%	3	0	3	YTA 3ac
Totals		**828**				**584**	**133**	**111**	

Mitigation specific to Alternative 2 is as follows:

- *Leptogium rivale* is an aquatic lichen and a Survey and Manage Species which occurs along some streams in the project area. This lichen will have a 100-foot protection buffer on either side of the stream in stream reaches where it is found.

Table 2: Riparian Reserve Prescriptions for Alternative 2

Stream Classification	NW Forest Plan Riparian Reserve Management Allocation Width	No-Harvest Buffers (in areas contributing to primary stream shade and channel bank stability)	Areas in Riparian Reserves, outside of stream buffers where Thinning is Proposed
Fish-bearing streams (Quartzville, McQuade, Galena, Minniece, Bruler, Butter, Gold and Little Meadows Creeks)	344 ft. either side of the stream channel	100 foot no-harvest buffer on either side of the stream channel will be the minimum buffer width and 344 feet no-harvest buffer on either side of the stream channel will be the maximum buffer width	Thinning will occur in the area between 100 and 344 feet from the stream channel, depending on the width of the no-harvest buffer. Channels with 344 feet no-harvest buffers will not be thinned.
Fish-bearing streams – (exception to above rule) The portion of **Canal Creek** within Unit 27	344 ft. either side of the stream channel	132 feet no-harvest buffer on the south side of the creek and 100 foot no-harvest buffer on north side of creek	On the south side of the creek, thinning will occur between 132 feet and 344 feet from the stream. On the north side of the creek, thinning will occur between 100 feet and 344 feet from the stream.
Perennial non-fish-bearing streams	172 ft. either side of the stream channel	Variable-width, no-harvest buffers ranging from a minimum of 66 feet to 172 feet on either side of the streams.	Thinning will occur from 66 feet to 172 feet from the stream depending on the width of the no-harvest buffer. Channels with 172 foot no-harvest buffers will not be thinned.
Intermittent streams	172 ft. either side of the stream channel	No-harvest buffers will be variable widths, with the minimum width being 25 feet either side of the stream and will include trees contributing to channel bank stability.	Thinning will occur from the outer edge of the variable-width, no-harvest buffer which is as least 25 feet from the stream to the outer edge of the riparian reserve which is 172 feet from the stream.

Note: all stream buffers are measured from the trees nearest the stream, not the water's edge, and occur on either side of the stream.

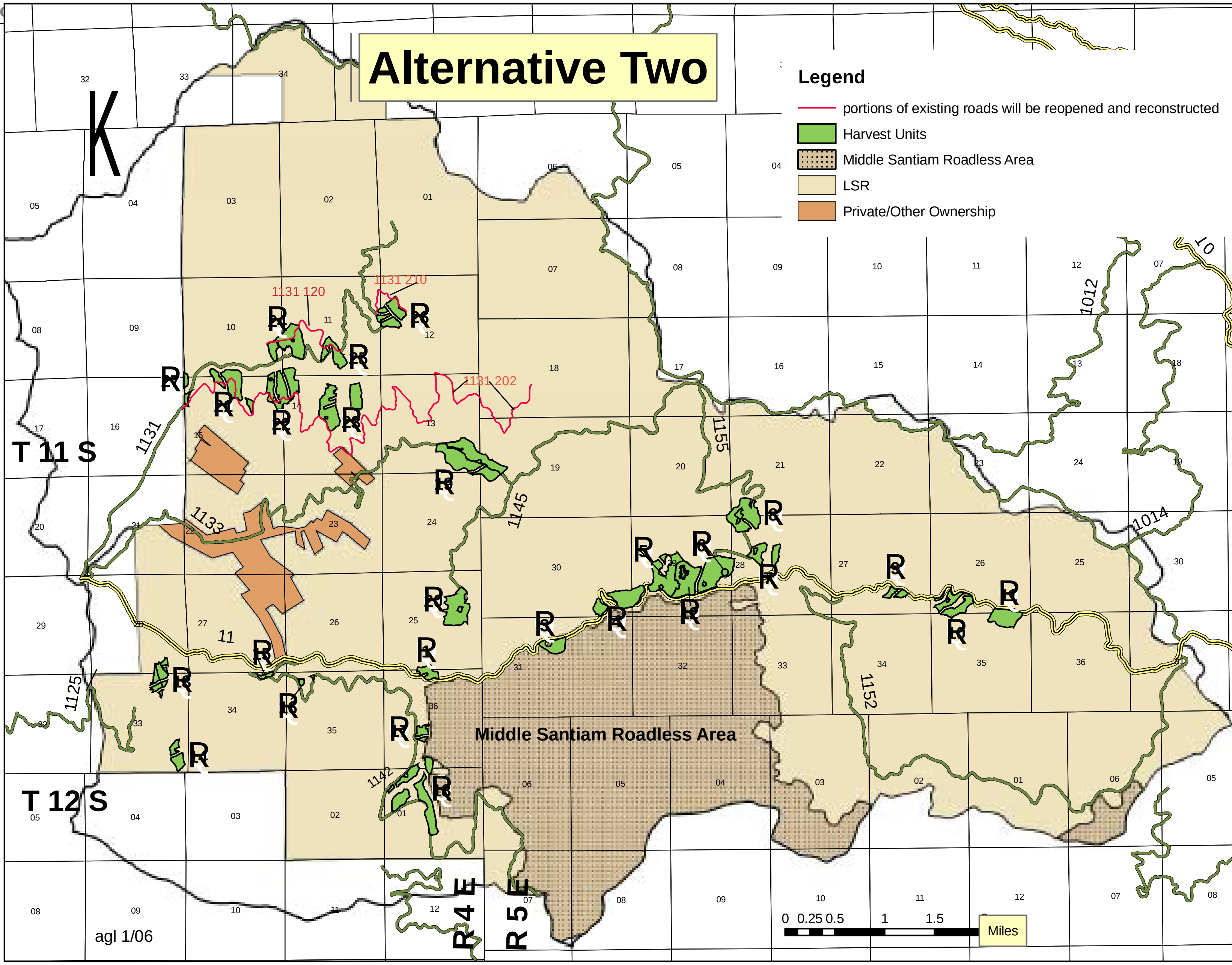

Alternative Two
Legend
portions of existing roads will be reopened and reconstructed
Harvest Units
Middle Santiam Roadless Area
LSR
Private/Other Ownership
Middle Santiam Roadless Area
T 11 S
T 12 S
R 4 E
R 5 E
1131 120
1131 210
1131 202
1131
1133
1145
1155
1152
1125
1142
1012
1014
11
0 0.25 0.5 1 1.5
Miles
agl 1/06

Table 3: Alternative 3 Unit Prescriptions

Unit #	Refor. #	Total Acres	Trees Per Acre	Canopy Cover Percentage	Dominant Tree Release (DTR)	Skyline Acres	Helicopter Acres	Ground-based Acres	Fuel Treatment HP = hand pile 1 chain along roads YTA = yard tops attached
1	Q1	7	110	60%	10% above rd. 720	1	6	0	HP 7ac along 1100 rd
3	Q4	11	90	50%	3%	0	11	0	HP 2ac along 1100 rd
4	Q5	33	90	50%	10%	3	30	0	Pullback 7 acres of slash along 11 rd, end haul to west side of unit & dump for soil stabilization
5	Q6	32	90	50%	3%	7	7	18	YTA 14ac., HP 8ac along 11 and 1155 rds
6	Q7	26	90	50%	10%	8	10	8	HP 8ac 11 rd.
7	Q8	22	110	60%	3%	12	0	10	YTA 200ft below landings and HP 4ac along 11 and 1155 rds
8	Q11	25	70	40%	No DTR	11	0	14	HP 6ac 1155 rd
9	Q12, Q12A	3	110	60%	3% (1/8th acre)	3	0	falling only	HP 2ac along1100 rd
10	Q13	14	110	60%	3% (1/8th acre)	14	0	falling only	HP 5ac along1100 rd
11	Q14, Q14A, Q14B	27	90	50%	10%	27	0	falling only	HP 2ac along 1100 rd.
12	Q41	8	70	40%	No DTR	0	0	8	HP 6ac along 1155 rd & around perimeter of dispersed site in NW corner
13	Q50, Q50A	9	90 West	50% west 90% east	10% west, 1/8 ac. openings east	6	3	0	HP 4ac along spurs 805 & 808

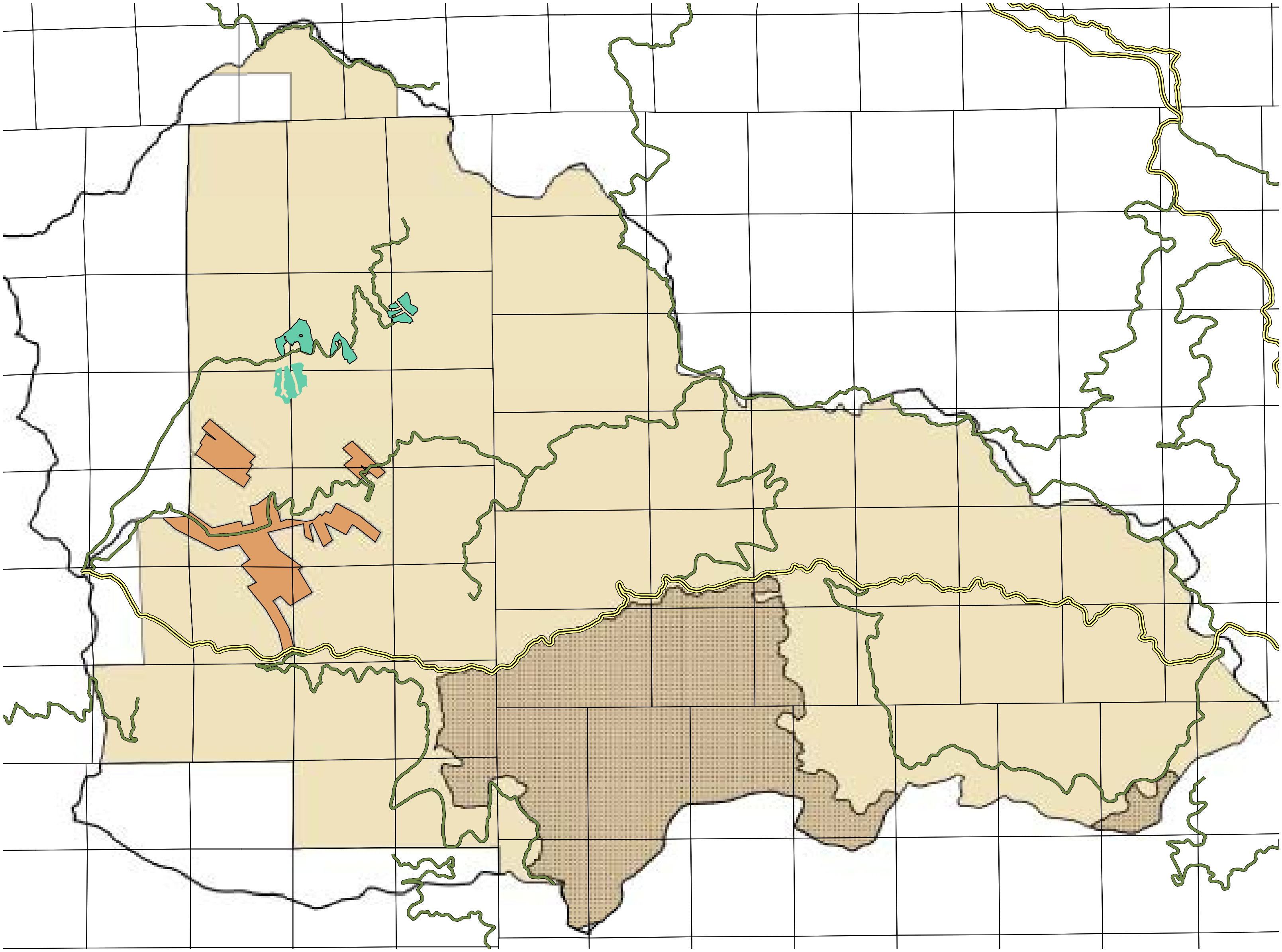
Table 3: Alternative 3 Unit Prescriptions

Unit #	Refor. #	Total Acres	Trees Per Acre	Canopy Cover Percentage	Dominant Tree Release (DTR)	Skyline Acres	Helicopter Acres	Ground-based Acres	Fuel Treatment HP = hand pile 1 chain along roads YTA = yard tops attached
14	Q51	9	90	50%	3%	1	8	0	HP 3ac along spur rd 805 & around dispersed site
15	Q70	3	70	40%	No DTR	3	0	0	YTA 3ac
16	Q71	1	70	40%	No DTR	1	0	0	No treatment
17	Q72	3	110	60%	5 %	3	0	0	HP 1ac along 1142 rd
18	Q73	59	90	50%	10%	50	9	0	YTA 59ac
19	Q102	78	70 110	40% north of 1133 60% south of 1133	No DTR north 3% south	78	0	0	YTA 78ac, HP 11ac along 1133 rd
20	Q115	37	90	50%	3%	27	4	6	Burn landings only
21	Q201, Q201A	13	110 90	60% north of 202 50% in helicopter	3%	13	0	0	Burn landings only
22	Q202	27	110	60%	10%	21	6	0	Burn landings only
23	Q203	45	70 110	40% east of stream 60% west of stream	No DTR east, 10% west	35	10	0	Burn landings only
24	Q206	40	90	50%	3%	33	7	0	HP 4ac along 1131 rd
25	Q207	9	90	50%	3%	6	3	0	HP 2ac along 1131 rd
26	Q209	10	90	50%	10%	5	5	0	HP 2ac along 1131 rd
27	Q240	6	110	60%	3%	3	0	3	YTA 3ac
Total		**557**				**371**	**119**	**67**	

Table 4: Alternative 3 Riparian Reserve Prescriptions

Stream Classification	NW Forest Plan Riparian Reserve Management Allocation Width	No-Harvest Buffers (in areas contributing to primary stream shade and channel bank stability)	Areas in Riparian Reserves, outside of stream buffers where Thinning is Proposed
Fish-bearing streams (*except McQuade and Canal Creeks*) (includes Quartzville, Galena, Minniece, Bruler, Butter, Gold and Little Meadows Creeks)	344 ft. either side of the stream channel	172 feet no-harvest buffer either side of stream channel	Thinning will occur outside of the no-harvest buffer in the area between 172 feet and 344 feet from the stream channel
Fish-bearing streams McQuade Creek Unit 18	344 ft. either side of the stream channel	344 ft. no-harvest buffer either side of the stream channel	No thinning will occur in this Riparian Reserve in Unit 27.
Fish-bearing streams The portion of **Canal Creek** within Unit 27	344 ft. either side of the stream channel	132 feet no-harvest buffer on either side of stream channel	Thinning will occur outside the no-harvest buffer between 132 feet and 344 feet from the stream channel
Perennial non-fish-bearing streams	172 ft. either side of the stream channel	172 feet either side of stream channel	No treatment in Riparian Reserves on perennial non-fish bearing streams
Intermittent streams	172 ft. either side of the stream channel	Variable-width, no-harvest buffers to include trees contributing to channel bank stability	Thinning will occur outside of no-harvest buffers from the outer edge of the buffer to 172 feet from the stream channel

Note: all stream buffers are measured from the trees nearest the stream, not the water's edge, and occur on either side of the stream.



Mitigation Common to All Alternatives

Mitigation measures were developed to ease some of the potential adverse impacts the various alternatives may cause. Common mitigation measures that apply to specific units, regardless of alternative, are also listed. The following mitigation measures will be applied to any of the action alternatives unless another mitigation measure is specifically identified in a particular unit prescription in Appendix A: Unit Prescriptions. Common mitigation measures that apply to specific units, regardless of alternative, are also listed

Table 12: Mitigation Measures

Unit Number	Resource	Required Mitigation Measures	Restriction Dates
5, 6, 8, 19, 23, and 26	Big Game	• Close all newly constructed and re-opened spur roads following timber operations for this harvest entry.	N/A
All	Snags and Down Wood	• Retain existing snags in all harvest units, to the extent possible • Snags required to be felled for safety reasons will remain on site for down woody component • 10% Retention buffers required on all harvest units, will be concentrated at accumulations of down wood wherever possible • Leave 5 extra standing trees per acre, in addition to existing coarse woody debris and snags, to be topped after the timber sale to create snags. Trees in the large diameter class should be selected whenever possible for snags. • Five trees per acre will be felled and retained during harvest operations to contribute to down wood habitat. Trees selected will be within the median range of trees within the stand.	N/A
22, 23, 24	Oregon slender salamander	• Maintain a minimum 66-foot no-harvest buffer on known locations	N/A
All	Spotted Owl	• Standards outlined for spotted owls in the Biological Opinion (USDI March 2005) will be adhered to. All units are subject to restrictions identified in the Biological Opinion unless habitat is known to be unoccupied as determined by surveys done using Region 6 protocol.	Mar. 1 – July 15
All	Peregrine Falcon	• Potential nesting locations will be determined prior to timber harvest activities. If active nests are located, implement seasonal restrictions on harvest operations in nest vicinity.	Jan. 15- July 31
1, 4, 5, 9, 10, 21, 22, 24, 25, 27	PETS: Harlequin Ducks	• Logging operations will be restricted within ¼ mile of streams during nesting period.	Mar. 1 – July 15
All	Fuel Treatment/ Air Quality	• Slash in units logged by ground-based systems will be crushed and used in the skid roads. • Slash will be hand piled within 1 chain of major forest roads: 1100, 1131, 1133, 1142, 1155 and 1100-805 within harvest units bordering these roads and piles will be burned.	N/A

<table>
<tr><th>Unit Number</th><th>Resource</th><th colspan="4">Required Mitigation Measures</th><th>Restriction Dates</th></tr>
<tr><td rowspan="10">All</td><td rowspan="10">Road Closures LSR</td><td colspan="4">Selected roads will be closed within the LSR to improve habitat function and usability, reduce wildlife harassment and to minimize potential spread of non-native plants and noxious weeds into the LSR.</td><td rowspan="10">NA</td></tr>
<tr><th>Road #</th><th>Closure Type</th><th>Road Closure Miles</th><th>Comments</th></tr>
<tr><td>1131 120</td><td>Gate</td><td>1.18</td><td>Storm proof</td></tr>
<tr><td>1131 202</td><td>Gate</td><td>7.98</td><td>Storm proof</td></tr>
<tr><td>1100 720</td><td>Berm</td><td>1.61</td><td>Storm proof</td></tr>
<tr><td>1145 000</td><td>Berm</td><td>0.59</td><td>Storm proof</td></tr>
<tr><td>1100 811</td><td>Berm</td><td>0.17</td><td>Storm proof</td></tr>
<tr><td>1100 737</td><td>Berm</td><td>1.00</td><td>Storm proof</td></tr>
<tr><td>1100 743</td><td>Berm</td><td>0.56</td><td>Storm proof</td></tr>
<tr><td>1145 387</td><td>Gate</td><td>1.33</td><td>Access through gate</td></tr>
<tr><td>All</td><td>Fish</td><td colspan="4">• Any project activity such as culvert replacement that must occur within fish-bearing and other perennial streams will comply with Oregon Department of Fish and Wildlife seasonal restrictions on in-stream work activities. Best Management Practices 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.
• Native-surfaced roads will be restricted for hauling during the winter rainy season to maintain water quality and fish habitat.
• Construction and or maintenance of roads will not be done when soils are saturated or run off occurs, to minimize erosion and sedimentation, and a stable fill will be constructed across all streams.
• All haul roads will be maintained in stable condition. Watering the road surface will be used if roads become excessively dusty during the summer.
• Ground-based yarding systems will operate only when soils are relatively dry following the rainy season in the spring though summer. Operations will be suspended if rainfall or precipitation results in pooling of water in skid trials or landings.
• Designated skid trails will be required in all ground-based yarding units. Skid trails will be located outside drainages, seeps, springs and/or concave landforms, which could accumulate and transport overland flow and sediment. Existing skid trails that are outside drainages, seeps and springs that meet the needs of the yarding system should be used wherever possible.
• Ground-based equipment will be limited to slopes less than 30 percent for harvester/forwarder and</td><td>June 1 – Sept. 30

Nov. 1 – May 31</td></tr>
</table>

Unit Number	Resource	Required Mitigation Measures	Restriction Dates
		conventional ground skidding operations. Short, isolated pitches up to 40 percent, on otherwise suitable slopes, may be approved after consultation with soil/watershed specialist determines that sediment transport to streams will not occur as a result. Adverse skidding conditions will be avoided through skid trail layout and use of alternative yarding systems • Full suspension will be required when yarding over perennial stream channels. Where full suspension is not obtainable over intermittent streams, partial suspension will be required and yarding will be limited to when the stream is dry. • Where cable yarding requires corridors through a Riparian Reserve, corridors will be laid out to result in the least number of trees cut for corridors. Trees located within no-harvest buffers that must be cut to facilitate yarding corridors will be felled into the channel whenever possible, and left on site. • All skid trails and landings will be water barred to provide adequate drainage. Water bars location should occur where local terrain facilitates effective drainage of the skid trail or landing. In general, water bars should be constructed every 100 feet on slopes less than 15 percent, and every 50 feet on slopes greater than 15 percent. Water bars should be "keyed in" to the cut bank and have a clear outlet on the down hill side. Where available, slash should be placed on skid trails and landings. • All areas of exposed soil, such as landings, skid trails, decommissioned roads, and cut and fill slopes associated with road construction or maintenance will be seeded with non-invasive cereal grains such as winter wheat, and native perennial species. • Temporary roads will be decommissioned after completion of logging operations. Decommissioning of roads may include: berming the entrance, removal of culverts, out-sloping the road surface, pulling-back side slope fill material onto the cut slope, installation of water-bars, removal of placed rock, and re-vegetation of the road prism. • In units containing stream channels, all existing large woody debris will be retained within Riparian Reserves to maintain channel stability; provide nutrients and food for aquatic plants and insects, and to provide buffering so as to filter sediment from runoff and maintain water quality	
All	Residual Tree Protection	No thinning during sap flow to protect remaining trees from damage during logging operations, unless approved by District Silviculturist	below 2500 ft = Mar 5- May 15 above 2500 ft = Apr 30-June 30
18, 26	Noxious weeds	100-foot containment buffer around existing noxious weed sites in Units 18 and 26 to maintain a dense canopy next to the roads and limit spread of noxious weeds	

Unit Number	Resource	Required Mitigation Measures		Restriction Dates
All	Noxious Weeds continued	• Money will be collected from the proposed timber sale to survey and control noxious weeds on all harvest units and roads in the planning area. • Pre-treat existing weed sites • Survey to locate noxious weed populations and remove individuals and populations, where possible, in harvest units and along adjacent road systems. • Existing weed sites of meadow knapweed, false brome and Scotch broom will be buffered from thinning activities to prevent weed seed from being transported throughout the harvested area. • All road construction and logging equipment will be pressure washed prior to working in the area. • Obtain gravel for road construction and reconstruction from a weed-free rock sources. • Minimize areas of soil disturbance during all harvest activities including spur road construction and re-opening, road reconstruction, etc. Seed all disturbed areas with native species, including landings and subsoiled skid roads, to reduce weed establishment. • Berm, gate, or rip and seed any new roads and re-opened roads to reduce disturbance and incoming weed seed due to vehicular traffic.		N/A
Unit Number	Sensitive Plants	**Species**	**Number of Sites**	**Protection Measure**
3		*Pseudocyphellaria mallota*	1	172’
4		*Pseudocyphellaria rainierensis* *Pseudocyphellaria mallota*	13 1	100’ 172’
5		*Pseudocyphellaria rainierensis* *Leptogium cyanescens*	2 1	100’ 172’
6		*Pseudocyphellaria rainierensis* *Leptogium cyanescens*	1 1	100’ 172’
7		*Pseudocyphellaria rainierensis*	1	100’
8		*Pseudocyphellaria rainierensis* *Nephroma occultum*	1 1	100’ 172’
9		*Pseudocyphellaria rainierensis* *Leptogium rivale in creek*	2 linear	100’ 100’
10		*Pseudocyphellaria rainierensis*	1	Out of unit 100’

Unit Number	Resource	Required Mitigation Measures		Restriction Dates
		Leptogium rivale in 2 creeks in unit	2 linear	
11		*Pseudocyphellaria rainierensis* *Leptogium rivale in creek east of unit*	3 linear	100’ 100’
12		*Pseudocyphellaria rainierensis*	4	100’
Unit Number	Sensitive Plants continued	**Species**	**Number of Sites**	**Protection Measure**
13		*Pseudocyphellaria rainierensis* *Pseudocyphellaria mallota* *Leptogium cyanescens*	8 2 2	100’ 172’ 172’
14		*Pseudocyphellaria rainierensis*	3	100’
16		*Leptogium rivale in creek* *Leptogium cyanescens*	linear 5	100’ 172’
17		*Pseudocyphellaria rainierensis*	3	100’
18		*Pseudocyphellaria rainierensis* *Pseudocyphellaria mallota* *Leptogium rivale* in McQuade Creek	3 1 linear	100’ 172’ 100’
21		*Pseudocyphellaria rainierensis*	8	100’
22		*Pseudocyphellaria rainierensis*	8	100’
23		*Pseudocyphellaria rainierensis*	1	100’
24		*Pseudocyphellaria rainierensis*	7	100’
25		*Pseudocyphellaria rainierensis* *Leptogium cyanescens*	11 1	100’ 172’
26		*Pseudocyphellaria rainierensis* *Leptogium rivale* in creek south of unit	1 linear	100’ 100’
5, 6, 8, 19, 23, and 26	Spur roads construction and re-	• Roads will not be reopened for use during thinning if they are within a Riparian Reserve’s first site tree (172 feet distance). • All existing spur roads opened to access harvest units and all new spur roads constructed will be closed,		N/A

Unit Number	Resource	Required Mitigation Measures	Restriction Dates
	opening	water barred and seeded with native seeds following activities.	
3	Landing Construction	• The landing for this unit will be located outside of the Middle Santiam Roadless Area. No roads will be constructed or re-used within this harvest unit because the unit falls within the roadless area.	N/A
All	Recreation	• No log hauling operations on weekends during peak recreation season. A weekend is defined as starting at 5pm on Friday and ending at 7pm on Sunday. • Berms placed on local roads after logging operations will be placed far enough away from main roads to create dispersed recreation sites, whenever possible. • Reconstruct or replace any existing dispersed recreation sites impacted by logging operations or road closures. • Whenever possible, wildlife trees felled for downed wood should be directed across skid roads to block ATV access.	July 4 – Aug. 31

Unit Number	Resource	Required Mitigation Measures	Restriction Dates
All	Special habitats - general	*Special habitats will be protected in accordance with the Forest Plan and the Special Habitat Management Guide (see Appendix A: Unit Prescriptions for specific information regarding protective measures for special habitats known to occur in or adjacent to proposed units).* ***General protection measures include:*** • Directional falling away from special habitats • Avoiding placement of equipment, skyline corridors, and designated skid roads through special habitat areas.	N/A
	Special habitats - Seeps/springs	• 172 feet, if seeps/springs greater than 1/4 acre in size. If less than ¼ acre and if contains riparian vegetation such as skunk cabbage or devil's-club, then a buffer of 50 feet-172 feet will be implemented	
	Special habitats - Ponds	• 600 feet no-harvest buffer	
	Special habitats - Caves	• Variable buffer widths; determined by Wildlife Biologist	
	Special habitats - Rock gardens	• 200 feet buffer, if rock garden is greater than 1/2 acre in size	
	Special habitats - Rock outcrops	• 150 feet buffer, if rock outcrop is greater than 2 acres	
	Special habitats - Other	• Smaller seeps, rock gardens and outcrops will be buffered commensurate with their size and the adjacent harvest prescription. There should be no direct disturbance to the habitat or its ecotone. Small rock outcrops are abundant in the planning area and therefore do not require buffering in the thinning units, provided that direct disturbance is avoided. Additional special habitats encountered during project layout will be protected in consultation with resource specialists.	
All	Mining	• Mining claimants will be notified by mail that logging operations may affect access to their claims. Mining claimants will be given reasonable access to their claims during harvest operations as required by contract clauses.	N/A
All	Heritage Resources	• Protect eligible heritage sites. • In the event that heritage resources are encountered during project implementation project activity will cease until an archeologist can make a determination of effect on the heritage resource.	N/A

Unit Number	Resource	Suspension Requirements	Duff Retention Requirements
1	Soils	Partial, some ground	60-80%
3		Partial	60-80%
4		Partial, some ground	60-80%
5		Partial and ground	40-60%
6		Ground, some partial	30-50%
7		Partial	60-80%
8		Partial and ground	30-50%
9		Partial, some ground	40-60%
10		Ground and partial	20-40%
11		Ground and partial	30-50%
12		Ground, some partial	30-50%
13		Partial, some ground	60-80%
14		Partial, some ground	60-80%
15		Partial, some ground	60-80%
16		Partial	60-80%
17		Partial	60-80%
18		Partial	60-80%
19		Partial	60-80%
20		Partial, some ground	60-80%
21		Partial	60-80%
22		Partial	60-80%
23		Partial	60-80%
24		Partial	60-80%
25		Partial	60-80%
26		Partial	60-80%
27		Ground	20-40%

Unit Number	Resource	Required Mitigation Measures	Restriction Dates
All	Soils	• Upon completion of harvest activities, skid roads for ground-based equipment shall be ripped or subsoiled to return the site to near original productivity. All ripped and subsoiled areas will be seeded with native seed mix. • Erosion control measures will be implemented as soon as possible after soils have been disturbed. • Ground-based equipment should generally operate in the dry season, usually considered May through October, unless otherwise restricted by other resource concerns or agreed to by Forest Service personnel. • Harvested trees should usually be topped and limbed in the units in order to provide for nutrient recycling and control of ravel and slough on steep side slopes, unless otherwise specified in fuel treatment requirements. • Ground -based equipment shall generally be limited to slopes less than 30%, unless otherwise directed by Forest Service personnel. • Ground-based skidding equipment or forwarders shall stay on designated skid trails. Ground-based skid trails will be pre-designated and pre-approved before use (LTSR). They should generally be about 10 feet wide and should not usually exceed 15 feet in width, and where practical the skidder, cat or processor/ forwarder should travel on slash. Traveling on slash will help reduce off site soil erosion or lessen soil compaction. LTSR should be included in the contract. Tractor skid roads will generally be 150 to 200 feet apart. Processor/forwarder skid roads will generally be about 50 to 60 feet apart. • Partial or one end suspension is required on skyline units, except at tail trees and landings. Given the uneven terrain in some units, small areas of ground lead may occur along ridge lines or benches. • Unless otherwise approved, the reopening of temporary, unclassified roads should occur in the dry season, usually June through October to avoid surface erosion from exposed soil. Open roads should be storm proofed if they have to set through extended periods of wet weather. • Where practical, at the completion of harvest activities, limbs and woody debris should be placed on areas of exposed soil to reduce the potential for off site soil erosion. • Unclassified or temporary haul roads used outside the standard operating season should generally be rocked to reduce erosion. • Cable corridors spacing should be set to both minimize damage to vegetation as well as the underlying soil. • Trees, not designated for harvest in riparian buffers that need to be cut to facilitate harvest operations, should be dropped into the stream to aid in woody debris recruitment. • Avoid disturbance to the existing down woody debris concentrations from the initial entry as much as practical. • At the completion of harvest activities, heavily used, tractor skid roads (existing or created) that are not part of the dedicated transportation system should be adequately subsoiled with a "Forest cultivator" or an equivalent winged ripper in order to return the site to near original productivity, unless otherwise waived by the Forest Service. This can be accomplished either by the contractor or through the KV process. • Standard contract language should provide for sufficient erosion control measures during timber sale operations (BMP T-13). Revegetation of areas disturbed by harvest activities (such as landings, temporary roads, and equipment storage areas) is required with an appropriate grass seed mix (BMP T-14, T-15, and T-16).	May – Oct June - Oct

<table>
<tr><th>Unit Number</th><th>Resource</th><th colspan="2">Required Mitigation Measures</th><th>Restriction Dates</th></tr>
<tr><td>1, 4, 16, 18, 19, 21, 22, 23, 24 and 25</td><td>Soils</td><td colspan="2">• Recent failures tracts are present in proposed units 19, 21, 22, and 24. Older sidecast failure scars are evident in Units 1, 4, 16, 18, 23 and 25. Consequently, for one to two chains below roads in these Units, leave trees will be designated such that the larger trees with extensive root mats, and especially those trees with pistol butt trucks (indicative of sidecast creep) will be maintained.</td><td></td></tr>
<tr><td rowspan="5">All</td><td rowspan="5">Riparian</td><td colspan="2">• No in-stream activities will take place in fish-bearing streams, or other perennial streams near their confluence with fish-bearing streams, outside of the in-water work window.
• Assure stream crossings allow natural flow of water
• No-harvest riparian buffers are prescribed to minimize sediment delivery to streams and reduce the potential for temperature increases. The riparian buffers vary by alternative as stated in the Description of Alternatives. All buffers are measured from the trees nearest the stream rather than the waters edge.
• Dry weather haul will be required on native surface spurs.
• To minimize impact from skyline corridors across streams and riparian areas, trees will be directionally felled into stream channels, where possible. If trees cannot be felled into stream channels, fell them away from riparian vegetation to minimize damage. These trees will be left on site.
• Ground-based harvest operations will be restricted in Riparian Reserves whenever soils are wet and not frozen.
• No DTR’s will occur closer than 172 feet from streams or in units thinned to 40% canopy closure
• Implement Best Management Practices (BMP’s) for all project activities. Utilizing BMP’s for this project specifically addresses direction and guidance in the protection of water quality. Objectives and mitigation for water quality for this project are listed in the following table:</td><td rowspan="5">July 15 – August 30

July 1 – October 31</td></tr>
<tr><th>Objective</th><th>Mitigation</th></tr>
<tr><td>Maintain or improve existing temperature regime along perennial streams in relation to water quality</td><td>Designation of riparian management units to maintain and improve shade canopies over stream channels (BMP T-2; T-7; T-8).</td></tr>
<tr><td>Continue recovery of downstream riparian and channel conditions</td><td>Design units to insure channel bank stability, and provide adequate buffers to reduce sediment inputs and minimize peak flow effects (BMP T-2; T-7; T-8; T-12). Boundaries are placed in such a manner to avoid compromising stability of the channel banks. No trees are cut which attribute to bank stability.</td></tr>
<tr><td>Maintain or improve the quality of water for domestic and fisheries users</td><td>Designate riparian management units and specific prescriptions for each individual unit adjacent to stream courses requiring protection (BMP; T-7).</td></tr>
</table>

Unit Number	Resource	Required Mitigation Measures		Restriction Dates
		Objective	**Mitigation**	
All	Riparian continued	Maintain natural filtration of surface, overland flow, through post sale activities.	Establish appropriate riparian management units and establish fire lines to ensure maintenance of established buffers, filter strips (BMP T-7; T-8; F-2; F-3).	N/A
		Maintain or improve channel bank stability.	Establish riparian management units that include channel bank areas and or establish marking prescriptions that prevent any tree attributing to bank stability from being marked (BMP T-2; T-6; T-7; T-8).	
		Control the amount of sediment leaving the road system.	Utilize appropriate clauses within the contract to ensure that winter haul occurs on roads with adequate surface rock and that erosion control techniques such as mulching of bare soils associated to the road system occur.	

 Quartzville LSR Thin

The chart below is sorted by percent of area in the DTR

Unit	Acres	Canopy Cover after Thin	TPA	DTR Percent
8	43	40	70	0
15	3	40	70	0
16	3	40	70	0
19	43	40	70	0
23	18	40	70	0
Subtotal	**110**			
3	17	50	90	3
5	48	50	90	3
14	15	50	90	3
20	43	50	90	3
21	10	50	90	3
24	47	50	90	3
25	22	50	90	3
7	22	60	110	3
9	9	60	110	3
12	38	60	110	3
19	44	60	110	3
21	28	60	110	3
27	6	60	110	3
Subtotal	**349**			
10	31	60	110	5
17	8	60	110	5
Subtotal	**39**			
6	49	50	90	10
11	29	50	90	10
13	10	50	90	10
18	65	50	90	10
26	28	50	90	10
1	12	60	110	10
4	40	60	110	10
22	49	60	110	10
23	36	60	110	10
13	12	90		1/8 ac. openings
Subtotal	**330**			

This chart is sorted by canopy closure after thinning.

Unit	Acres	Canopy Cover after Thin	TPA	DTR Percent
8	43	40	70	0
15	3	40	70	0
16	3	40	70	0
19	43	40	70	0
23	18	40	70	0
Subtotal	**110**			
3	17	50	90	3
5	48	50	90	3
6	49	50	90	10
11	29	50	90	10
13	10	50	90	10
14	15	50	90	3
18	65	50	90	10
20	43	50	90	3
21	10	50	90	3
24	47	50	90	3
25	22	50	90	3
26	28	50	90	10
Subtotal	**383**			
1	12	60	110	10
4	40	60	110	10
7	22	60	110	3
9	9	60	110	3
10	31	60	110	5
12	38	60	110	3
17	8	60	110	5
19	44	60	110	3
21	28	60	110	3
22	49	60	110	10
23	36	60	110	10
27	6	60	110	3
Subtotal	**323**			
13	12	90		1/8 ac. openings
Subtotal	**12**			

DTR above road only

west
east

north of road 1133
south of road 1133

north of road 202
in helicopter

east of stream
west of stream

Appendix B: Post Sale Activities

Timber Stand Improvement (TSI)

The following timber stand improvement treatments are prescribed for the units listed below in accordance with the Forest Plan.

Tree planting with native species is planned to improve structure and diversify stand age and species. Dominant Tree Release Areas will be planted with western red cedar and western white pine. In addition planting with western red cedar is planned for Unit 13 east of Forest Road 808 in both action alternatives. Underplanting with red cedar is also planned for Unit 12 in Alternative 3.

Precommercial thinning is prescribed to enhance species diversity, prolong early seral stage stand structure, increase growth rate of dominant trees, and reduce stand densities to Regional and Forest guidelines. See table and map below for managed stand information and location of precommercial thinning opportunities. Release is prescribed to reduce competition with brush species. Red alder will be cut to improve growth and survival of conifer seedlings.

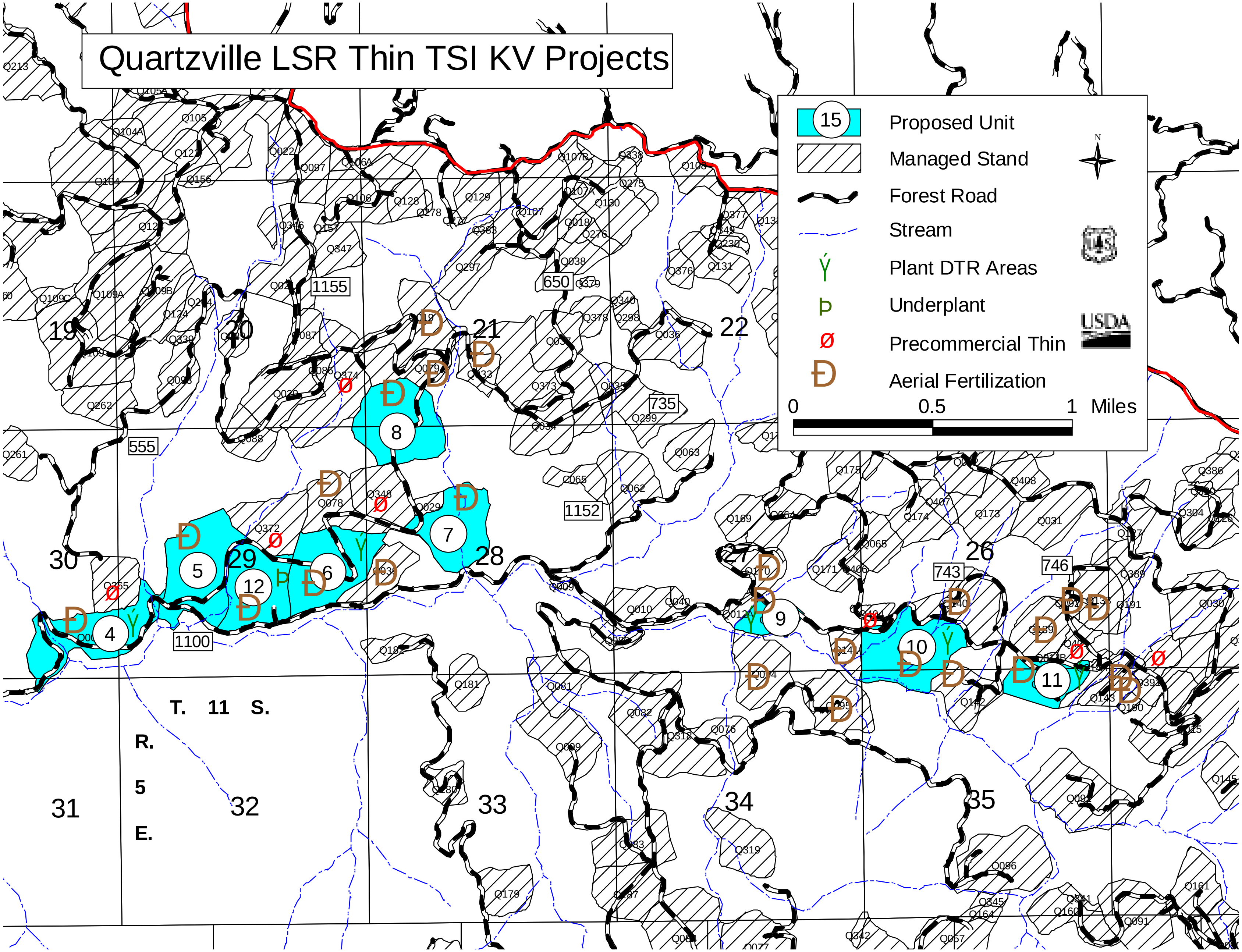
Aerial fertilization is prescribed at a rate of approximately 440 lbs. per acre, according to Regional and Forest guidelines. Fertilization will increase tree growth and improve forage conditions for wildlife. See table and map below for managed stand information and location of aerial fertilization opportunities.

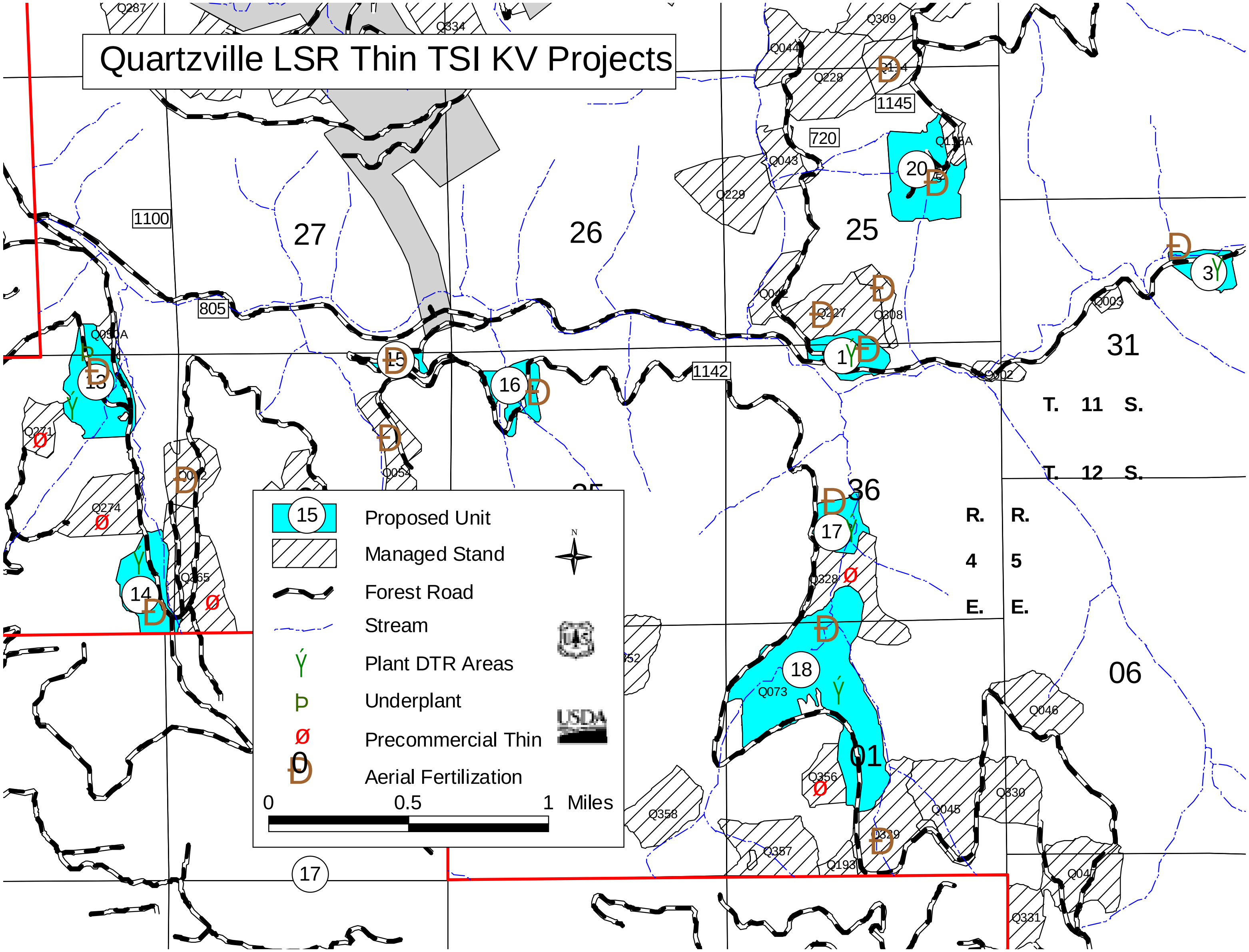
Above road 1100 adjacent to Unit 5 chain link fencing was placed on the slope to prevent ravel. Trees are trying to grow through the fencing but are being girdled. Cutting the fencing at the tree will allow the trees to grow and provide bank stability. $1000 will be collected.

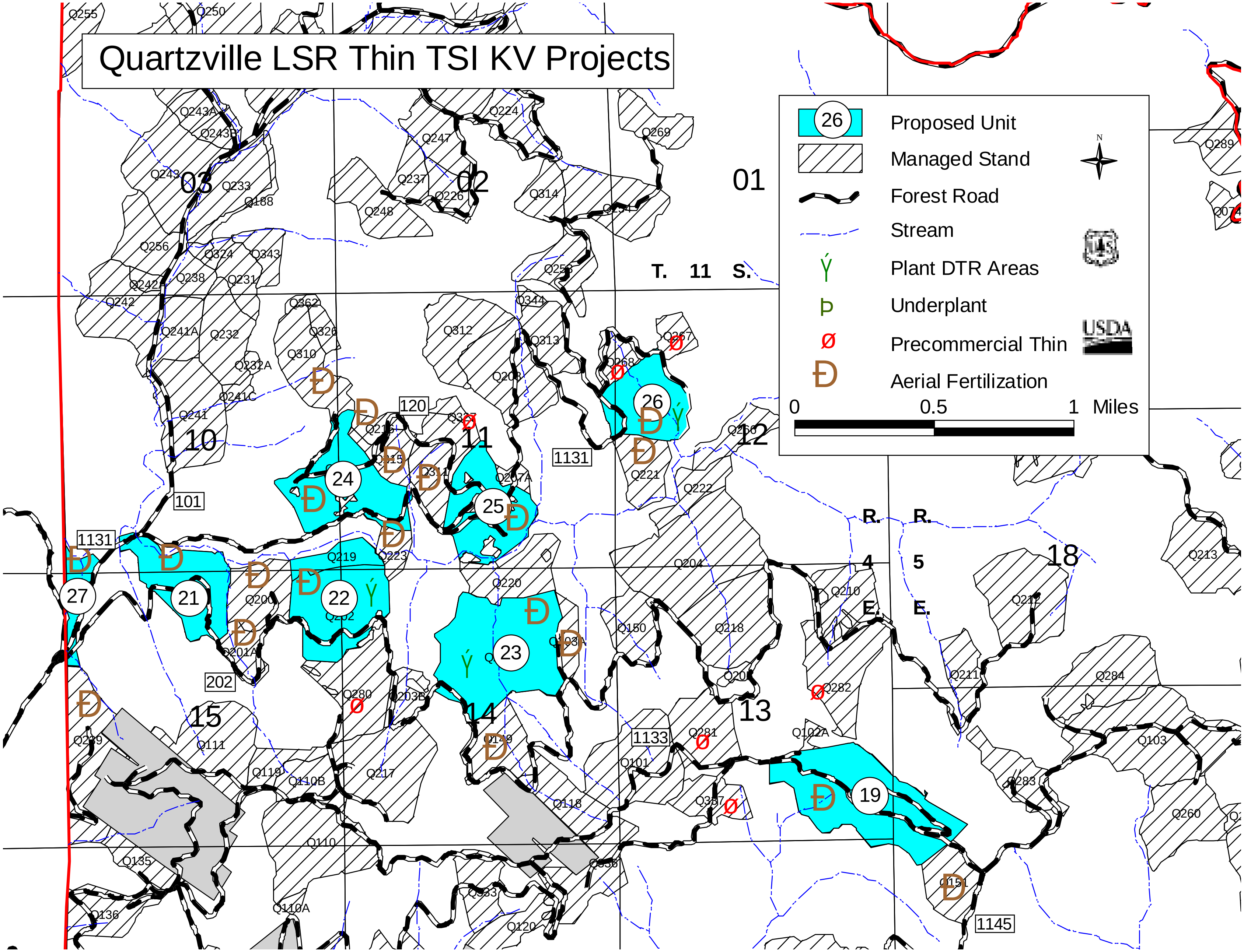
Table 1: *TSI Needs By Stand (see map)*

Treatment	Thinning Unit	Acres Alternative 2	Acres Alternative 3
Tree Planting in Dominant Tree Release Prescription $535 per acre planned for 2008	1	1	1
	3	7	4
	4	4	3
	6	5	3
	9	4	1
	10	2	1
	11	6	5
	13	4	2
	14	6	4
	17	1	1
	18	7	6
	22	5	3
	23	2	1
	26	3	1
	Totals	57 ($30,495)	36 ($19,260)
Underplanting $535 per acre	12		8 acres
	13	12 acres	6 acres
	Totals	12 ($6,420)	14 ($7,490)
Precommercial Thinning $205 per acre 510 acres in both action alternatives for a total of $104,550	4-Q265 2008	24	24
	5-Q372 2008	33	33
	6-Q348 2009	29	29
	8-Q374 2009	55	55
	10-Q404 2009	5	5
	11-Q401 2009	14	14
	11-Q391 2009	27	27
	13-Q271 2008	15	15
	14-Q274 2008	34	34
	14-Q365 2008	45	45
	17-Q328 2008	43	43
	18-Q356 2010	18	18
	19-Q282 2008	45	45
	19-Q337 2008	17	17
	19-Q281 2008	29	29
	22-Q280 2008	42	42
	25-Q327 2008	4	4
	26-Q267 2008	9	9
	26-Q268 2008	22	22
	Totals	510	510

Aerial Fertilization $110 per acre **Alternative 2 is 828 acres for $91,080 within thinning units and 794 acres for $87,340 of other managed stands** **Alternative 3 is 557 acres for $62,260 within thinning units and 794 acres for $87,340 of other managed stands**	Thinning Units 2009	828	557
	1-Q227 2008	39	39
	1-Q308 2008	6	6
	6-Q78 2008	29	29
	6-Q39 2008	14	14
	8-Q79 2008	28	28
	8-Q33 2008	15	15
	8-Q19 2008	37	37
	9-Q170 2009	19	19
	9-Q94 2008	35	35
	10-Q141 2009	11	11
	10-Q95 2008	37	37
	10-Q142 2008	29	29
	10-Q140 2008	35	35
	11-Q139 2008	22	22
	11-Q143 2008	17	17
	11-Q190 2008	3	3
	11-Q192 2008	5	5
	11-Q138 2008	32	32
	14-Q52 2008	24	24
	15-Q54 2008	39	39
	18-Q329 2008	38	38
	19-Q151 2008	25	25
	20-Q114 2008	20	20
	21-Q200 2008	36	36
	21-Q201A 2008	10	10
	22-Q223 2008	7	7
	23-Q149 2008	20	20
	23-Q203A 2008	8	8
	24-Q215 2008	19	19
	24-Q216 2008	6	6
	24-Q310 2008	41	41
	25-Q311 2008	39	39
	26-Q221 2008	22	22
	27-Q289-2008	27	27
	Totals	1,622	1351


Quartzville LSR Thin TSI KV Projects
15 Proposed Unit
Managed Stand
Forest Road
Stream
Plant DTR Areas
Underplant
Precommercial Thin
Aerial Fertilization
0
0.5
1
Miles
N
USDA
T. 11 S.
R. 5 E.
19
20
21
22
26
27
28
29
30
31
32
33
34
35
1155
650
735
555
1152
1100
743
746
4
5
6
7
8
9
10
11
12


Quartzville LSR Thin TSI KV Projects
15
Proposed Unit
Managed Stand
Forest Road
Stream
Plant DTR Areas
Underplant
Precommercial Thin
Aerial Fertilization
0
0.5
1
Miles
N
27
26
25
31
36
06
01
1100
805
1142
1145
720
T. 11 S.
T. 12 S.
R. 4 E.
R. 5 E.
1
3
13
14
16
17
18
20
Q287
Q334
Q309
Q044
Q228
Q043
Q229
Q227
Q308
Q002
Q003
Q271
Q274
Q265
Q054
Q328
Q073
Q046
Q356
Q358
Q357
Q193
Q045
Q330
Q331



Quartzville LSR Thin TSI KV Projects
Proposed Unit
Managed Stand
Forest Road
Stream
Plant DTR Areas
Underplant
Precommercial Thin
Aerial Fertilization
0
0.5
1 Miles
USDA
T. 11 S.
R. 4 E.
R. 5 E.
01
02
03
10
11
12
13
14
15
18
19
21
22
23
24
25
26
27
101
120
202
1131
1133
1145
Q255
Q250
Q243A
Q243B
Q243
Q233
Q188
Q224
Q247
Q237
Q226
Q248
Q269
Q314
Q256
Q324
Q343
Q238
Q231
Q242
Q253
Q344
Q362
Q326
Q310
Q312
Q313
Q208
Q267
Q268
Q241A
Q232
Q232A
Q241C
Q241
Q327
Q221
Q222
Q207A
Q219
Q223
Q204
Q220
Q200
Q202
Q201A
Q210
Q212
Q213
Q289
Q150
Q218
Q203A
Q280
Q203B
Q211
Q282
Q284
Q209
Q111
Q119
Q110B
Q217
Q149
Q281
Q101
Q102A
Q103
Q283
Q118
Q357
Q260
Q110
Q135
Q136
Q110A
Q333
Q120
Q151

Table 2: *TSI needs by Alternative*

	Alternative 2	Alternative 3
Tree Planting	$30,495	$19,260
Underplanting	$6,420	$7,490
Precommercial Thinning /Release	$104,550	$104,550
Aerial Fertilization in commercial thinning units	$91,080	$61,270
Aerial Fertilization in adjacent managed stands	$87,340	$87,340
Fencing Release	$1,000	$1,000
Total	$320,885	$280,910

Soil and Hydrology

Processor/Forwarder (ctl) yarding or felling is proposed for portions Units 5, 6, 8, 10, 11, 12, 20, and 27. Sub-soiling could be required to meet best management practices for erosion control and soil productivity. A collection will be made for 10% of the acres where ground-based logging systems will be utilized. There are 111 acres in Alternative 2 and 67 acres in Alternative 3 of ground based logging systems planned. Sub-soiling will be completed soon after harvest in FY 2008. $600 per acre will be collected to seed the subsoiled areas with native grasses.

Table 3: *Total Soils needs by Alternative*

	Alternative 2	Alternative 3
Sub-soiling at $400 per acre	11 ($4,400)	7 ($2,800)
Seeding with Native Species at $600 per acre	11 ($6,600)	7 ($4,200)
Total	$11,000	$7,000

Storms in 1996 and 1998 caused debris torrents in three of the thinning units; several of the units have an older debris torrent tracks (see soil report). The debris torrents would be good repositories for top material created during logging activities. Soil building from top decay will allow for future seed in of western red alder. Understory trees will be felled at 100-foot intervals at 45-degree angles to the stream to provide structure to reduce stream velocities during future high water flow events in Units 19 and 24. Trees will be released by the understory removal; the target species for release will be western red cedar where available, 8 structures will be created in each unit. In Units 4 and 22 top material will be placed in the debris chutes with helicopters, 2 hours of helicopter time will be required in each unit. Western red cedar will be underplanted in Units 5, 6, 7, 12, 14 and 18 in the riparain reserves associated with small wet areas (7 acres in 12, 6 acres in both 5 and 6, 2 acres each in 7, 14 and 18). A total of 25 acres will be underplanted at a cost of $500 per acre . Total cost will be $12,500.

A spur road in the NW corner of Unit 19 will be obliterated to restore natural hydrological functions. A collection of $3000 will be required. $2000 will be used for ripping and seeding and $1000 will be used to plant native material.

Two rock pits will be restored. A rock pit in Unit 8 will be restored to natural contours. $4000 will be collected. $2000 will be used for ripping and seeding and $2000 will be used to plant native material. The other pit is adjacent to Unit 26. $4000 will be collected. $2000 will be used for ripping and seeding and $2000 will be used to plant native material.

The riparian area near a mine site near Unit 1 will be restored. There are four claims within Unit 1; Clarence Mohr is the claimant for three (M&M I, II and III), Mike Koker is the claimant for the fourth (Just Passing Time). Reclamation was completed in July of 2003. Several opportunities exist for further improvement in the riparian reserve. 2 acres will be planted with native material at a cost of $600 per acre. The access road will be bermed at the last switchback above Quartzville Creek. Boulders will be placed to deter motorized traffic at the confluence of Quartzville and McQuade Creek at a cost of $1000. Approximately 300 feet of 4” plastic pipe and several pieces of 1” cable that used to cross the stream need to be removed. A classifier and a small barrel sized trammel will need to also need to be disposed of. Cutting with an acetylene torch before removal will be required to manage the size of material to be hand carried across the Quartzville Creek.. The cost of removal would include ten person days of work at $250 per day and the charge to deposit the refuse at a local transfer site. A collection of $3,000 will be required. Existing material from down material on site will be placed in McQuade Creek to create diversity and reduce stream energies. Estimated cost will be 5 structures and $500.

Along the main 1100 road adjacent to Quartzville Creek there are disperesed recreation sites that are negatively influencing the riparian reserve. Reducing compaction and vegetative damage by restricting size, trails, camping pads and access will improve and preserve riparian values. 8 sites will be improved at a cost of $1000 per site for a total of $10,000.

Table 4: *Total Watershed Restoration by Alternative*

	Alternative 2	**Alternative 3**
Debris Chute Restoration - Felling at $100 per structure (16 structures)	$1,600	$1,600
Slash Placement With Helicopter $1500/hour (4 hours)	$6,000	$6,000
Underplanting Riparian Reserves (25 Acres)	$12,500	$12,500
Dispersed Site Reclamation	$8,000	$8,000
Spur Road Obliteration	$3,000	$3,000
Rock Pit Restoration	$8,000	$8,000
McQuade Creek Restoration	$8,200	$8,200
Total	$47,300	$47,300

Wildlife

Snags will be created from retained leave trees after logging is completed. Five trees per acre will be retained for future snag habitat in the matrix units. Topping the larger sized Douglas fir will create an average of five snags per acre. The cost of topping is $50.00 per tree to be done the year logging will be completed, FY 2008.

Trees will be retained to provide future down wood with the timber sale contract.

Road closures within the planning area are noted in the appendix. Roads opened for logging with this sale will be closed, ripped and seeded, by the purchaser.

There are three gates planned with KV funds on roads 1131120, 1131202 and 11445387. Gates will cost at $1500 each. A gate on the 1100745 will be replaced at a cost of $1000.
There are five berms planned with KV funds on roads 1100720, 1145000, 1100811, 1100737 and 1100743. Berms will cost $500 each.

Table 5: *Total Wildlife needs by Alternative*

Treatment	Alternative 2	Alternative 3
Tree Topping at $50 per tree	828 acres 4,010 trees to top $207,000	557 acres 2,785 trees to top $139,250
Gates	4 at $1500 for $6000	4 at $1500 for $6000
Berms	5 at $500 for $2500	5 at $500 for $2500
Totals	$215,500	$147,750

Botany

Noxious Weeds

Ground-disturbing activities, including commercial thinning and road construction and reconstruction, encourage the spread of noxious weeds by increasing light, providing a mineral soil seedbed, and spreading weed seed. Vehicles and logging equipment can inadvertently spread weed seed by carrying it into the area on tires and caked on mud. KV monies are collected to survey the project area annually for five years for the presence of noxious weeds and to control their spread. Control methods will include manual removal and the release of insects for biological control. Herbicides are used only as a last resort and may only be used in accordance with the *Willamette National Forest Integrated Weed Management EA* (USDA Forest Service 1999).

The cost of noxious weed survey and control is $6.00/acre for commercial thinning. The cost of noxious weed survey and control is $20.00/acre for road construction and reconstruction. An additional 2 acres will be added to each unit for roadside weeding of existing roads within one-quarter mile. Roads that will be reconstructed for logging activities will be collected at the rate of $20 per acre. All roads will be closed after purchaser completes logging activities.

Table 6: *Noxious Weed Road Reconstruction and Construction KV collections by Alternative*

	Alternative 2	Alternative 3
1100' of reconstruction for a spur in Unit 5	2 acres	
600' of spur road in Unit 6	1 acre	
1400' of spur in Unit 8	2 acres	2 acres
500' of spur in Unit 8	1 acre	
1300' of spur in Unit 19	2 acres	2 acres
700' of spur in Unit 23	1 acre	1 acre
1800' of spur in Unit 26	3 acres	3 acres
52 acres of adjacent Forest Roads	52	52
Totals	64 acres 5 times for $6,400	60 acres 5 times for $6,000

Monitoring
Psueocyphellaria mallota in Unit 3 and *P. reinierinsis* in Units 5, 6, 12 and 23 are interior to commercial thinning activities in Alternative 2. The lichens will be monitored for long-term persistence. Cost of monitoring will be $200 per survey for two surveys in years one and five after harvest is complete. In Alternative 3 only the PSMA in Unit 3, and the PSRA in Units 5 and 23 will be interior.

Table 7: *Total Botany KV Collections by Alternative*

	Alternative 2	Alternative 3
Acres Commercially Thinned $6.00/acre	828 acres for five years $24,840	557 acres, for five years $16,710
Acres of Road Reconstruction or Construction $20.00/acre	$6,400	$6,000
Monitoring	$2,000	$1,200
Totals	$33,240	$23,910

Recreation
Forest Road 11 is managed as an Oregon Scenic Tour Route from US Highway 20 to State Highway 22. Four signs will be replaced in both action alternatives at a cost of $400 per sign. Dispersed recreation at sites along Quartzville Creek is primary. Dispersed sites also receive heavy use during big game hunting seasons. There are road closures planned to reduce road density. Road closures will reduce the number of campsites available. Road closures will be evaluated for terrain near the closure to provide new dispersed campsites in front of planned

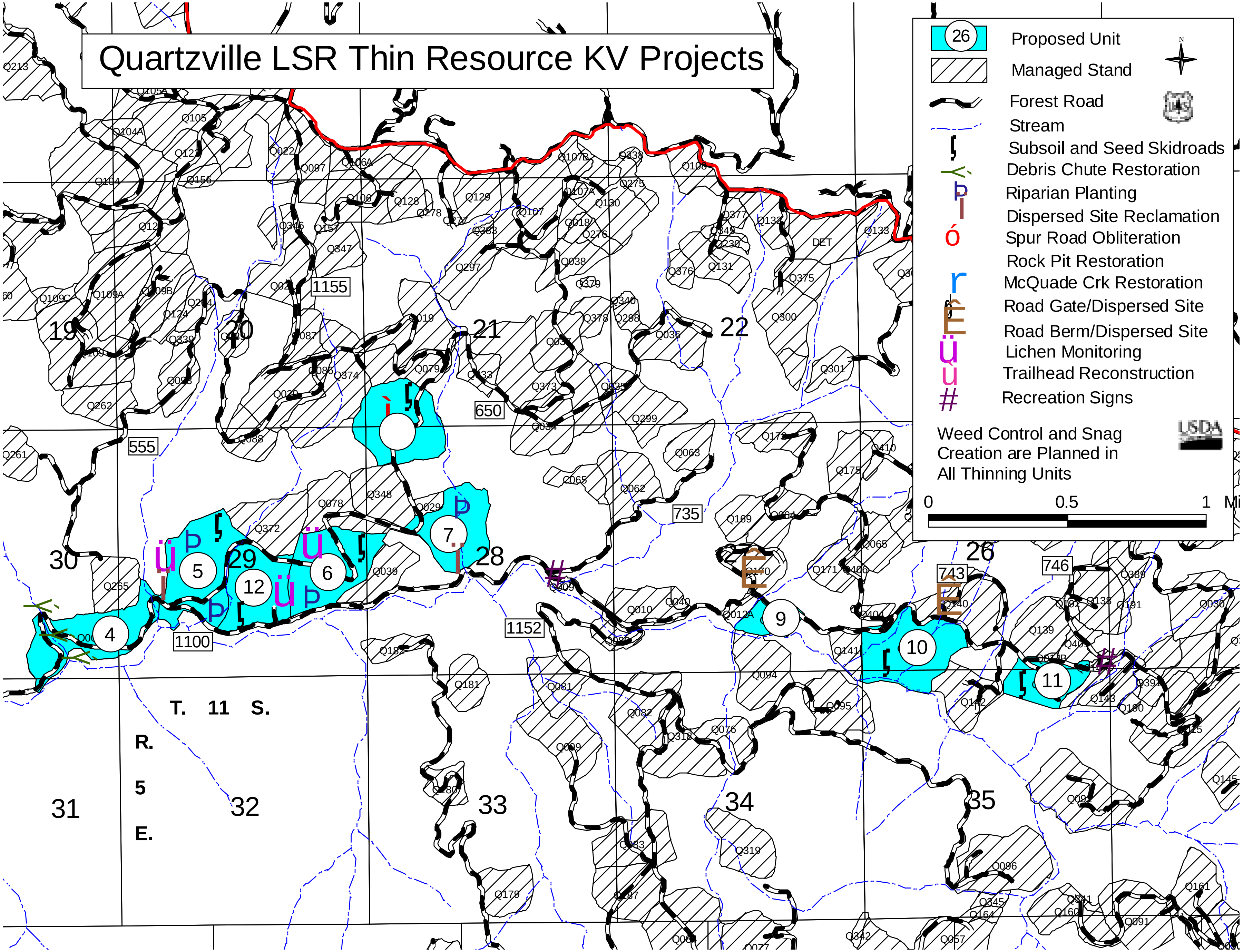
berms and gates. Nine dispersed site locations will be collected for at $500 per site in both action alternatives. The trailhead for the McQuade Creek Trail is within Unit 18. The trailhead could be used as a landing during logging activities. Harvest actions will reduce the effectiveness and visual appeal. Rehabilitation will cost $2,000 and is planned for both action alternatives.

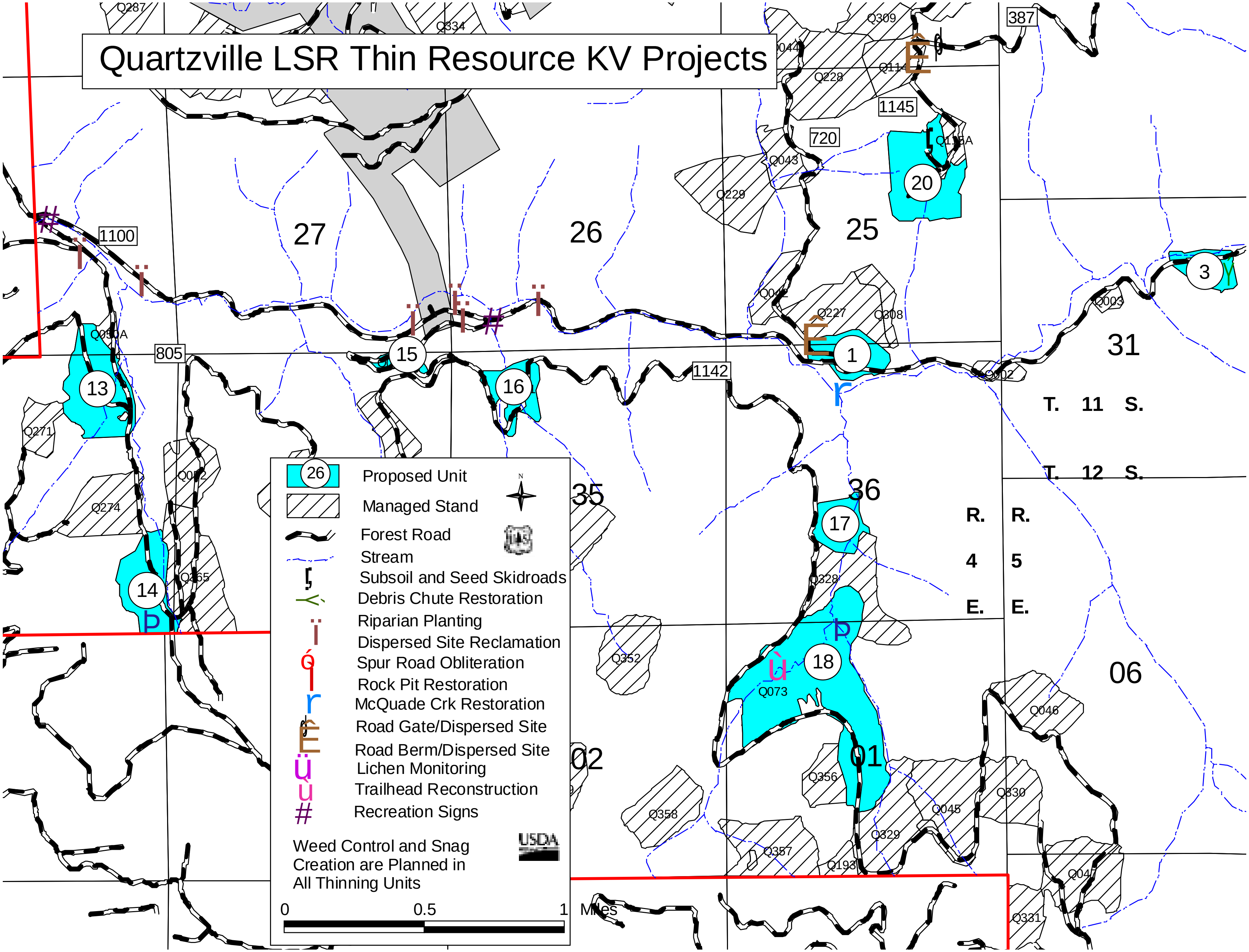
Table 8: *Total Recreation KV Collections by Alternative*

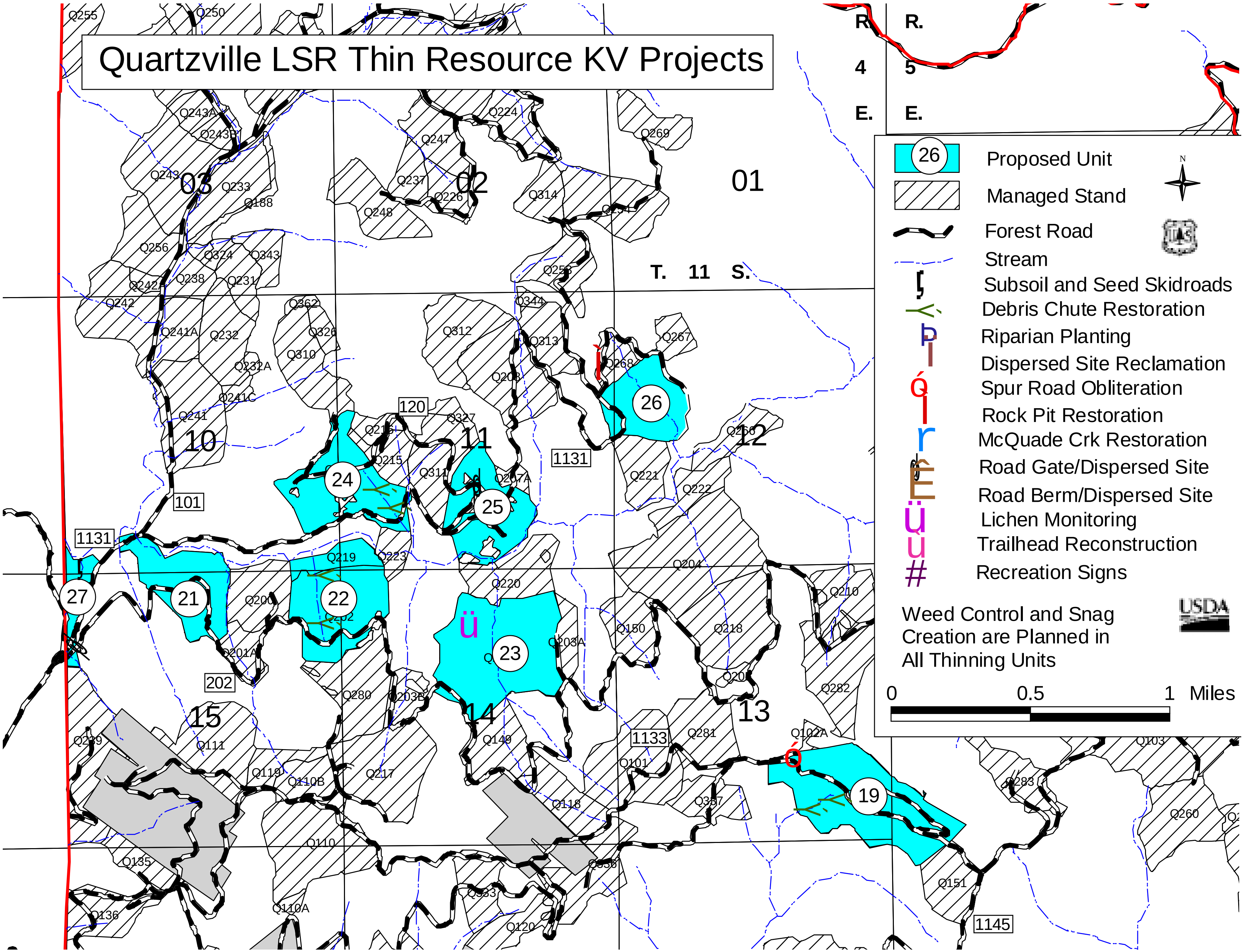
	Alternative 2	Alternative 3
Recreation Sign Replacement	$1,600	$1,600
Dispersed Site Relocation	$4,500	$4,500
Trailhead Rehabilitation	$2,000	$2,000
Totals	$8,100	$8,100

Firewood

A collection will be made to provide firewood for public use after the timber sale. The estimated the cost of the collection is $4,000.


Quartzville LSR Thin Resource KV Projects
26
Proposed Unit
Managed Stand
Forest Road
Stream
Subsoil and Seed Skidroads
Debris Chute Restoration
Riparian Planting
Dispersed Site Reclamation
Spur Road Obliteration
Rock Pit Restoration
McQuade Crk Restoration
Road Gate/Dispersed Site
Road Berm/Dispersed Site
Lichen Monitoring
Trailhead Reconstruction
Recreation Signs
Weed Control and Snag Creation are Planned in All Thinning Units
0
0.5
1
Mi
USDA
T. 11 S.
R. 5 E.
19
20
21
22
26
28
29
30
31
32
33
34
35
555
650
735
743
746
1100
1152
1155


Quartzville LSR Thin Resource KV Projects
Proposed Unit
Managed Stand
Forest Road
Stream
Subsoil and Seed Skidroads
Debris Chute Restoration
Riparian Planting
Dispersed Site Reclamation
Spur Road Obliteration
Rock Pit Restoration
McQuade Crk Restoration
Road Gate/Dispersed Site
Road Berm/Dispersed Site
Lichen Monitoring
Trailhead Reconstruction
Recreation Signs
Weed Control and Snag Creation are Planned in All Thinning Units
0 0.5 1 Miles
USDA
27
26
25
31
35
36
02
01
06
T. 11 S.
T. 12 S.
R. 4 E.
R. 5 E.
1100
805
1142
720
1145
387
1
3
13
14
15
16
17
18
20
Q287
Q334
Q309
Q228
Q043
Q229
Q042
Q227
Q308
Q003
Q002
Q271
Q274
Q265
Q352
Q073
Q046
Q356
Q358
Q357
Q193
Q329
Q045
Q330
Q331



Quartzville LSR Thin Resource KV Projects
R. 4 E.
R. 5 E.
T. 11 S.
01
02
03
10
11
12
13
14
15
26
Proposed Unit
Managed Stand
Forest Road
Stream
Subsoil and Seed Skidroads
Debris Chute Restoration
Riparian Planting
Dispersed Site Reclamation
Spur Road Obliteration
Rock Pit Restoration
McQuade Crk Restoration
Road Gate/Dispersed Site
Road Berm/Dispersed Site
Lichen Monitoring
Trailhead Reconstruction
Recreation Signs
N
Weed Control and Snag Creation are Planned in All Thinning Units
0
0.5
1 Miles
USDA
19
21
22
23
24
25
27
101
120
202
1131
1133
1145

Summary

Table 14: *Total KV Needs By Alternative*

	Alternative 2	Alternative 3
Timber Stand Improvement	$320,885	$280,910
Soil	$11,000	$7,000
Watershed	$47,300	$47,300
Wildlife	$215,500	$147,750
Botany	$33,240	$23,910
Recreation	$8,100	$8,100
Firewood	$4,000	$4,000
Total	$640,025	$518,970

In the event that the proposed timber sale does not generate sufficient funds to cover all the recommended KV projects, the projects will be funded in the following priority:

1 M (Mitigation) Noxious Weeds Control and Monitor
2 M Forage Seeding and Sub-soiling of Skid Roads
3 M Planting and Release in Riparian Areas
4 M Road Closures
5 M Dispersed Site Relocation and Reclamation
6 M Trailhead Rehabilitation
7 M Snag Creation
Rehabilitate Landings
Underplanting and DTR planting
Debris Chute Restoration
McQuade Creek Restoration
Fencing Release on Road Slope
Firewood
Precommercial Thinning of Other Managed Stands
Sensitive Species Monitoring
Fertilize Commercial Thin Stands
Recreation Sign Replacement
Obliterate Spur Road
Rock Pit Restoration
Fertilize Adjacent Managed Stands

All proposed action alternatives for the Quartzville LSR Thin EA show a positive return to the treasury. Short-term dollar costs and incomes have been used to provide relative economic values associated with each alternative. Values are not meant to be comprehensive because of the difficulty of assigning values to resource benefits.

Timber values from a recent commercial thinning timber sale of comparable timber were used for this comparison.

All acreage and costs used are estimates.

Table 1: Economic Analysis

	Alternative 2	Alternative 3
Gross Value ($500/MBF)	8,280 MBF * $500 = $4,140,000	5,570 MBF * $500 = $2,785,000
Associated Costs	$1,866,585	$1,387,880
Cost/Benefit Ratio	2.2	2.0
Present Value	$2,273,415	$1,397,120

Table 2: Logging Costs

	Alternative 2	Alternative 3
Ground-based Logging ($100 / MBF)	111 acres 1,110 MBF $111,000	67 acres 670 MBF $67,000
Skyline Logging ($120 / MBF)	584 acres 5,840 MBF $700,800	371 acres 3,710 MBF $445,200
Helicopter Logging ($200 / MBF)	133 acres 1,330 MBF $266,000	119 acres 1,190 MBF $238,000
Totals	$1,077,800	$750,200

Table 3: Road Costs

<table>
<tr><td colspan="4"></td><td>Alternative 2</td><td>Alternative 3</td></tr>
<tr><td colspan="4">*Road Reconstruction ($6000 / mile) 5.28 miles</td><td>$31,680</td><td>$31,680</td></tr>
<tr><td colspan="4">**Road Maintenance ($2000 / mile) 25 miles</td><td>$50,000</td><td>$50,000</td></tr>
<tr><td colspan="4">Road 1131210 will be reopened for use as haul routes. Reopening only will cost $15,000 per mile for .70 miles.</td><td>$10,500</td><td>$10,500</td></tr>
<tr><td colspan="4">Opening Existing Native Surface Operator’s Spurs ($15,000 / mile)</td><td rowspan="4">$16,500</td><td rowspan="4">$9,810</td></tr>
<tr><td colspan="2">Alternative 2</td><td colspan="2">Alternative 3</td></tr>
<tr><td>Unit 5
Unit 6
Unit 8
Unit 19
Unit 23</td><td>1100’
800’
1900’
1300’
700’</td><td>Unit 8
Unit 19
Unit 23</td><td>1400’
1300’
700’</td></tr>
<tr><td colspan="2">5800’ total 1.10 miles</td><td colspan="2">3400’ total .64 miles</td></tr>
<tr><td colspan="4">Construct Native Surface Operator’s Spurs ($20,000 / mile) 100’ or .02 miles in Unit 5 for Alternative 2 only</td><td>$400</td><td>$0</td></tr>
<tr><td colspan="4">Total Road Costs</td><td>$109,080</td><td>$101,990</td></tr>
</table>

**Road Reconstruction will be for areas of Roads 1131120 and 1131202 that were water barred for storm protection. The mileage just for the areas disturbed by water bar removal would be .14 miles of the total 5.28 miles.*
***Road Maintenance will consist mainly of spot rocking, brush cutback, blade road and clean ditches on gravel roads.*

Fuels Treatments are those for which brush disposal deposits would be made. Hand piling will be collected on the mainline road 1100, 1131, 1133 and 1155.

Table 4: Fuels Treatment Costs

Hand Pile ($820 / Acre) 66' either side of road		Alternative 2			Alternative 3		
Unit 1	Road 1100	.2 miles	3 acres	$2,460			$0
Unit 3	Road 1100	.4 miles	6 acres	$4,920	.1 miles	2 acres	$1,640
Unit 4	Road 1100	.2 miles	3 acres	$2,460	.1 miles	2 acres	$1,640
Unit 5	Road 1100 Road 1155	.2 miles .4 miles	9 acres	$7,380	.2 miles .3 miles	8 acres	$6,560
Unit 6	Road 1100 Road 1155	.1 miles .4 miles	8 acres	$6,560	.4 miles	6 acres	$4,920
Unit 7	Road 1155	.1 miles	2 acres	$1,640	.1 miles	2 acres	$1,640
Unit 8	Road 1155	.4 miles	6 acres	$4,920	.2 miles	3 acres	$2,460
Unit 9	Road 1100	.1 miles	2 acres	$1,640			$0
Unit 10	Road 1100	.2 miles	3 acres	$2,460	.1 miles	2 acres	$1,640
Unit 11	Road 1100	.2 miles	3 acres	$2,460	.2 miles	3 acres	$2,460
Unit 12	Road 1100 Road 1155	.2 miles .2 miles	6 acres	$4,920	.1 miles	2 acres	$1,640
Unit 13	Road 805	.1 miles	2 acres	$1,640			$0
Unit 14	Road 805	.1 miles	2 acres	$1,640	.1 miles	2 acres	$1,640
Unit 15	Road 1142	.1 miles	2 acres	$1,640	.1 miles	2 acres	$1,640
Unit 16	Road 1142	.1 miles	2 acres	$1,640	.1 miles	2 acres	$1,640
Unit 17	Road 1142	.1 miles	2 acres	$1,640	.1 miles	2 acres	$1,640
Unit 18	Road 1142 Trail 3397	.6 miles	10 acres	$8,200	.5 miles	8 acres	$6,560
Unit 19	Road 1133	.4 miles	6 acres	$4,920	.3 miles	4 acres	$3,280
Unit 20	Gated Road			$0			$0
Unit 21	Gated Road			$0			$0
Unit 22	Gated Road			$0			$0
Unit 23	Gated Road			$0			$0
Unit 24	Road 1131	.1 miles	2 acres	$1,640	.1 miles	2 acres	$1,640
Unit 25	Road 1131	.2 miles	3 acres	$2,460	.1 miles	2 acres	$1,640
Unit 26	Road 1131	.1 miles	2 acres	$1,640	.1 miles	2 acres	$1,640
Unit 27	Road 1131	.1 miles	2 acres	$1,640	.1 miles	2 acres	$1,640
Totals		$70,520			$47,560		

Table 5: Total Associated Costs

	Alternative 2	Alternative 3
Logging Costs	$1,077,800	$750,200
Road Costs	$78,240	$71,150
Fuels Treatment Costs	$70,520	$47,560
Total KV Costs *	$640,025	$518,970
Total Costs	$1,866,585	$1,387,880

** See Appendix B: KV Collections Table 14*

Botanical Resources Biological Evaluation for Quartzville LSR Thin
Sweet Home Ranger District, Willamette National Forest

Prepared by: /s/ Alice C. Smith ____________________ ____________________
Alice C. Smith **Date**
District Botanist

Introduction

Forest management activities that may alter habitat for PETS (proposed, endangered, threatened, or sensitive) species require a Biological Evaluation (FSM 2671.44) to be completed. The Biological Evaluation process (FSM 2672.43) is used to assist in determining the possible effects the proposed management activities have on:

A. Species listed or proposed to be listed as endangered (E) or threatened (T) by the U.S. Fish and Wildlife Service (FWS).

B. Species listed as sensitive (S) by the USDA Forest Service, Region 6. There are 71 botanical species listed on the Regional Forester's Sensitive Plant List that are documented or suspected to occur on the Willamette National Forest (Attachment 1).

Project Location and Description

This project proposes to commercially thin plantations in the Quartzville Late Successional Reserve. The units are located in:
T.11S., R.4E., Sections 10, 11, 12, 13, 14, 15, 24, 25, 28, 33, 34, 35, and 36
T.12S., R.4E., Section 1
T11S., R.5E., Sections 21, 26, 27, 28, 29, 30, 31, 35

There are three alternatives described below:
<u>Alternative 1</u> – No action; no thinning or other management activities will occur.
<u>Alternative 2</u> - Under this alternative 828 acres will be thinned in 27 units. Riparian buffers vary from 0 to 132 feet.
<u>Alternative 3</u> – Under this alternative 558 acres will be thinned in 26 units. Riparian buffers of 172 feet will be left on all streams in and adjacent to the units.

The units consist of mostly 40 year old Douglas-fir with scattered western hemlock, western red-cedar, and patches of red alder. All of the stands were harvested in the past; there are no natural stands included in the thinning project. The thinning prescriptions vary from 40-60% canopy cover and many include dominant tree release and retention areas to increase variability within the units.

Biological Evaluation Process

Under the suggested procedure for conducting a biological evaluation as described in a memo issued August 17, 1995 by the Regional Foresters of Regions 1, 4, and 6, the

Biological Evaluation is a seven step process to evaluate possible effects to Proposed, Endangered, Threatened, and Sensitive (PETS) species. The seven steps are as follows:

1. Review of existing documented information
2. Field reconnaissance of the project area.
3. Determination of effects of proposed project on PETS species.
4. Determination of irreversible or irretrievable commitment of resoures (required for listed and proposed species only)
5. Determination of conclusions on effects.
6. Recommendations for removing, avoiding, or compensating adverse effects.
7. Documentation of consultation with other agencies, references, and contributors.

Evaluation of effects for each species may be complete at the end of step #1 or may extend through step #7, depending on project details. Steps 1, 2, 3, and 5 are included in this document. Step 6 is included in the Environmental Assessment and will not be discussed in detail in this document.

Evaluation and Survey of the Planning Area

Pre-field review was performed for the Quartzville LSR Thin in the summers of 2002 and 2003 in order to determine the presence of known sites or habitat for PETS species. Using the Willamette National Forest list of potential PETS species (compiled from current USFWS listings, Oregon Natural Heritage Program listings, Oregon Department of Agriculture listings, and the Regional Forester’s sensitive species list), maps of known sensitive plant populations were checked for previously reported sites and aerial photos and topographical maps were scrutinized for potential habitat.

In areas where pre-field review identified potential habitat, field reconnaissance was done. Surveys were done in the summers of 2002 and 2003. The entire project area was field-surveyed at level B, high intensity. Surveys were not conducted for fungi because single pre-disturbance surveys for these species have been deemed impractical (USDA 1998; USDA 2000; USDA 2004). All fungi except *Bridgeoporus nobilissimus*, which is a perennial conk, were formally Category B Survey and Manage Species (rare but pre-disturbance surveys impractical). According to the *Guidelines* (page 122) “If pre-disturbance surveys are not practical under the Survey and Manage Standards and Guidelines, (most Category B and D species), or a species status is undetermined, (Category E and F species), then field surveys are not likely to occur under the Special Status Species Programs either.” In general, the habitat requirements of fungal species found on the Willamette National Forest sensitive species list are poorly understood. The literature provides very general habitat characteristics for most of these species; therefore they are listed in Table 1 as having potential habitat in the project area.

Table 1 displays the results of pre-field review, the level of field surveys performed, and the results of the surveys:

Table 1: Summary of Evaluation Process for PETS Species in the Quartzville LSR Thin

Species	**Prefield Review**	**Field Recon.**	**Species Presence**
Agoseris elata	Habitat not present	NA	No
Arabis hastatula	Habitat not present	NA	No
Arinica viscsoa	Habitat not present	NA	No
Asplenium septentrionale	Habitat present	Level B, high	No
Aster gormanii	Habitat not present	NA	No
Boletus pulcherrimus	Habitat present	Not practical	Unknown
Botrychium minganense	Habitat not present	NA	No
Botrychium montanum	Habitat not present	NA	No
Botrychium pumicola	Habitat not present	NA	No
Bridgeoporus nobillisimus	Habitat present	Level B, high	No
Calamagrostis breweri	Habitat not present	NA	No
Carex livida	Habitat not present	NA	No
Carex scirpoidea var. stenochlaena	Habitat present	Level B, high	No
Castilleja rupicola	Habitat not present	NA	No
Chaenotheca subroscida	Habitat present	Level B, high	No
Cimicifuga elata	Habitat present	Level B, high	No
Coptis trifolia	Habitat not present	NA	No
Cordyceps capitata	Habitat present	Not practical	Unknown
Cortinarius barlowensis	Habitat present	Not practical	Unknown
Corydalis aqua-gelidae	Habitat present	Level B, high	Yes, outside unit
Cudonia monticola	Habitat present	Not practical	Unknown
Dermatocarpon luridum	Habitat present	Level B, high	No
Eucephalis (Aster) vialis	Habitat not present	NA	No
Frasera umpquaensis	Habitat not present	NA	No
Gentiana newberryi	Habitat not present	NA	No
Gomphus kaufmanii	Habitat present	Not practical	Unknown
Gyromitra californica	Habitat present	Not practical	Unknown
Hypogymnia duplicata	Habitat present	Level B, high	No
Iliamna latibracteata	Habitat not present	NA	No
Leptogium burnetiae var. hirsutum	Habitat present	Level B, high	No
Leptogium cyanescens	Habitat present	Level B, high	Yes
Leucogaster citrinus	Habitat present	Not practical	Unknown
Lewisia columbiana var. columbiana	Habitat not present	NA	No
Lobaria linita	Habitat not present	NA	No
Lupinus sulphureus var. kincaidii	Habitat not present	NA	No
Lycopodiella inundata	Habitat not present	NA	No
Lycopodium complanatum	Habitat present	Level B, high	No
Montia howellii	Habitat not present	NA	No
Mycenia monticola	Habitat not present	NA	Unkown

Species	Prefield Review	Field Recon.	Species Presence
Nephroma occultum	Habitat present	Level B, high	Yes
Ophioglossum pusillum	Habitat not present	NA	No
Pannaria rubiginosa	Habitat present	Level B, high	No
Pellaea andromedaifolia	Habitat present	Level B, high	No
Peltigera neckeri	Habitat present	Level B, high	No
Peltigera pacifica	Habitat present	Level B, high	No
Phaecollybia attenuata	Habitat present	Not practical	Unknown
Phaecollybia dissiliens	Habitat present	Not practical	Unknown
Phaecollybia pseudofestiva	Habitat present	Not practical	Unknown
Phaecollybia sipei	Habitat present	Not practical	Unknown
Pilophorus nigricaulis	Habitat present	Level B, high	No
Polystichum californicum	Habitat present	Level B, high	No
Potentilla villosa	Habitat not present	NA	No
Pseudocyphellaria rainierensis	Habitat present	Level B, high	Yes
Ramalina pollinaria	Habitat not present	NA	No
Ramaria amyloidea	Habitat present	Not practical	Unknown
Ramaria gelantiaurantia	Habitat present	Not practical	Unknown
Ramaria largentii	Habitat present	Not practical	Unknown
Rhizomnium nudum	Habitat not present	NA	No
Romanzoffia thomsonii	Habitat present	Level B, high	No
Scheuchzeria palustris var. americana	Habitat not present	NA	No
Schistostega pennata	Habitat present	Level B, high	No
Scirpus subterminalis	Habitat not present	NA	No
Sisyrinchium sarmentosum	Habitat not present	NA	No
Sowerbyella rhenana	Habitat present	Not practical	Unknown
Tetraphis geniculata	Habitat present	Level B, high	No
Tholurna disimilis	Habitat not present	NA	No
Usnea longissima	Habitat present	Level B, high	No
Utricularia minor	Habitat not present	NA	No
Wolffia borealis	Habitat not present	NA	No
Wolffia columbiana	Habitat not present	NA	No

Potential Effects on PETS Species

Potential effects are documented in this Biological Evaluation in accordance with the formats put forth for listed species in the 1986 Endangered Species Act regulations, (50 CFR Part 402), and the March 1998 USFWS/NMFS Endangered Species Consultation Handbook; and for sensitive species, in the Forest Service manual section 2670 and in a memo issued August 17, 1995 by the Regional Foresters of Regions 1, 4, and 6.

Attachment 3 gives details on the effects categories described in this memo. Table 2 shows conclusions for effects of proposed actions on sensitive species with respect to each alternative in the Environmental Assessment. Some effects information is also listed in the "Discussion of PETS Species" section below.

Key to Abbreviations in Table 2 (see Attachment 4)

NI	=	No Impact
MIIH	=	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
WOFV*	=	Will Impact Individuals or Habitat with a Consequence That the Action May Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability for the Population or Species
BI	=	Beneficial Impact

*Considered a trigger for a significant action in NEPA

Table 2: Quartzville LSR Thin Sensitive Species Biological Evaluation: Summary of Conclusion of Effects**

Species	Alt. 1	Alt. 2	Alt. 3
Asplenium septentrionale	NI	NI	NI
Boletus pulcherrimus	NI	MIIH	MIIH
Bridgeoporus nobilissimus	NI	NI	NI
Carex scirpoidea var. stenochlaena	NI	NI	NI
Chaenotheca subroscida	NI	NI	NI
Cimicifuga elata	MIIH	BI	BI
Cordyceps capitata	NI	MIIH	MIIH
Cortinarius barlowensis	NI	MIIH	MIIH
Cordydalis aqua-gelidae	NI	NI	NI
Cudonia monticola	NI	MIIH	MIIH
Dermatocarpon luridum	NI	NI	NI
Gomphus kaufmanii	NI	MIIH	MIIH
Gyromitra californica	NI	MIIH	MIIH
Hypogymnia duplicata	NI	NI	NI
Leptogium burnetiae var.hirsutum	NI	NI	NI
Leptogium cyanescens	NI	NI	NI
Leucogaster citrinus	NI	MIIH	MIIH
Lycopodium complanatum	NI	NI	NI
Nephroma occultum	NI	NI	NI
Pannaria rubiginosa	NI	NI	NI
Pellaia andromedaefolia	NI	NI	NI
Peltigera neckeri	NI	NI	NI
Peltigera pacifica	NI	NI	NI
Phaecollybia attenuata	NI	MIIH	MIIH
Phaeocollybia pseudofestiva	NI	MIIH	MIIH
Phaeocollybia sipei	NI	MIIH	MIIH
Pilophorus nigricaulis	NI	NI	NI

Polystichum californicum	NI	NI	NI
Psuedocyphellaria mallota	NI	NI	NI
Psuedocyphellaria rainierensis	NI	NI	NI
Ramaria amyloidea	NI	MIIH	MIIH
Ramaria aurantiisiccescens	NI	MIIH	MIIH
Ramaria gelatiniaurantia	NI	MIIH	MIIH
Ramaria larentii	NI	MIIH	MIIH
Romanzoffia thompsonii	NI	NI	NI
Schistotega pennata	NI	NI	NI
Sowerbyella rhenana	NI	MIIH	MIIH
Tetraphis geniculata	NI	NI	NI
Usnea longissima	NI	NI	NI

Further Information and Effects on PETS Species Located

Corydalis aqua-gelidae

One site of *Corydalis aqua-gelidae* (coldwater corydalis) was located in the headwaters of McQuade Creek, which is upstream from Unit 18 by approximately 1000 feet (horizontal distance). *Corydalis aqua-gelidae* is a regional endemic and is found only in southwest Washington and northwest Oregon. This site is the only known population on the Sweet Home Ranger District. There is another population on the Middle Fork Ranger District. Based on the distance between the *Corydalis aqua-gelidae* site and the proposed thinning, no impact on the site is anticipated.

Leptogium cyanescens

Leptogium cyanescens (blue vinyl) is a minute blue-gray to black lichen found on the bark of hardwood trees and shrubs, particularly *Acer macrophyllum*. Eight sites of this lichen were located, five of which were in Unit 16. The other three sites are in Units 5 and 13. All sites are being buffered by 172 feet. Thinning in other portions of the units will likely enhance habitat in the future because more light will be available for hardwood trees and shrubs.

Nephroma occultum

Nephroma occultum (cryptic paw) is a bluish-gray lichen that grows closely appressed to conifer tree trunks and branches. Two sites of this lichen were found, one each in Units 2 and 8. Unit 2 was subsequently dropped from the project. The site in Unit 8 will be buffered by 172 feet to help protect the site from physical damage and maintain some microsite characteristics.

Pseudocyphellaria mallota

Pseudocyphellaria mallota is a small gray cyanolichen with yellow pseudocyphellae. This lichen inhabits fine conifer branches in cyanolichen-rich pockets. It was first found in North America in 1999. This species has not yet been formally added to the Regional Forester's Sensitive Species List, however, it is on Oregon Natural Heritage Program's List 2 that contains taxa which are threatened or endangered in Oregon but are more common elsewhere. Species on List 2 are added to the regional list when it is updated. It is expected that the list will be updated in 2005. Five sites were located in Units 3, 4, 13 and 18. These sites will be buffered by 172 feet.

Pseudocyphellaria rainierensis

Pseudocyphellaria rainierensis (old-growth specklebelly) is a bluish-gray to greenish-gray flat, ribbon-like lichen that grows on a variety of substrates. It is most often found in old-growth conifer forest. This species is relatively abundant on the Sweet Home and Detroit Ranger Districts but is limited in abundance elsewhere. In the Quartzville LSR Thin it was often found on remnant *Taxus brevifolia*. Eighty-two sites of this lichen were located and it was found in almost every unit. Sites were often on the edge of the stand near old-growth trees. Small buffers of 100 feet will protect the sites from physical disturbance. *Pseudocyphellaria rainierensis* is thought to be dispersal limited rather than sensitive to microclimatic changes (Sillett 1995). Although many sites were found in the sale area, each site is small and represented by a small amount of biomass.

Effects Determination for those Species in which Surveys are Impractical

There are 16 species of fungi for which surveys were not conducted. Fungi fruit inconsistently and would require multiple surveys each year for several years to determine their presence. Eleven of these fungi are mycorrhizal, four are saprophytic on duff or wood and one is a parasite on truffles. The effect of thinning on these species is largely unknown.

Direct Effects of Alternatives: Under Alternative 1, No-action, no acres will be thinned, therefore there will be no direct effects to sensitive fungi, assuming they are present in the stands. Under the action alternatives, it seems likely that individual sites may be negatively affected in the short term by host tree removal, physical disturbance, soil compaction, and the disruption of mycelial networks (Kranabetter and Wylie 1998, Amaranthus and Perry 1994). Soil compaction resulting from harvesting equipment and the creation of temporary access roads can reduce host tree root growth and root tip availability for fungi (Amaranthus, et.al., 1996; Amaranthus and Perry, 1994). Reductions in the number of fruiting bodies of chanterelles, a common mycorrhizal species, were noted after initial thinning but appear to rebound after several years (Pilz et al 2003). Two hundred seventy more acres are thinned in Alternative 2 than in Alternative 3 and 115 acres are thinned with a processor forwarder as compared to 58 acres thinned by this logging system in Alternative 3. More soil compaction is likely to occur under Alternative 2 due to the increased use of the processer forwarder. Further, host tree removal in particular in the dominant tree release areas, is likely to have a detrimental impact on the mycorrhizal fungi. Species richness of ectomycorrhizal fungi decreases exponentially as gap size increases (Durell et al. 1999). Given this, Alternative 2 will likely have greater direct impact on sensitive fungi if they occur in these stands. Although individual and short term impacts may occur, it is not likely to result in a trend toward Federal listing or loss of viability for sensitive fungi species.

Indirect Effects of Action Altrernatives: Under Alternative 1, No-action, no acres will be thinned and the stands will undergo a slow decline before presumably opening up enough to provide an understory. Windthrow, snowdown, and insect and disease pockets will create openings. Coarse woody debris will be abundant as trees die due to overcrowding. Indirect effects to sensitive fungi would likely be minimal. Under the action alternatives, indirect effects of commercial thinning to fungal habitat include the short-term loss of moisture retention capabilities due to the drying effect of over-story shade removal, and the reduction of water storage with the disturbance or removal of forest floor organic material and large wood. Loss of large woody material and host trees also represents a reduction of available nutrients and possible inoculum source for future fungal regeneration and expansion. Further, one tree species that is being favored by the thinning prescriptions is western red-cedar (*Thuja plicata*) and this species does not support ectomycorrizal species. A large proportion of western red-cedar in a stand reduces contact between root systems of host trees (Kranabetter and Kroeger 2001). However, thinning will 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 mycorrhizal species. Duff retention and coarse woody debris creation will benefit both the saprophytic and mycorrhizal species (Lindblad 1998). If this is the case then Alternative 2, which treats more acres than Alternative 3, may have an increased beneficial effect over the long term.

Cumulative Effects of Alternatives: There has been no timber sale activity in the Quartzville LSR for nearly 10 years. Habitat disturbing activity has been limited to mining, recreation, and road maintainance that affect small areas. No additional cumulative effects are expected beyond what is discussed under indirect effects.

ATTACHMENT 1: **Regional Forester's Sensitive Plant List for the Willamette National Forest (Revised 2004).** Species of federal, state, and local importance are included on the R-6 list.

Species	Occurrence on WNF	ONHP Status	State Status	Federal Status	Habitat Types
Agoseris elata	S	2			MM,DM
Arabis hastatula	D	1		SofC	RO
Arnica viscosa	S	2			RS
Asplenium septentrionale	S	2			RO
Aster gormanii	D	1			RS
Boletus pulcherrimus	D	1			CF
Botrychium minganense	D	2			RZ,CF
Botrychium montanum	D	2			RZ,CF
Botrychium pumicola	S	1	LT		HV
Bridgeoporus nobilissiumus	D	1			CF
Calamagrostis breweri	D	2			MM,RZ
Carex livida	S	2			WM
Carex scirpoidea var. stenochlaena	D	2			RO
Castilleja rupicola	D	2			RO
Chaenotheca subroscida	D	3			CF
Cimicifuga elata	D	1	C		CF
Coptis trifolia	S	2			WM,CF
Cordyceps capitata	D	not listed			CF
Cortinarius barlowensis	D	2			CF
Corydalis aqua-gelidae	D	1	C		RZ,CF
Cudonia monticola	D	3			CF
Dermatocarpon luridum	S	3			RZ on rock
Eucepahlis (Aster) vialis	S	1	LT	SofC	CF
Frasera umpquaensis	D	1	C		MM
Gentiana newberryi	D	2			MM
Gomphus kaufmanii	D	3			CF
Gyromitra californica	D	2			CF
Hypogymnia duplicata	S	3			CF
Iliamna latibracteata	S	2			CF,RZ
Leptogium burnetiae var. hirsutum	S	3			CF
Leptogium cyanescens	D	3			CF
Leucogaster citrinus	D	3			CF
Lewisia columbiana var. columbiana	D	2			RS
Lobaria linita	D	2			RO
Lupinus sulphureus var. kinaidii	S	1	LT	LT	MM,DM
Lycopodiella inundata	D	2			WM

Species	**Occurrence on WNF**	**ONHP Status**	**State Status**	**Federal Status**	**Habitat Types**
Lycopodium complanatum	D	2			CF
Montia howellii	D	4	C		RZ
Mycenia monticola	D	not listed			CF
Nephroma ocultum	D	4			CF
Ophioglossum pusillum	D	2			WM
Panaria rubiginosa	D	2			CF
Pellaea andromedaefolia	S	2			RO
Peltigera neckeri	D	not listed			CF
Peltigera pacifica	D	not listed			CF
Phaeocollybia attenuata	D	4			CF
Phaeocollybia dissiliens	D	3			CF
Phaeocollybia pseudofestiva	D	3			CF
Phaeocollybia sipei	D	3			CF
Pilophorus nigricaulis	D	2			RO
Polystichum californicum	D	2			RO
Potentilla villosa	D	2			RS,RO
Pseudocyphellaria mallota	D	2			CF
Pseudocyphellaria rainierensis	D	4			CF,RZ
Ramalina pollinaria	D	2			CF,RZ
Ramaria amyloidea	D	2			CF
Ramaria aurantiisiccescens	D	4			CF
Ramaria gelatiniaurantia	D	3			CF
Ramaria largentii	D	3			CF
Rhizomnium nudum	D	2			CF
Romanzoffia thompsonii	D	1			RS
Scheuchzeria palustris var. americana	D	2			WM
Schistostega pennata	D	2			CF
Scirpus subterminalis	D	2			SW,WM
Sisyrinchium sarmentosum	S	1	C	SofC	MM,DM
Sowerbyella rhenana	D	3			CF
Tetraphis geniculata	S	2			CF
Tholurna dissimilis	D	2			CF
Usnea longissima	D	3			CF,RZ
Utricularia minor	D	2			SW
Wolffia borealis	S	2			SW
Wolffia columbiana	S	2			SW

Occurrence on Willamette National Forest:

S = Suspected

D = Documented

Oregon Natural Heritage Program (ORNHP):

1 = Taxa threatened or endangered throughout range.
2 = Taxa threatened or endangered in Oregon but more common or stable elsewhere
3 = Species for which more information is needed before status can be determined, but which may be threatened or endangered (Review).
4= Species of concern not currently threatened or endangered (Watch).

Oregon State Status:

LT = Threatened
LE = Endangered
C = Candidated

Federal Status: These plant species were originally published as CANDIDATE THREATENED (CT) in the Smithsonian Report, **Federal Register**, July 1, 1975, or as PROPOSED ENDANGERED (PE) in a later report, **Federal Register**, June 16, 1976. The latest **Federal Register** consulted was dated September 30, 1993. Updated listings appear periodically in the Notice of Review (USFWS); the status of several species is categorized as follows:

LE = Listed as an Endangered Species
LT = Listed as a Threatened Species
PE = Proposed as an Endangered Species
PT = Proposed as a Threatened Species
C = Candidate for Listing as Threatened or Endangered
SofC = Species of Concern; taxa for which additional information is needed to support proposal to list under the ESA.

Habitat Types:

MM = Mesic meadows
WM = Wet meadows
DM = Dry meadows
RZ = Riparian zones, flood plains
CF = Coniferous forest
RS = Rocky slopes, scree
RO = Rock outcrops, cliffs
DW = Dry open woods
HV = High volcanic areas
SW = Standing water

ATTACHMENT 2: **Field reconnaissance survey levels for determining presence potential for TES species.**

Level A: Aerial photo interpretation and review of existing site records. Determination of the potential for a listed species to occur within the proposed project area. No field surveys completed.

- Low potential: Less than 40% potential for listed species Inhabiting the project area.
- Moderate potential: 40-60% potential for a listed species Inhabiting the proposed project area.
- High potential: Greater than 60% potential for listed species inhabiting the proposed project area.

Level B: Single entry survey of probable habitats. Areas are identified by photos and existing field knowledge. Field surveys are conducted during the season most favorable for species identification.

- Low intensity: Selected habitat surveys (approximately 5-10% of area) are conducted with a single entry for listed species inhabiting the proposed project area.
- Moderate intensity: Selected habitat surveys (approximately 10-40% of area) are conducted with a single entry for listed species inhabiting the proposed project area
- High intensity: Selected habitat surveys (approximately 40-60% of area) are conducted with a single entry for listed species inhabiting the proposed project area

Level C: Multiple entry surveys are conducted for listed species likely to inhabit the proposed project area.

- Low intensity: Selected habitat surveys (approximately 5-10% of area) are conducted with repeated entries for listed species inhabiting the proposed project area.

Moderate intensity:	Selected habitat surveys approximately 10-60% of area) are conducted with repeated entries for listed species inhabiting the proposed project area.
High intensity:	Selected habitat surveys (approximately 60-80% of area) are conducted with repeated entries for listed species inhabiting the proposed project area.

ATTACHMENT 3:

Conclusion Of Effects For Use In Biological Evaluation and Assessments
USDA Forest Service – Regions 1, 4, and 6
August, 1995

Listed Species:

1. No Effect

   Occurs when a project or activity will not have any "effect" on a listed species or critical habitat.

2. May Affect – Likely to Adversely Affect (LAA)

   If the determination in the biological assessment is that the project May Affect – Likely to Adversely Affect (LAA) a listed species or critical habitat, formal consultation must be initiated (50 CFR 402.12). Formal consultation must be requested in writing through the Forest Supervisor (FSM 2670.44) to the appropriate FWS Field Supervisor, or NOAA Fisheries office.

3. May affect – Not Likely To Adversely Affect (NLAA)

   If it is determined in the biological assessment that there are "effects" to a listed species or critical habitat, but that those effects are May affect – Not Likely To Adversely Affect (NLAA), then written concurrence by the FWS or NOAA Fisheries is required to conclude informal consultation (50 CFR 402.13).

4. Beneficial Effect

   Written concurrence is also required from the FWS or NOAA Fisheries if a beneficial effect determination is made. Requests for written concurrence must be initiated in writing from the Forest Supervisor to the State Field Supervisor (FWS or NOAA).

Proposed Species:

Whenever serious adverse effects are predicted for a proposed species or proposed critical habitat, conferencing is required with the FWS or NOAA.

1. No Effect

   When there are "no effects" to proposed species, conferencing is not required with FWS or NOAA.

2. Not Likely to Jeopardize the Continued Existence of the Species of Result in Destruction or Adverse Modification of Proposed Critical Habitat

   This conclusion is used where there are effects or cumulative effects, but where such effects would not have the consequence of losing key population or adversely effecting "proposed critical habitat". No conferencing is required with FWS or NOAA if this conclusion is made. However, for any proposed activity that would receive a “Likely To Adversely Affect” conclusion if the species were to be listed, conferencing may be initiated.

3. Likely to Jeopardize the Continued Existence of the Species or Result in Destruction or Adverse Modification of Proposed Critical Habitat

This conclusion must be determined if there are significant effects that could jeopardize the continued existence of the species, result in adverse modification or destruction of proposed critical habitat, and/or result in irreversible or irretrievable commitments of resources that could foreclose options to avoid jeopardy, should the species be listed. If this is the conclusion, conferencing with FWS or NOAA is required.

Sensitive Species:

1. No Impact(NI)

A determination of “No Impact” for sensitive species occurs when a project or activity will have no environmental effect on habitat, individuals, a population, or a species.

2. May Impact Individuals or Habitat, But Will Not Likely Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species (MIIH)

Activities or actions that have effects that are immeasurable, minor, or are consistent with Conservation Strategies would receive this conclusion. For populations that are small – or vulnerable – each individual may be important for short and long-term viability.

3. Will Impact Individuals or Habitat with a Consequence that the Action May Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species (WIFV)

Loss of individuals of habitat can be considered significant when the potential effect may be:

1. Contributing to a trend toward Federal listing (C-2 or C-2 species)
2. results in a significantly increased risk of loss of viability for a species
3. Results in a significantly increased risk of loss of viability for a significant population (stock)

4. Beneficial Impact (BI)

Projects or activities that are designed to benefit, or that measurably benefit a sensitive species should receive this conclusion.

REFERENCES

Abrams, L. 1944. Illustrated Flora of the Pacific North States. Stanford University Press. Stanford, California. Four volumes.

Amaranthus, M.P. and D.A. Perry. 1994. The functioning of ectomycorrhizal fungi in the field: linkages in space and time. Plant and Soil 159: 133-140.

Fitz, H. 1981. Sensitive Plants of the Willamette National Forest. Willamette National Forest. Eugene, Oregon. 56 pp.

Hickman, J.C., ed. 1993. The Jepson Manual. University of California Press. Berkeley, California. 1400 pp.

Hitchcock, L.C. and A. Cronquist. 1973. Flora of the Pacific Northwest. University of Washington Press. Seattle Washington. 730 pp.

Johnson, J.M. 1980. Handbook of Uncommon Plants in the Salem BLM District. Salem BLM District. Salem, Oregon. 291 pp.

Kranabetter, J.M. and P. Kroeger. 2001. Ectomycorrhizal mushroom response to partial cutting in a western hemlock-western redcedar forest. Canadian Journal of Forest research 31:978-987.

Lang, F.A. 1969. The first record of *Asplenium septentrionale* L. Hoffm. In Oregon. American Fern Journal 59:2

McCune, B. and L. Geiser. 1997. Macrolichens of the Pacific Northwest. Oregon State University Press. Corvallis, Oregon. 386 pp.

Munz, P.A. and D.D. Keck. 1968. A California Flora and Supplement. University of California Press. Berkeley, California. 1681 pp. + 224 pp

Oregon Natural Heritage Program. 2004. Rare, Threatened and Endangered Plants and Animals of Oregon. Oregon Natural Heritage Program, Portland, Oregon. 105 pp.

Pilz, D., et al. 2003. Ecology and management of commercially harvested chanterelle mushrooms. PNW-GTR-576

Sillett, S.C., 1995. Branch epiphyte assemblages in the forest interior and on clearcut edge of a 700 year old Douglas-fir canopy in western Oregon. The Bryologist 98(3)

US Department of Agriculture, Forest Service. 1987. Publication No.:R6-Ecol 257-B-86. Plant Association and Management Guide – Willamette National Forest. Hemstrom, M.A., S.E. Logan, and W. Pavlat. 312 pp.

US Department of Agriculture, Forest Service. 1990. Forest Service Manual: FSM 2600-Wildlife, Fish and Sensitive Plant Habitat Management. WO Amendment 2600-90-1 Effective 6/1/90

US Department of Agriculture, Forest Service. 1990. Environmental Impact Statement, Land and Resource Management Plan, Willamette National Forest.

US Department of Agriculture, US Department of the Interior. 1994a. Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species with the Range of the Northern Spotted Owl.

___. 1994b. Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl.

US Department of Agriculture, Forest Service, Regions 1, 4, and 6. 17Aug 1995 Memo (File Code 2670/1950): Streamlining Biological Evaluation and Conclusions for Determining Effects to Listed, Proposed, and Sensitive Species. Salwasser, H., D. Bosworth, and J. Lowe.

US Department of Agriculture, Forest Service. Revised 1999. Willamette National Forest Sensitive Plant Handbook. Dimling Lippert, J. and Sarah Uebel.

US Department of Agriculture, US Department of Interior. 2000. Final Supplemental Environmental Impact Statement for Amendment to the Survey and Manage, Protection Buffer, and Other Mitigation Measures Standards and Guidelines.

US Department of Agriculture, US Department of Interior. 2001. Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines.

US Department of Agriculture, US Department of Interior. 2004. Record of Decision To Remove or Modify the Survey and Manage Mitigation Measure Standards and Guidelines.

United States Department of Agriculture | Forest Service | Willamette National Forest Sweet Home Ranger District | 3225 Highway 20 Sweet Home, OR 97386 Tel (541) 367-5168 FAX (541) 367-9221

File Code: 2520 Watershed Protection and Management

Date: February 2, 2005

Re: Quartzville LSR Thin Hydrology Report

To: Mike Rassbach; District Ranger

To: Donna Short: District Plans Staff

I. Introduction

Proposed Project Overview:

The Proposed Action for this project is to commercially thin approximately 1000 acres of roughly 40-year-old managed stands/plantations; these managed stands are categorized as early-mid and mid seral forest. Within the Quartzville Late-Successional Reserve-RO213 (LSR) the stands are in the Quartz, Canal and Galena sub watersheds (see enclosed maps); the three sub watersheds total 41, 629 acres. One 60 year-old natural stand is also being evaluated for thinning. This action will be analyzed and considered in an Environmental Assessment (EA) and designed to meet Forest Plan Objectives and Standards & Guidelines.

Field review of these sites occurred during 2003 and 2004 field seasons. All proposed units were visited and evaluated for their hydrologic, stream channel and riparian conditions. Recommendations and observations discussed in this report are based on this field information.

II. Purpose and Need

The purpose of this project is to reduce stocking levels of managed and a natural stands with commercial thinning. The managed stands were previously regeneration harvested between 1950 and 1969. The fire regenerated natural stand is approximately 60 acres. Since initial reforestation, additional conifer and hardwood seedlings have entered these stands through natural seeding. Existing stocking levels in the proposed stands average 250 trees per acre, and should to be lowered to optimize tree growth, stand development and improve trends towards late seral forest. If these stands remain at their current stocking levels for the next 10-20 years, tree growth will continue to diminish, crown ratios will shrink, under story development will be suppressed, and natural mortality will increase. Increased mortality will subsequently elevate fuel loading on the ground and the risk of significant damage from potential fire events.

Benefits to thinning these young stands include: greater plant species diversity, improved vertical stand structure, higher wildlife habitat quality, and wood products for local and regional markets.

Currently, the Sweet Home Ranger District has over 17,000 acres of managed stands over 30 years old. An estimated 1,000 acres per year are growing into this category for the next 20 years These acres will require stocking level reduction to maintain the stand vitality and optimal tree growth. The Quartzville, Canal and Galena sub watersheds include some of these stands that could benefit from commercial thinning.

The adjacent table lists the sub watersheds within the Quartzville Watershed, acres and location for the proposed thinning stands.

Thinning Sub watersheds	Acres	Location
Upper Quartzville Creek	400	T11S, R5E, S21, 26-30, 31, 35. T11S, R4E, S36.
Canal Creek	350	T11S, R4E, S10, 11, 12, 14, 15.
Galena Creek	250	T11S, R4E, S13, 24, 25, 28, 33-36. T11S, R5E, S30. T12S, R4E, S.1.
Total	1000	

III. Water Quality and Hydrologic Processes:

Actions that could potentially impact the water quality include: 1) increase in stream sedimentation and storage, 2) increase in water temperature, 3) increase in water yield, 4) increase in peak flows and change in timing of peak flows and 5) chemical changes in water quality from slash treatment (mainly burning).

Beneficial uses, dependent on aquatic resources, in this planning area are: domestic water use; resident fisheries use; aquatic non-fish species use; riparian dependent species use; water-related recreation; hydroelectric power generation; and water-related fire suppression and road maintenance needs.

Average annual precipitation in the project area ranges from 48 to 122 inches occurring mainly between October and May. Elevation ranges from 1600 to 3600 ft where proposed units are located. Precipitation is primarily rain at the lower elevations (<2000 ft.). The Transient Snow Zone (TSZ) is defined as areas between 1200 to 4,900 foot elevation that may alternately receive snow or rain.

Quartzville Creek is found within the in the project area and is on the Oregon Department of Environmental Quality's 2002 303(d) List of Water Quality Limited Water bodies for temperature. River mile 3.3 to 26.8 are listed in the draft 2004 listing for summer temperature.

The stands in the project area are greater than 35 years of age, and were expected to have hydrologic recovery from the last harvest (Harr, 1983, pg. 385). Since the project area includes small streams with their entire catchments, all of the catchment's area was expected to be in a state of full hydrologic recovery. Therefore, the existing water yield and base flow of the project area was expected to be within the range of natural variability. Upon utilizing the Aggregate Recovery Percentages (ARP), calculations it was determined that currently Canal Creek sub-watershed was 84% recovered, Galena Creek Sub-watershed was 88% recovered, and Upper Quartzville Creek was 87% recovered. This reduction in recovery from what Harr projected was determined to be due to the low site productivity of the stands and the affect of past harvesting within the sub-watershed. Mid point levels from the Willamette National Forest Land and Resource Management Plan (Appendix E-21) have Canal at 85%; Upper Quartzville at 75% and McQuade at 85%. Due to re-mapping of the sub-watersheds McQuade Creek was incorporated into Galena sub-watershed.

Previous stand management affected the streams found within the area by removing large wood, vegetation and channeling runoff down skid roads. Past activity created areas, which currently have developed into ephemeral channels and in some locations perennial channels. Where old landing locations have collected runoff, stands of alder developed and are decreasing in vigor.

IV. Regulatory Framework

The Quartzville LSR Project Initiation Letter's Purpose and Need is to: " to reduce stocking levels of managed and a natural stands with commercial thinning". Forest plan objectives establish a need for action to:

- *Manage the area consistent with the desired future condition for the various management allocations and in a way that reflects the range of historic conditions described in the Quartzville Watershed Analysis.*

- *Meet objectives outlined in the Aquatic Conservation Strategy (specifically Aquatic Conservation Strategy Objectives - ACSO #'s 1, 2, 8 and 9).*

- *Manage forested stands at the landscape level, while considering habitat diversity, the size and shape of contiguous habitat blocks, and habitat function.*

- *Manage Late Successional Reserves (LSR) promoting practices that "…can accelerate the development of young stands into multi-layered stands with large trees and diverse plant species, and structures that may in turn, maintain or enhance species diversity." (ROD, B-6)*

V. Procedures and Methodology

This report will by no means be able to cover all of the Laws, Acts, Executive Orders, and Standards and Guidelines associated with water quality and riparian management, however, the thought processes of the Hydrologist conducting the review of these projects will be covered.

A. Willamette National Forest Land and Resource Management Plan:

The 1990 Land and Resource Management Plan (LRMP) for the Willamette National Forest identified water quality as a significant issue to guide its development, it described the desired future condition of water quality in 10 and 50 years; and it designed standards and guidelines creating operational requirements to meet water quality objectives.

> *"This Forest Plan responds to the high level of concern for water and riparian resources by requiring strict application of Best Management Practices, including: retaining live trees along wetlands and Class IV streams where needed; scheduling no harvest in riparian areas along Class I, II, and III streams and adjacent lakes; accounting for the potential for adverse cumulative effects in scheduling of timber harvest; proposing watershed improvement projects to stabilize existing high risk conditions; and by implementing a comprehensive program to monitor water quality and related habitat."* (LRMP III-3-4)

B. Memorandum of Understanding, Oregon Department Environmental Quality:

The Pacific Northwest Region entered into an agreement with the State of Oregon adopting "General Water Quality Best Management Practices" in November 1988. Best Management Practices are practices or combinations of practices determined by the State after problem assessment, examination of alternative practices and appropriate public participation, to be the most effective, practicable means of preventing or reducing the amount of pollution generated by non-point sources to a level compatible with water quality goals. (Federal Register, Volume 40, No.230 dated 11/28/75) These practices are cited in this hydrology report on pages 19 and 20.

Specific Forest Management Direction Includes

Strategic goal:

Maintain the integrated ecological functions of rivers, streams, wetlands, lakes, and the associated riparian areas Forest -wide. (LRMP IV-3).

Resource management goal:

Maintain water quality through acceptable levels of water temperature, suspended sediment, chemicals, and bacteria. (LRMP IV-4)

Standards and Guides (S&G's):

S&G's help the manager stay within the constraints prescribed by law as well as provide environmental safeguards for management activities.

Forest-Wide: 28 separate S&G's including Federal and state statute and regional guidelines address road construction and maintenance, streamside protection, and management of mass movement. There is also a forest-wide S&G to address watershed enhancement.

Management Areas:

Eight S&G's address water quality in Management areas (MA's) other than riparian; 41 for MA 15/riparian; and 8 specific to water quality.

C. Additional Directional Documents:

1.) FEMAT: In 1993: The Forest Ecosystem Management Assessment Team Report (FEMAT) for the Pacific Northwest and Northern California identified the Aquatic Conservation Strategy (ACS) "aimed at maintaining and restoring the ecological health of aquatic ecosystems." One of the objectives of the ACS is to "Maintain and restore water quality...." (FEMAT V-30). Components of the strategy are Riparian Reserves, Key Watersheds, Watershed Analysis, and Watershed Restoration.

2.) NWFP: In 1994 the Northwest Forest Plan (NWFP) included the ACS as an integral component. The NWFP amends land allocations and S&G's in the Forest LRMP, however, the most restrictive S&G's of the two would be maintained. It establishes Riparian Reserves and Key Watersheds across the landscape and sets forth detailed requirements land managers must meet within those reserves in accordance with the ACS.

3.) ASCO: In October of 2003 a Final Supplemental Environmental Impact Statement was released entitled: " *Clarification of Language in the 1994 Record of Decision for the Northwest Forest Plan National Forest and Bureau of Land Management districts Within the Range of the Northern Spotted Owl Proposal to amend Wording about the Aquatic Conservation Strategy".* Within this supplement clarification language was provided to consider actions effects upon the aquatic system. While this language clarifies it does not change the original intent of FEMAT in the management of ASCO's.

A key feature of the NWFP is that Watershed Analysis be performed as a systematic way to characterize aquatic, riparian and terrestrial features in a watershed. Watershed Analysis "consists of technically rigorous and defensible procedures designed to identify processes that are active within a watershed, how those processes are distributed in time, and space, the current upland and riparian conditions of the watershed, and how all of these factors influence riparian habitat and other beneficial uses." (NWFP S&G B-21) The Quartzville Watershed Analysis was completed in September 2002.

Information found in these analyses is used by managers to refine interim riparian reserves widths assigned in the NWFP, while prescribing land management activities including watershed restoration and developing monitoring programs. Information from watershed analysis is used in project specific National Environmental Policy Act (NEPA) planning.

> *Thought process:* Incorporating the above direction into prescribing specific prescription for each unit and disclosing the effect of these activities in the Direct and Indirect Effects section of the this report would meet intent of the LRMP. Site-specific prescriptions were used to provide the "most effective, practicable means of preventing or reducing the amount of pollution generated by non-point sources...." (Federal Register, Volume 40, No. 230 dated 11/28/75).

D. Municipal Watershed and Management Activities Effects on Water Users.

Forestry related activities and related water quality center around the requirements of the Federal Water Pollution Control Act Amendments of 1972 (Pl 92-500). This act revises and reenacts previous Federal Water Pollution Control Acts of 1970, 1965, 1956, and 1948 to restore and maintain the chemical, physical, and biological integrity of the nation's waters by eliminating pollutant discharges into the waters of the United States and providing surface waters suitable for uses. Section 208 of this law deals with non-point pollution of which forestry type activities are included. A previous revision (1970) requires Federal agency compliance with water quality standards.

As part of the Clean Water Act, the states were required to develop a State-wide Water Quality Management Plan and to set standards for water quality. In December of 1978, the Region -6 of the Forest Service and the Oregon Department of Environmental Quality (DEQ), signed an MOU delineating the responsibilities of each pursuant to the implementation of the Statewide Water Quality Management Plan. This agreement was where both parties, FS and DEQ, laid out the terms of the Best Management Practices and the State determined if Forest Service practices meet or exceed state BMP's. These reviews occur periodically and the state determines if the BMP's will meet the revised state standards. Currently one of these revisions is ongoing. The current BMP's are determined to meet or exceed state standards set for waters of the state. These were last published in November of 1988 for the Pacific Northwest Region.

> *Thought Process*: Provided Best management Practices are being met and the State feels waters of the State are being protected; utilization of those practices on site specific basis will protect the municipal waters of the state. Forest wide S&G's also play a role in meeting these standards. Riparian reserve delineation on all streams and unstable landscapes adds additional assurance that waters are being protected. Watershed analysis is completed for the area, site-specific prescriptions will be implemented utilizing BMP's, ACS objectives were discussed, and effects of various alternatives are being discussed. All prescriptions are under the guidance of the NWFP which is a the legal document providing direction for the protection of water quality along with Willamette's Land and Resource Management Plan.

Currently (December 4, 2004) the USDA Forest Service and the Bureau of Land Management have created a *Sufficiency Analysis for Stream Temperature Evaluation of the adequacy of the Northwest Forest Plan Riparian Reserves to achieve and maintain stream temperature water quality standards.* The premise of this document is:

> *"The ACS[1] provides a comprehensive framework for protection and restoration of aquatic and riparian systems. The ACS is composed of four parts: Key Watersheds, Riparian Reserves, Watershed Analysis, and Restoration. Key watersheds serve as the cornerstones of aquatic species recovery, and special guidelines apply to federal lands within key watersheds. Watershed Analysis is required in key watersheds and Riparian Reserves prior to determining how proposed land management activities meet ACS objectives. Finally, watershed restoration is integral to recovery of fish and riparian habitat and water quality. Of these elements, Watershed Analysis and Riparian Reserves are fundamental to understanding water quality issues and designing mitigation or treatments necessary to recover water quality to levels that meet state and federal water quality standards and support beneficial uses" (Sufficiency Analysis for Stream Temperature, 2004 pg4).*

> *Thought Process:* Treatment within riparian areas has been designed to comply with "Sufficiency Analysis for Stream Temperature - Evaluation of the adequacy of the Northwest Forest Plan Riparian Reserves to achieve and maintain stream temperature water quality standards" (USDA Forest Service and USDI BLM, 2004). This document was prepared in collaboration with Oregon Department of Environmental Quality and United States Environmental Protection Agency to provide documentation of Northwest Forest Plan compliance with the Clean Water Act with regard to state water quality standards for stream temperatures. As such, it redeems several of the Forest Service responsibilities identified in "Memorandum of Understanding between USDA Forest Service and Oregon Department of Environmental Quality To Meet State and Federal Water Quality Rules and Regulations" (USDA Forest Service and Oregon DEQ, May 2002). The Sufficiency Analysis provides current scientific guidance for management of riparian vegetation to provide effective stream shade, including appropriate methods of managing young stands for riparian objectives other than shade, such as production of large wood for future recruitment.

E. Riparian Reserves and Management Activities.

In 1993: The Forest Ecosystem Management Assessment Team Report (FEMAT) for the Pacific Northwest and Northern California identified the Aquatic Conservation Strategy (ACS) "aimed at maintaining and restoring the ecological health of aquatic ecosystems." One of the objectives of the ACS is to "Maintain and restore water quality...." (FEMAT V-30). Components of the strategy are Riparian Reserves, Key Watersheds, Watershed Analysis, and Watershed Restoration.

In 1994 the Northwest Forest Plan (NWFP), included the ACS as an integral component. The NWFP amends land allocations and S&G's in the Forest LRMP. It establishes Riparian Reserves and Key Watersheds across the landscape and sets forth detailed requirements land

[1] NWFP consists of the Record of Decision and Standards and Guidelines, the Final SEIS, and the Forest Ecosystem Management Assessment Team report; April, 1994 and July, 1993.

managers must meet within those reserves in accordance with the ACS. Within the discussion of these ACSO's water quality is required to be maintained or restored (ACSO 4), with the parameters of interest being temperature, chemistry, and suspended loads.

On pages 19 and 20 the objectives and mitigations for riparian management are discussed. All proposed actions are tied to the watershed analysis for the area (Quartzville Watershed Analysis, September, 2002).

> *Thought Process:* Quartzville Watershed analysis Aquatic Recommendation #1 states: "*Actively manage Riparian Reserves to achieve Aquatic Conservation Strategy Objectives on federal lands. Plan and implement riparian silvicultural projects designed to accelerate growth of riparian conifers to improve potential for LWD recruitment on federal lands. ……."* In order to meet this recommendation and have the riparian reserves obtain LSR and ACS objectives, site-specific prescriptions have been developed. In meeting the ACS objectives water quality objects would also be met. Channel conditions within some of the proposed stands warrant stream restoration work at this time. Knuesen -Vandenberg monies will be used in areas where the greatest benefit could occur. The State of Oregon DEQ also supported action within riparian reserves:
>
> > *"Implementation of the NWFP accommodates vegetation treatment necessary or desirable to restore ecological health in Riparian Reserves that have been harvested or affected by fire exclusion or other disturbances. The NWFP also provides for long-term maintenance of water quality. To determine how treatment of Riparian 'reserves can contribute to accomplishing these objectives, when proposing management in Riparian Reserves the following assumptions must apply:*
> >
> > 1. *Vegetation density is high and will benefit from thinning.*
> > 2. *Vegetation treatment will not result in more than a 50% reduction in canopy closure and will not occur in the primary shade zone."*
>
> *<u>Sufficiency Analysis for Stream Temperature</u> (December 4, 2004) USDA Forest Service, BLM; pg 21.*
>
> Figures 2 and 3 of the Sufficiency Analysis for Stream Temperature (December 4, 2004), shows that minimum NWFP Riparian Reserves widths would provide full shading to a stream of up to 45 feet wide (based on average tree height of 150 feet and a slope of 0%) and would meet of exceed what is necessary to maintain and protect vegetation with the potential to provide stream shade. By protecting stream shade on perennial stream systems, water temperature will also be maintained and restored, thus meeting water quality standards.

<u>F. Cumulative Effects and Management Activities</u>:

Effects of a cumulative nature are those effects which independently do not pose a risk to water quality yet, when added together may have some measurable effect on water quality. DEQ has accepted the Willamette National Forest LRMP method for accessing cumulative effects by accepting BMP W-5. The methodology used can be found on pages E-4 through E-25 in

Willamette's LRMP.   As part of this analysis land-types and beneficial users (municipal water users) were used to establish a midpoint level to trigger when intensive field analysis would be done. In order to characterize other effects the management activity under question is determined to have a disturbance factor associated to it. The model utilized is Aggregate Recovery Percentage, ARP as found on page E-6 of the LRMP.   This model states if stands are maintained above a 70 percent canopy they are considered to be 100 percent recovered. Looking at the watershed condition types for streams found within the project area determines what management prescriptions should be followed. (Page E-10 to E-17; LRMP)   "This criteria is intended to address the potential for changes in peak flows during rain-on-snow events, and the associate potential change in the stability of the stream banks and streambed." (LRMP pg. E-6)

> *Thought Process:* Seeing that the project involved thinning within stands that are currently unraveling due to stand density, threshold level became a minor concern when weighed against long term effects.   It was determined that implementing activities would better preserve the stand into the future and off set any sort term impact from removing the material.   Silvicultural prescriptions for the area are site specific and site-specific hydrology prescriptions protected unstable areas, hence, cumulative effects tradeoffs were considered for the short-term and the long term. Short-term effects anticipated include additional accumulation of snow from reduced canopy levels, short-term disturbance from the removal of the material and were anticipated. Implementation of specific BMP's also reduces the potential cumulative effect from additional temporary road building in the area. The Watershed condition types were type 1, 2, 3, and 4 channels (LRMP; pg. E-10-12). Under types 1 & 2 no recommended ARP is required due to the stability of the channels, and under types 3 & 4 ARP levels can be within 5 points +/-, of the threshold. Upon reviewing these criteria and the streams involved in this project it is not anticipated that adverse cumulative effects will occur.

G. Accountability, Monitoring and Assessing Management Activities:

Willamette LRMP contains a complete section on Implementation and Monitoring, Section V. LRMP. Under the plan, yearly monitoring reviews are completed on each District. Results of this monitoring can be obtained from the Supervisors Office in Eugene and will not be dicussed in this report.

VI. Existing Condition:

A. Hydrology

The Quartzville LSR project areas hydrology is similar to other documented watersheds within the Western Cascades. Peak flows occur during rain and rain-on-snow events in the transient snow zone that is estimated to occur between 450 to 1200 meters (1,500 feet and 4,000 feet) elevation (Christner and Harr, 1982). Due to the orientation of these tributary watersheds to the dominant winter storm patterns, the elevation of this transient snow zone changes to approximately 365 meters to 1500 meters (1200 to 4900 feet) for the Quartzville LSR project area.

Water storage in these watersheds is limited to some deeper upland soils, colluvial deposits, flood plains, earthflow perimeters. These areas create small forested wetlands. Colluvial soils, ancient earthflow terraces, and flood plains act like sponges, retaining water and releasing it slowly during periods of low precipitation. General storage is low due to shallow and rocky nature of the soils. Annual precipitation for the area averages from 48 inches in the valley segments to 122 inches on peaks and ridges. Intense precipitation is episodic in nature, and it often generates peak flows that are a major disturbance mechanism for stream channels and associated riparian areas.

B. Stream Channels

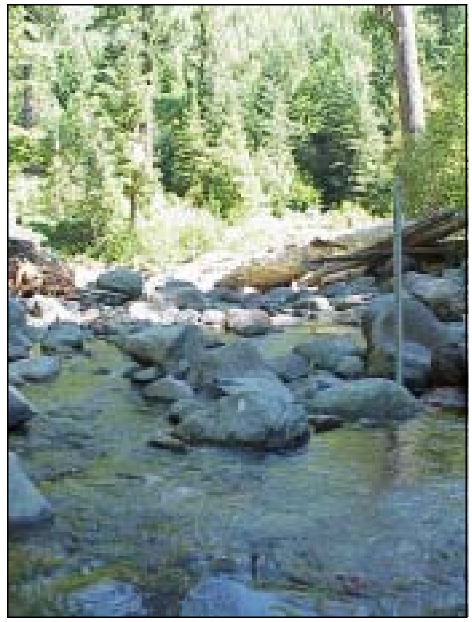
Deeply incised dendridic streams are found within the project area as evidenced by first to third order stream channels. This pattern of dendridic streams is the result of high gradient channels draining colluvial and volcanic formed slopes that have been altered by erosion. High gradient stream channels are associated with valley walls greater than 65 percent slope and contain channel bottom materials that are dominated by bedrock and boulders. These high-energy stream channels exhibit very little sinuosity. Rosgen type Aa+, A, B, and G channels are present within the proposed project area.

Headwater channels have low sediment storage capacity due to the lack of channel structure such as logs and boulders.

Sediment storage capacity increases as streams transition into the valley regions yet only associated to structure and meander bends. Streams within the proposed project could be typified as being transport streams. Portions of Quartzville Creek do containing depositional reaches associated to wider valley segments and junction of tributary streams.

Debris torrents have at times played an important role in the development of the first and second order stream channels in this planning area. Material from debris torrents builds terraces in third and fourth order stream channels, which are shaped and reshaped by peak, flow events. Units 4, 7, 13, 14, 16, 17, 18, 19, 21, 22, 23, 24, 25, and 27 are adjacent to channel that have experienced torrents in the recent past (< 25 years) or contain channels where torrents originated.

United States Department of Agriculture
Forest Service
Willamette National Forest
Sweet Home Ranger District
3225 Highway 20
Sweet Home, OR 97386
Tel (541) 367-5168
FAX (541) 367-9221



Type B channels are present in higher order channels such as Quartzville Creek, McQuade Creek, Galena Creek, Little Meadows Creek, Gold Creek, Canal Creek and Elk Creek. These B type channels contain a high percentage of exposed bedrock and large boulders. In addition, debris torrent activity in headwaters streams feed these Creeks with structure. Most of the fine sediments are, transported out of the system and into Quartzville Creek.

The historic morphological characteristics of stream valleys in Quartzville project area are similar to existing conditions. The basic stream patterns and channel gradients are largely influenced by the underlying geology. The geology has not changed a great deal since the reference time frames, 100 years ago. The valley of Quartzville has been artificially narrowed in parts to maintain road access into the area. This has reduced the storage capacity of the valley in these section and maintained sediment transport.

C. Water Quality

Beneficial uses, dependent on aquatic resources, in this planning area are: domestic water use; resident fisheries use; aquatic non-fish species use; riparian dependent species use; water-related recreation; hydroelectric power generation; and water-related fire suppression and road maintenance needs. Historically, Quartzville Creek provided anadromous habitat for winter steelhead and Spring Chinook prior to the construction of Foster and Green Peter dams.

Water off this project area flows into Quartzville Creek and Green Peter Reservoir. Water then joins water from the South Santiam River, which serves as a domestic water supply for several downstream municipalities, including Foster, Sweet Home, and Albany.

Water quality parameters critical to beneficial users are temperature, and type and timing of sediment input. Another potential critical parameter is biological contaminants. Stream segments are listed under 303(d) classification with the State of Oregon because they exceeded the temperature criterion of 18.0 C (64.4 F) for salmonid migration and rearing (December 2003 Temperature criteria adopted by the Environmental Quality Commission and approved by

USEPA in March 2004). The main-stem of Quartzville Creek is listed from river mile 3.3 to 26.8 for exceeding summer rearing temperatures of 18.0 C.

D. Riparian Reserves:

Riparian reserves for this planning area are based on the interim widths established in the Northwest Forest Plan. Widths vary depending upon the height of the potential sites tree. All units, except unit 18, fall within the western hemlock plant association and contain a 172-foot slope distance riparian reserve for class III and IV streams (344 feet total, including both side of stream) and 344 feet for fish bearing streams (688 feet total, including both side of stream). Quartzville Creek, McQuade Creek, Galena Creek, Canal Creek, Little Meadows Creek and Johnny Creek are the known fish-bearing stream associated to this project. Unit 18 fall within the true fir zone and contains a 150 foot slope distance riparian reserve for class III and IV streams (300 feet total, including both side of stream) and 300 foot slope distance riparian reserve for fish bearing streams (600 feet total, including both side of stream).

Riparian conditions are varied and very site specific. Past management activities have compacted soils in skid trails and directed overland flow, which creates scoured stream channels and small wetlands. These areas exhibit a stocking of alder, and have small wetlands (25'x50') associated to them. Species mix contains alder component for approximately 25-50 feet from the channel, and then transfer into a more upland species character. Diversity within the riparian varies depending upon slope, aspect and hydrology. Units 5, 6, 7, 10, 12, and 18 show the greatest diversity within the riparian reserve areas. Remaining units tend to be monotypic and single species dominated. Approximately 653 acres of riparian reserves are associated with the units proposed.

Approximately 65 percent of the reserves do not contain the vertical diversity or the complexity that signifies a healthy riparian reserve. Characteristics of these areas include dense overstocked stands with a closed canopy, small crown diameter, sparse vertical crown (<25% of total tree height), an increase in fuel loadings associated to the mortality of suppressed trees, and the lack of large down wood. These characteristics are similar to upland areas.

VII. Environmental Consequences:

A. Discussion of Alternatives:

Two action alternatives and one no action alternatives are currently being considered for this project. Table 1, compares the alternatives and respective acreages impacted. Table 2 shows treatment prescriptions and the logging systems in Alternative 2 and Table 3 shows treatment prescriptions and the logging systems in Alternative 3.

Table 1:

UNIT	Riparian Reserve Treated Stream Distance (ft)	Stream Angle Degrees from North	Nomograph @	Average Channel Width	Effective Shade Nomograph % Current Condition	Measured Riparian Acres associated to units.	Alternative II treated acres	Alternative III treated acres
1	580	18; 58	A; B	100'(II); 10'(III)	53; 90+%	13	5	0
3	1900	80; 330	C; A	60'	30; 58%	12	7	6
4	1570	32; 317; 343	B; A	15'; 50'; 10'	75; 60; 83%	38	11	3
5	4125	2; 32; 65; 274; 337; 347.	A; B; C	<10'	78- 90%	35	23	8
6	2805	11; 27; 68; 352; 360	A; B; C	40'; 15'; <10'	74%; 90%; 90%	26	23	0
7	2145	69; 359	C; A	40'; 12'	51%; 70%;	27	21	<1
8	990	275; 307	C; B	<10'	78%; 80%	20	14	<1
9	1980	39; 42; 46; 108	B; C	50'; <10'	50%; 70%	14	10	2
10	330	52; 57; 65; 108	B; C	10'; 15'; 40'	78%; 70%; 51%	44	20	0
11	825	30	B	10	78%	3	2	0
12	2970	4; 347	A	10'; 15'	82%; 90%	43	33	2
13	2805	60; 247; 274; 351	B; C	10'; 15'; 40'	78%; 70%; 51%	37	18	2
14	660	263; 345	C; A	40'; 30'; 10'	45%; 80%; >90%	17	8	1
15	headwater	352; 360	A	<10	>90%	3	2	2
16	580	360	A	25'	79%	19	2	1
17	910	3; 81; 86	A; C	35'; 10'	76%; >90%	12	6	2
18	3960	30; 55; 73; 81; 185; 320; 330; 340	B; C; A	50'; 35'; 45'; 10'; <10'	75%; 35%; 44%; >90%	61	29	15
19	4125	28; 34; 48; 56; 58; 78	B; C	15'; 10'; <10'	87%; >90%	45	37	28
20	headwaters	-	-	<10	-	10	10	0
21	3050	3; 12; 26; 31; 245; 277; 344	A; B; C	<10'; 15'; 50	>90%; >90%; 42%	40	25	0
22	250	170	A	50'; <10'	60%; >90%	34	20	1
23	660	70; 77	C	40'; <10'	50%; >90%	24	9	0
24	1570	344; 356; 358	A	15'; 10'; <10'	>90%	15	7	0
25	1485	34; 73; 334; 355	B; C; A	60'; <10'	62%; >90%	23	15	3
26	1485	14; 37; 65; 79; 80	B; B; C	50'; 10'; <10'	62%; >90%; >90%.	35	25	6
27	580	320	A	10	>90	7	<1	0
Total	**42,340 ft.**					**653Ac.**	**383Ac.**	**84Ac.**

@ *A. North 315 to 22.5 degrees from North: South 157.5 to 202.5 degrees from North:*
B. Northeast 22.5 to 67.5 and 202.5 to 247.5; Northwest 292.5 to 315 and 112.5 to 157.5.
C. East 67.5 to 112.5; and West 247.5 to 292.5 degrees from North.

Alternative 1: No Action alternative;

At this time management of this area is not warranted or appropriate to the meeting of the agency goals for the area. Existing conditions will change in that the current stands proposed for thinning will stop growing to their full potential and increased fuel loading will occur and additional mortality will occur.

Riparian reserves would eventually convert to conifer and could potentially decease in vigor as a result of no action. Stream channel, hydrology and water quality would remain unchanged during the short term. Conditions could be created as result of this alternative that could increase the potential for a stand replacement fire. If this occurred hydrology, stream channels and water quality would be negatively impacted. Increase discharge resulting from lack of vegetation and increased snow loading would generate increased peak flows. Depending upon the size of the fires increased peak flows could generate downstream effects to the stream channel, and hence water quality.

Under alternative I, adverse effects would be the decline in stand vigor and growth and the increase in fuel loading within the riparian reserves. As the stand grows competition for light and nutrients will cause mortality of some of the trees that are suppressed. This will reduce the health of the stand and create a fuel load that would lend itself to stand replacement fire. Loss of stand health would jeopardize the ability of the riparian areas to obtain old growth characteristics. (Citation)

Under alternative 1 channel stability will remain at the present condition. Rosgen type A & G channels will experience a direct short-term period of instability of their lower banks and substrate, as small wood is accumulated from the declining stand. Overstocking will force the stand to naturally select dominant trees. Suppressed trees will die and fall providing small diameter wood into the channel. This wood will trap small amounts of sediment and deflect flows into the channels lower banks. This wood is not large enough to moderate flow energies and can be mobilized under moderate flows.

Indirectly as this wood breaks down increases in sediment loads will pulse through the channel. The small size of the material available and its decomposition rate, 10 to 20 years depending upon its contact with water, sets the channel up to higher sediment loads through time.

Cumulatively these pulses should have a temporal and spatial distribution that is within the historic range of variability. Rationale to explain this belief is based on observing the effect of post under-story fire and observing suppressed unmanaged stands within the western cascades. Channel stability would have a short decline, sediment inputs would rise slightly and water temperature would remain similar to current conditions. No improvements to these characteristics are anticipated under this action.

<u>Alternative 2</u>;

Unit #	Refor #	Acres	Harvt. Sys	CC after Thin	DTR/RA	Skyline	Helicopter	Processor
1	Q1	12	H, S	60%CC, 110 TPA	10% DTR of area above 720 RD	5	7	0
3	Q4	17	H	DTR only	40% DTR	0	17	0
4	Q5	40	H, S	60%CC, 110 TPA	10%DTR	10	30	0
5	Q6	48	S,CTL,H	50% CC, 90TPA	No DTR, existing openings	15	10	23
6	Q7	49	S,CTL	50%CC	10% DTR	18		31
7	Q8	22	S	60% CC	No DTR	22	0	0
8	Q11	43	S, CTL	40%, 70 TPA	No DTR	28	0	15
9	Q12, Q12A	9	S	DTR only, 60% CC	40% DTR	9	0	0
10	Q13	31	S	60% CC	5 % DTR	31		(fall)
11	Q14, Q14A, Q14B	29	CTL,S	60% CC	20% DTR	29		(fall)
12	Q41	38	CTL,S	50%	No DTR			38
13	Q50, Q50A	22	H,S	50% West of road	East 30% DTR 10% DTR	12	10	0
14	Q51	15	H,S	DTR only	40% DTR	4	11	0
15	Q70	3	S	40% CC	No DTR	3	0	0
16	Q71	3	S	40% CC	No DTR	3	0	0
17	Q72	8	S	60% CC	5 % DTR	8	0	0
18	Q73	65	S, H	50%CC	10% DTR	57	8	0
19	Q102	87	S	40% CC North of 1133, 60% CC South of 1133	No DTR	87	0	0
20	Q115	43	S,CTL, H	50%CC	No DTR	35	3	5
21	Q201, Q201A	38	S,H	60%CC North (below) of 202 road, in helicopter 50%CC	No DTR	28	10	0
22	Q202	49	S,H	60%CC	10% DTR	41	8	0
23	Q203	54	S	East of stream 40%CC, West of stream 60%CC	No DTR East, 10% DTR West	54	0	0
24	Q206	47	S,H	50%	No DTR	39	8	0
25	Q207	22	H,S	50%	No DTR	11	11	0
26	Q209	28	S	50%CC	10% DTR	28	0	0
27	Q240	6	CTL, S	60%	No DTR	3		3
Total		828				580	133	115

Under this alternative thinning would be maximized using a combination of logging systems, (helicopter, skyline, and ground based logging systems). Approximately 828 acres would be treated under this alternative. This includes approximately 385 acres of riparian reserves treated or 58% of riparian reserves found to be associated to units. The effects of implementation, varies depending upon the type of logging system utilized.

a) ***Hydrology***: Hydrology of the area is anticipated to experience slight fluctuations resulting from the removal of vegetation during the project. Any fluctuation would be short term due to the remaining vegetation utilizing the available water once the stand responds to the thinning. A seasonal increase in groundwater would result in wet areas associated to the stands increasing in size or duration. Stream flow could also be affected in amount and duration of flow. These affects would be short lived until such time that trees remaining on the site would utilize the available water. (Citation HJ Andrews Paper)

All other units are within the rain on snow-dominated zone. With target canopy closures ranging from 40-60%, snow accumulation will increase until such time that canopy closures reach 70 percent. On units 1, 3, 4, 6, 9, 10, 11, 13, 14, 17, 18, 22, 23, and 26 Designated Tree Removal (DTR) will create small openings ¼ acre openings around dominate trees. These areas will accumulate additional snow due to loss of canopy. Depending on the spacing of these openings it is anticipated that with a 5 to 20% DTR additional accumulation will be dispersed across the landscape and result in a minor effect to the hydrology of the area. With stands that will be receiving > 20% DTR it is anticipated that hydrologic recovery would occur within 25 years. This recovery is less than established recovery curves due to the occupancy of the edges and the ability of the stand to utilize the openings. Units 3, 9, 13, and 14 are designed to have 30-40% of their area be in DTR's. DTR's will not be placed within the riparian reserve buffers that are being maintained adjacent to stream channels.

b) Stream Channels: Channels found within the project area will be unchanged with the exception of designated crossings. These crossings will be designed to allow the natural flow of waters down the stream channels. Channel bank stability will be retained through the marking prescription. Channels are Rosgen types Aa+, A, B, and G channels which are resistant high-energy type channels. The change in hydrology will result in minor changes in intensity and duration of stream flow. The channel associated to the units will easily handle these flows with only minor effects. These effects would be related to minor mining of channel banks, and mobilization of channel deposits.

Under alternative 2 units 5, 6, 8, 12, and 20 contain processor forwarder acres that account for 115 acres. Designated skid patterns will be predetermined across all streams and riparian areas to reduce the effect of the disturbance. Channels will be avoided and riparian buffers will insure that channel banks are not disturbed. Skyline and helicopter yarding methods will be utilized to remove material from the unit. Full suspension across all channels is required with these systems and channel characteristic is not expected to change. A total of 828 acres will be treated utilizing the various yarding methods.

c) *Water Quality*: Due to the laws and regulations surrounding water, it is required to not have a detrimental affect on water resources. Through the implementation of Best Management practice mentioned in this report, it is anticipated that the waters associated to the project area will be protected. Water quality is important for downstream beneficial users. The quality of water flowing off the project area is anticipated to be similar to the existing quality. Temperature aspects will be protected through maintenance of the primary shade zone and through the use of marking prescriptions. All units associated to the proposed action will have the standards, guides, and best management practices applied to them and will meet the *Sufficiency Analysis for Stream Temperature* criteria.

The critical element in the maintenance of water quality in the planning area is the existing riparian areas. Provided these riparian areas are maintained in a healthy state the stream systems would be anticipated to obtain their desired future condition and water quality maintained. Future management activities are considered in the long-term objectives for riparian areas of perennial and intermittent streams. Long-term riparian objectives are considered along with other resource goals and objectives agreed to by the interdisciplinary team. Streamside management prescriptions are designed to maintain Aquatic Conservation Strategy Objectives (ACSO), as defined in Willamette's LRMP to meet these long-term objectives.

In meeting these objectives and applying mitigations, page 19-20, it is anticipated that adverse impacts to downstream beneficial users will be reduced to elements of risk. A higher risk of potential impacts exists by implementing such a diverse prescription. Interpretation from plan to field may create a situation where short-term impacts to downstream users occur. These impacts could consist of riparian areas being taken below prescribed canopy levels, skid road paralleling small channels, DTR's placed adjacent to primary shade zones, and channel banks being affected from falling and removing of trees. These affects while small in impact do retard the ability of the aquatic system to recover and function under the desired future condition as outlined in the Quartzville Watershed Analysis. It would be expected that this impact would persist for approximately 5- 25 years upon completion of the project. After this time it is anticipated that recovery of the stands will be such to offset any loss occurred. Large structure will occur within the reserves, fuel loadings reduced, canopy development will be enhanced, and primary shade zones will be closer to 80 % optimum shade than pretreatment conditions. Desired future conditions of the riparian reserves and adjacent stands would be consistent with the Quartzville Watershed Analysis and the LSR assessment.

Alternative 3

Under this alternative selected riparian reserves will be buffered and thinning will not occur within all of the reserves. The main difference between alternative 2 and 3 is that Riparian reserves will be generally excluded. Thinning would be maximized using a combination of logging systems, (helicopter, skyline, and ground based logging systems; approximately 557 acres would be treated. This includes approximately 84 acres of riparian reserves or 13% of riparian reserves found to be associated to units. The 84 acres account for headwater reserve areas, small wetland reserve areas and the 172-344 foot portion of riparian reserves associated to fish bearing streams. The effects of implementation, varies depending upon the type of logging system utilized.

Under this action alternative similar short-term disturbance to the forest floor and canopy will occur as in alternative 2. With the utilization of Best Management Practices and Contact requirements, there are no anticipated adverse impacts to downstream beneficial users.

a) Hydrology: Hydrology of the area is anticipated to experience slight fluctuations resulting from the removal of vegetation during the project. 271 fewer acres will be disturbed under this alternative than with alternative 2. Similar affects would occur as in alternative 2 on those areas treated.

b) *Stream Channels*: Channels found within the project area under this alternative will be protected from disturbance due to full riparian reserves being utilized. With full riparian reserves channels will be affected as a result of skyline corridors or designated processor forwarder roads crossing certain channels. This loss of over story in skyline roads is minimal and not anticipated to create a detrimental effect.

No management within riparian reserves provides a higher concentration of small diameter material that becomes available to the stream channel. Rosgen type A & G channels will experience a direct short-term period of instability of their lower banks and substrate, as small wood is accumulated from the declining stand. Overstocking will force the stand to naturally select dominant trees. Suppressed trees will die and fall providing small diameter wood into the channel. This wood will trap small amounts of sediment and deflect flows into the channels lower banks. This wood is not larger enough to moderate flow energies and can be mobilized under moderate flows.

c) ***Water Quality***: Under Alternative 3 a lower risk associated to water quality occurs within the short term and a higher risk occurs for the long term. Under the sufficiency analysis for stream temperatures the Nomographs show that with treatment 80% optimum shade can be produced within ½ the time the stand is currently growing. Growth rates for the sites average approximately 1 foot per year for the untreated stand. Upon treatment anticipated growth would be approximately 2 feet per year (Ken Loree personal communication, January 2005). If this holds true, the current average tree, height of 80 to 100 feet, would grow to height 100 to 120 within 20 years. Upon treatment this height could be realized within 10 years. The difference in tree height does not tell the complete story. With the tighter growing stand canopy health is compromised providing for potential damage occurring from blow-down or snow-down. Canopies that are full and robust tend to have stronger root systems and withstand wind and snow loads.

d) Riparian Reserves**:** In meeting these objectives and applying the above stated Mitigations in alternative 2, it is anticipated that adverse impacts to downstream beneficial users will be reduced to elements of risk. A lower risk of potential impacts exists by implementing simpler prescriptions. Eliminating activities within the riparian reserve reduces the risk of impacts resulting from felling and removal of timber from the reserves. Directional felling would not be required except for those incidental cable roadways or processor roads that are required to cross channels. Impacts would be less than in alternative 2 due to proximity to stream courses and less acres disturbed. These would all be related to short term impacts. For the long term stand conditions and riparian conditions may be impacted from the decline in stand canopy structure. Suppressed trees would eventually die and create an abundance of small to medium class wood. While good for the soils organic layer it could pose a problem in fuel loading and potential risk of fire starts within the reserves. It has been determined through small stand management studies that diversity within small stands provides the greatest good (citation). Large structure will occur eventually within the reserves (20 years plus), fuel loadings reduced due to decomposition and available moisture within reserves (10 years), canopy development occurs, and primary shade zones will reach 80 % optimum shade. Time would be the driver under this alternative rather than management.

VIII. Cumulative Effects and Management Activities:

When added together, cumulative effects are those that independently do not pose a risk to water quality, but collectively may have some measurable effect on water quality. DEQ has accepted the Forest Plan method for accessing these effects by accepting the BMP W-5 for addressing cumulative effects. A brief discussion on the process for assessing cumulative effects on the watershed is listed below. For a complete discussion of this methodology please reference pages E-4 through E-25 of the Forest Plan FEIS. A summary follows:

A. Preliminary Assessment

Step 1: Identify Location and Type of Potential Effect. These include:

Decreased diversity and stability of aquatic spawning and rearing habitat (gravels & pools), due to decreases in large woody material;

Increased pool filling by deposited sediment and bed load;

Decreased quality of spawning gravels due to increased water velocity during peak flows and increased embededness by fine sediments;

Increased stream channel erosion from cumulative increases in rain-on-snow peak flow runoff;

Increased stream bank erosion and stream widening due to cumulative effects of increases in peak flows, sediment, and decreases in large woody material;

Increased turbidity from a cumulative increase in sediment and;

Increased water temperatures from direct removal of shade, and/or from stream widening.

Step 2*:* Identification of Assessment Area

Step 3: Assessment of Conditions - Where one or more of the following three conditions exists within the project area, the potential for cumulative effects should be considered an issue in development of project alternatives, and an intensive assessment should be considered.

1. *A high potential for increases in sediment from mass movement or surface erosion exists.*
2. *The potential for changes in the timing and size of peak flows exists due to changes in hydrological recovery of the vegetation in the transient snow zone.*
3. *The role and functioning of large woody material in the water, and the amounts of large woody material available for future recruitment to the channel has been substantially reduced below natural levels.*

B. Intensive Assessment

Step 1: *Collect Information on Potential Upland Sediment Sources*

Step 2*:* *Collect Information on Stream Condition*

C. Selection of Project Practices

Practices should be selected which are highly effective in protecting beneficial uses, and will provide a low risk of adverse effects to streambank and streambed stability.

As part of this analysis, land types and beneficial uses (municipal water usage) were used to establish a mid-point level to trigger when intensive field analysis would be done. The model utilized is Aggregate Recovery Percentage (ARP), as found on page E-6 of the Forest Plan. This model states if stands are maintained above a 70 percent canopy they are considered 100 percent recovered. It is then determined after looking at the watershed condition types for streams found within the project area what management prescriptions should be followed (Forest Plan, pgs. E-10 to E-17). "This criteria is intended to address the potential for changes in peak flows during rain-on-snow events, and the associate potential change in the stability of the streambanks and streambed" (Forest Plan, pg. E-6).

The project involved thinning within stands that are currently unraveling due to stand density. Threshold levels became a minor concern when weighed against long-term effects. It was determined that implementing activities would better preserve the stand into the future and off set any sort term impact from removing the material. Silvicultural prescriptions for the area are site specific and site-specific hydrology prescriptions protected unstable areas, hence, cumulative effects tradeoffs were considered for the short –term and the long term.

Short-term effects anticipated include additional accumulation of snow from reduced canopy levels, short-term disturbance from the removal of the material and were anticipated. Implementation of specific BMP's also reduces the potential cumulative effect form additional temporary road building in the area. The Watershed condition types were type 1, 2, 3, and 4 channels (LRMP; pg. E-10-12). Under types 1 & 2 no recommended ARP is required due to the stability of the channels, and under types 3 & 4 ARP levels can be within 5 points +/-, of the threshold. Upon reviewing these criteria and the streams involved in this project it is not anticipated that adverse cumulative effects will occur.

IX. Best Management Practices:

Best Management Practices (BMP's) are utilized in the development of mitigation and compliance to ACSO's. These BMP's can be found in "General Water Quality Best Management Practices" Pacific Northwest Region, November 1988.

Utilizing BMP's for this project specifically address direction and guidance in the protection of water quality. Quartzville LSR Thin project objectives and mitigation for water quality are:

Objective;

Maintain or improve existing temperature regime along perennial streams in relation to water quality.

Mitigation;

Designation of riparian management units to maintain and improve shade canopies over stream channels (BMP T-2; T-7; T-8).

Objective:

Continue recovery of downstream riparian and channel conditions.

Mitigation:

Design units to insure channel bank stability, and provide adequate buffers to reduce sediment inputs and minimize peak flow effects (BMP T-2; T-7; T-8; T-12). Boundaries are placed in such a manner to avoid compromising stability of the channel banks. No trees are cut which attribute to bank stability.

Objective;

Maintain or improve the quality of water for domestic and fisheries users.

Mitigation;

Designate riparian management units and specific prescriptions for each individual unit adjacent to stream courses requiring protection (BMP; T-7).

Objective;

Maintain natural filtration of surface, overland flow, through post sale activities.

Mitigation;

Establish appropriate riparian management units and establish fire lines to ensure maintenance of established buffers, filter strips (BMP T-7; T-8; F-2; F-3).

Objective;

Maintain or improve channel bank stability.

Mitigation;

Establish riparian management units that include channel bank areas and or establish marking prescriptions that prevent any tree attributing to bank stability from being marked (BMP T-2; T-6; T-7; T-8).

Objective;

Control the amount of sediment leaving the road system.

Mitigation;

Utilize appropriate B and C clauses within the contract to insure that winter haul occurs on roads with adequate surface rock and that erosion control techniques such as mulching of bare soils associated to the road system occur.

X. Enhancement Opportunities:

Channel conditions within some of the proposed stands warrant stream restoration work at this time. Knuesen -Vandenberg monies will be used in areas where the greatest benefit could occur.

Quartzville Stand Structure, Vigor and Diversity

Prepared by Suzanne Schindler

R6 Certified Silviculturist,

1/17/06

Recent studies of old-growth forest development in the central Oregon Coast Range suggest that today's young managed stands may not develop old-growth characteristics without thinning (Muir et al. 2002). This and other western Oregon studies support the notion of thinning young stands to accelerate the development of old forest structures. These studies have shown that thinning can help develop large diameter branches, large deep crowns, wind-firm stems, and can help develop a diverse understory of shrub and herbs.

Existing Landscape Conditions

The stand development of the proposed units is in the Stem Exclusion Stage as included in the following definitions.

Seral Stage definition in *"Forest Stand Dynamics"* **written by Chad Oliver (1990, pp. 148-159):**

- **Stand Initiation Stage** -After a disturbance, new individuals and species continue to appear for several years.
- **Stem Exclusion Stage** -After several years, new individuals do not appear and some of the existing ones die. The surviving ones grow larger and express differences in height and diameter; one species and then another may appear to dominate the stand.
- **Understory Reinitiation Stage** -Later, forest floor herbs and shrubs, and advance regeneration reappear and survive in the understory, although they grow very little.
- **Old-Growth Stage** -Much later, overstory trees die in an irregular fashion, and some of the understory trees begin growing to the overstory.

Appendix C in the Mid- Willamette Late Successional Reserve (LSR) Assessment (1998) classifies these plantations as early mid-seral stage because of their age and mid-seral because of the dominant size class of 9-21 inches. The average Quartzville stand diameter is 11 inches and ranges between 7- and 22-inch trees (see analysis file for summary of 2000 Stand Exams). Since these plantations are in relatively high production sites they have larger diameters, however, there is little understory development, and the forest floor is relatively bare of herbs and shrubs; relating to the Stem Exclusion Stage addressed in the above definition.

In Chapter 7, page 6, of the Quartzville Watershed Analysis (2002) density management and thinning is recommended to develop and maintain late-seral forest stand characteristics. The following table displays stand types in the Distribution of Sera! Stages Acres for the planning area subwatersheds. Approximately 42% of the three subwatersheds are in the Late-Successional seral stage and 14 % is in the Stem Exclusion (early seral) stage. Thinning the Stem Exclusion stands will increase the rate they will grow into the desired Understory Reinitiation and Late-Successional structure. l'he remaining trees after thinning will have more growing space and nutrient availability thus increasing their vigor.

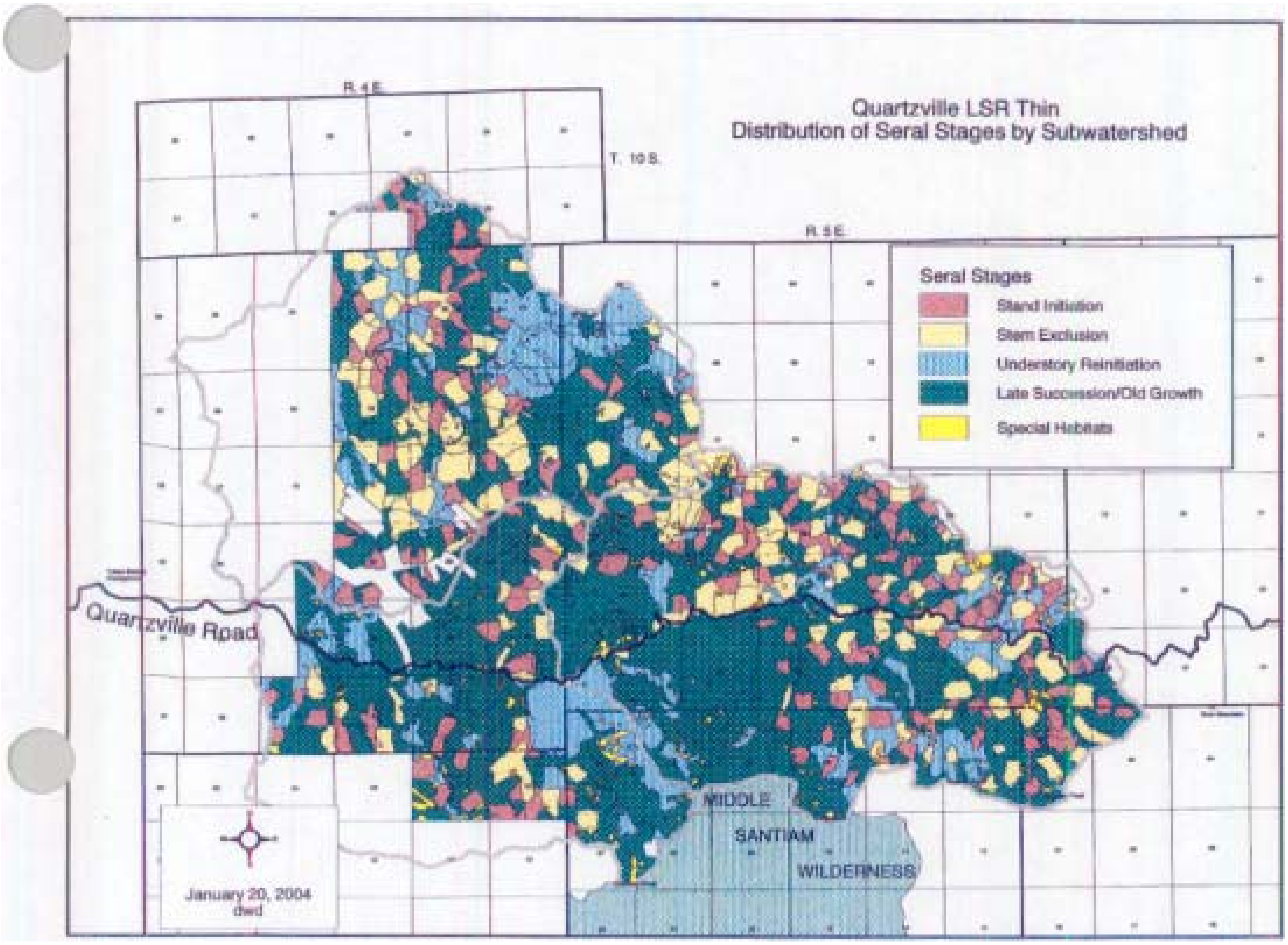
Distribution of Seral Stages Acres

Seral Stages

Seral Stages	Canal Creek Subwatershed	Quartzville Creek Subwatershed	Galena Creek Subwatershed
Seral 1 – Stand Initiation	1,571	2,197	846
Seral 2 – Stem Exclusion	2,347	2,736	792
Seral 3 – Understory Reinitiation	2,068	1,752	1,403
Seral 4 – Late-Succ/Old Growth	4,161	8,475	4,922
Non-Forested and Special Habitats	189	411	292
Other Federal Lands	2,674	0	106
Private Ownership	2,004	0	2,392
41,629 Total Acres	15,014	15,862*	10,753

Non-Forested and Special Habitats: For this analysis special habitats are considered non-forested stands. However, not all non-forested areas are special habitats. .Some acres not accounted due to GI,S' slivers.

The Canal, Quartzville, and Galen Creek Subwatersheds are in the Quartzville Watershed that has a total 95,468 acres (including private and other federal ownership).



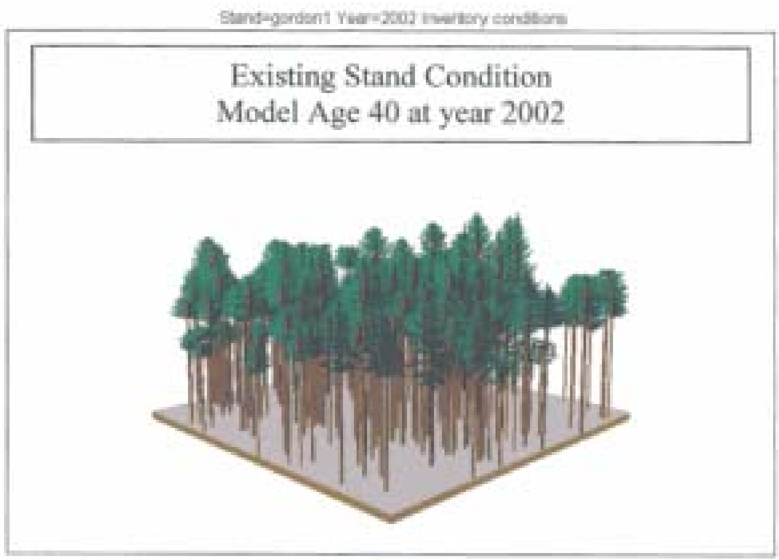
Existing Stand Conditions

Stand vigor and growth is slowing as indicated by decreased radial growth from stand exam increment boring core samples. Some smaller diameter trees have begun to die due to overcrowding and competition between trees for nutrients and light. These dense even-aged, single canopy stands are in early- to mid-seral development stage and have not yet transitioned to late-successional forest habitat.

The existing conditions of all the managed stands proposed for treatment are the result of clear cutting between 1960 and 1967. Since initial reforestation, additional conifer and hardwood seedlings have entered these stands through natural seeding. Generally, these 40 year old plantations are dense, even-aged, single canopy stands ranging from 200 to 340 trees per acre greater than 7-inch diameter. Stand average of **11** inch diameter. Considerable investment has been made as evidenced by 22 of the 27 stands being precommercially thinned at age 15. Fertilization has also occurred on 9 of the stands indicating high productivity potential.

The stands are mainly at lower elevations below 3,400' and a;re primarily composed of Douglas-fir. As elevation increases more true firs are present; Units 8, 10, 11, 19 and 20 are at or above 3,400'. Slopes range from 10% to 90% and average 40%. Usually, growth potential is better at lower elevations on the gentler slopes.

The 27 stands have a Relative Density (RD) range of 45% to 69% with an average of 52%. Relative Density is a percentage of the maximum Stand Density Index (sm). sm defines the limits of maximum stocking. Optimum densities for most combination of factors of a stand occur between 35% and 55% RD (Drew and Flewelling, 1979). At lower densities, greater than 15%, less growth per unit is obtained but this is offset by greater growth per tree. These 40-year old stands are approaching 55% and 11 of these stands are over 55% which is the point at which competition induced mortality starts.



Alternative* 1 -No *Action

These plantations will continue to grow gradually over time but they will develop differently from existing stands that have achieved old-growth dimensions (Tappeiner et at. 1997). Tappeiner states ".. .it appears that the old stands developed with lo~'-density, regenerated over time, and had little inter-tree competition."

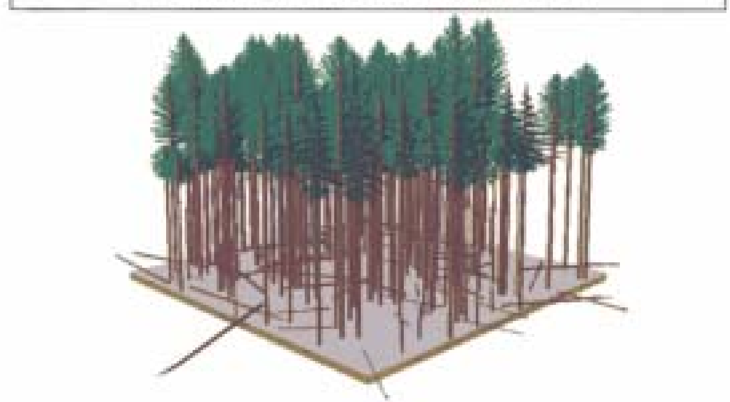
Inherent in managed stands are high-density plantings to insure growth survival. For these stands, Douglas-fir will become more dominant as crowns crowd together and shade out understory conifers, shrub vegetation, and many hardwoods. The dominant trees will continue to develop and many of the intermediate and suppressed trees will slowly be removed from the stand through mortality and decay. On most acreage, the stems per acre will decrease to approximately half of current conditions in about 70 years. A relatively even-aged stand of predominately Douglas-fir will emerge with a scattering of shade-tolerant conifers in the understory.

In those areas with heavy stocking and stagnant growth, little change will occur and trees in these stands will remain small and suppressed. In overstocked conditions, crowns become smaller indicating less vigor and more susceptibility to insect and disease attack. The desired future condition to accelerate late-seral characteristics would not occur through the No Action Alternative. Through modeling, the stands are predicted to reach some late-successional characteristics such as large Douglas-firs at stand age of200 or year 2163. However, there is no new cohort or multiple canopies developing, the shade tolerant trees are stagnating and there is a lost opportunity for recovery of wood fiber.

In the Gordon Three Thin Environmental Assessment (2004) Unit 10 was used as a sample stand and modeled to grow out over 200 years. This sample stand is similar to the low elevation high-site managed stands at Quartzville.

Stand growth and treatments were modeled using the updated Forest Vegetation Simulation (FVS) Model 6.21, Suppose Version 1.14, Westside Cascades Geographic Variant (Wykoff, et al. 1982). This model simulates the growth and yield of stands over time. Treatments were modeled for ten-year increments to a 200-year time period.
Model runs are available in the analysis files at the Sweet Home Ranger District and as of January 2006 on the Willamette National Forest web page under Resources, NEPA Projects Documentation, Sweet Home, and Gordon Three Thin EA and Appendix I.

Alternative 1 No Action
Growth Model Age 80 at year 2043



Stand=aardan1 Year=2043 Beainnina of cvcle

Alternative **2** *and* **3**

The proposed stand treatments have been designed to meet the purpose and need of accelerating the development of late-successional stand characteristics in young stands within the Quartzville LSR, while also meeting other resource requirements/objectives.

The main difference between action alternatives are the acres treated in riparian reserves:
.Alternative 2 thins 828 .Alternative 3 thins 566

~

With Alternative 3 -262 fewer acres in the riparian reserves will be treated and these portions of the stand will take longer to reach late-successional stand characteristics.

Optimum densities for most combination of factors of a stand occur between 3 5~~ and 55% Relative Density (RD); and at lower densities, greater than 15%, less growth per unit is obtained but this is offset by greater growth per tree (Drew and Flewelling, 1979). Alternative 2, after thinning, will have a range of 26% to 43% RD and an average of 34% RD. Alternative 3, after thinning, will have a range of28% to 50% RD and an average of 40% RD. Both action alternatives will be within optimum RD, however, Alternative 2 will treat more acres and will have greater tree growth towards meeting late-successional characteristics sooner.

Project objectives are to encourage the development of the following six stand characteristics as listed in the Purpose and Need in Chapter One of the Quartzville EA and are met with the prescribed treatments for both alternatives. More specific direct and indirect effects are further discussed in the next pages.

1. An appropriate stand component of large diameter trees -both alternatives reduce stand densities by approximately 50%. Average stand densities are 250 trees per acre (TP A); prescriptions reduce densities to 70, 90, and 110 TP A. By decreasing inter-tree competition more light and nutrients are available to the residual trees which grow faster as a result. Refer to diameter growth discussion and table.
2. Variations in stand densities that are occasionally interspersed with small openings -three densities are prescribed interspersed with quarter-acre gaps.
3. Multi-layered stands with well developed understories -reducing the tree densities will open up the stand so more light can reach the ground to promote shrub and young tree growth.
4. An abundant supply of snags and down woody material of sufficient size and arrangement to meet habitat and ecological needs -by thinning, 4 to 5 inches of growth is gained in 40 years.
5. Complex stand structure and diversity -see 1-4 and 6.
6. Diverse, native species composition including hardwoods and other minor species -Unit prescriptions in the Appendix state Douglas-fir, noble fir, Western hemlock and red alder will be thinned; all other species will be retained and cedar over 10-inch diameter will be spaced off for leave trees. Cedar will also be planted in Unit 13. This will provide a diverse composition of native species.

Both alternatives have the same thinning treatments applied to the 27 units. Growth projections and modeling of future stand conditions were analyzed by the FVS model for three thinning density reductions to 70, 90, and 110 TP A. Trees per acre reflect the net tree numbers to be retained on each stand after snag and coarse wood prescriptions are met.

The sample stand used, Gordon Three Thin Unit 10, is some what better than average with respect to growth than the other units, but is representative in species composition, aspect, slope, and general attributes of the stand. The model uses data from stand exam plots taken to the Pacific Northwest Forest Service Region 6 specifications.

The results of this growth model are displayed in the diameter growth figure for the stand when thinned in year 2003 to 70, 90, and 110 TP A (respectively) and grown to age 80 at 2043. The most notable result is increased small tree regeneration with thinning; allowing more light to the ground for seedling and understory development (refer to the No Action Model figure).

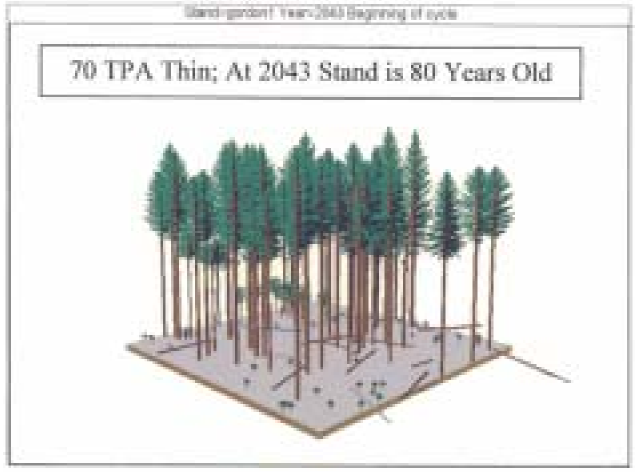
Diameter Growth -FVS Model	
Age 40 @2003	**Age 80 @2043**
Existing 225 TPA	18.42 DBH
Thin to 70 TPA	22.48 DBH
Thin to 90 TPA	22.05 DBH
Thin to 100 TPA	21.55 DBH

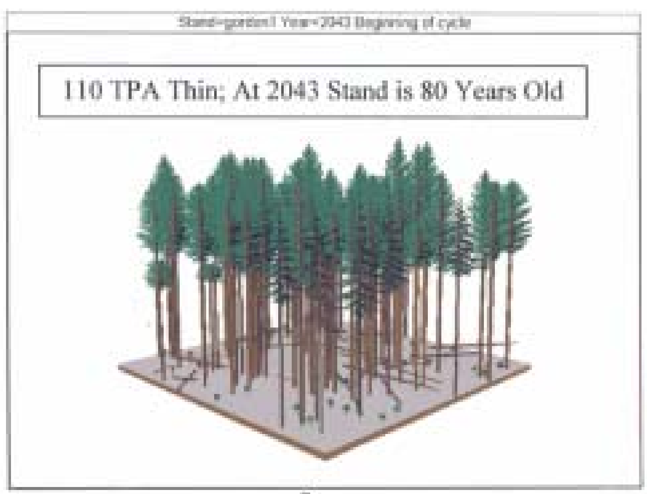
Diameter growth rates will increase as a direct effect of thinning. The resulting stand, freed from inter-tree competition, will have large-diameter trees sooner thus accelerating the development of late-successional structure. At age 80, the quadratic mean diameter greater than 7 inches (at Diameter Breast Height - DBH) will be three to four inches larger than if left un- thinned (see Table 18); thinning to 70 TPA results in 22.48 inch diameter at age 80 versus with no treatment (existing 225 TPA at average 12 inch diameter) the trees grows slower reaching 18.42 inch diameter at age 80.

Increased growth rates will speed the development of high-quality snags and large, coarse woody debris.

Live-crown ratios will increase under all treatments. Conifers go through a replacement period within their crowns after thinning, where needles maintained under low light (shade needle) will be replaced by needles adapted for higher light conditions (sun needles). Once that replacement occurs, crown growth will accelerate until crowns grow together and light again limits growth. Live crown ratio (to bare bole/stem of tree) can be considered an index of individual tree vigor (Oliver and Larson 1996). Thinning to 70 TP A will maintain the larger crown ratios longer. Trees with large crown ratios will not only grow faster, but will be more resistant to insects, diseases, and other environmental hazards.

Modeled growth results from
thinning to 70, 90, and 110 TPA at age 80.





Because of previous management direction, Douglas-fir was the species of choice when planting for pre-commercial thinning activities. Now some stands or portions of units show high percentages of Douglas-fir in the overstory. Thinning will allow for the selective removal of Douglas-fir, a high value wood product, and the enhancement of other conifer species and hardwoods by their selective retention. This will also make the stand, as a whole, more resilient.

A second thinning entry is likely to occur in the next 20 or 30 years due to retaining a relatively moderate level of trees per acre at these initial thins. Units located near main roads and benefits to further accelerating late-successional structure from the second thinning density reduction will result in increased diameter growth along with other late- successional characteristics such as multiple canopy enhancement.

Variable thinning as discussed in the Mid-Willamette LSR Assessment (1998) will be achieved with dominant tree release (DTR) and no-thin Retention Areas (RA) interspersed with the 70, 90, or 110 TP A thinning densities throughout the units. A certain amount of the best dominant trees will be located and the smaller trees will be removed around them for 66 feet or Y4-acre DTRs.

Dominant trees will be released for 10% of the acres in 9 units, 5% of the acres in 2 units, 3% of the acres in 13 units, and no DTRs in 5 units. The dominant trees will be released from direct competition.

Only Unit 13 will have cedar tree seedlings planted in the 1/8-acre opening to start a second age class and insure species diversity. Natural seed in is expected surrounding the retained dominant trees released and new cohort/multiple canopy to develop.

Retention areas (RA) will be in the same percentages or greater. The size range of RA will vary but will be at least 1/4-acre and will be grouped to retain processes and conditions for plant and wildlife diversity benefits. Different combinations of DTR and RA, or neither, are prescribed based on site specific conditions and are fully disclosed in Appendix A: Units Prescriptions. The resulting combination of thinning prescrip1ions will give the stands and landscape a variable thin appearance and in the long-ternl will more closely resemble the randomness of late-successional stands.

The Mid- Willamette LSR Assessment also directs the consideration depending on site- specific conditions of no-thin buffers next to existing Late-Successional structure. Buffers have been prescribed for units where appropriate; see Appendix A: Units Prescriptions. These no-thin buffers are generally I DO-feet wide; however, some snags and down wood creation will occur in these areas. This Coarse Woody Debris will remain on site to provide additional stand structure and diversity of habitat.

Vegetation Cumulative Effects

The additive effects of past, present, and reasonably foreseeable silvicultural activities have cumulatively lead to the existing landscape and stand conditions in the Quartzville planning area.

About 1300 acres of additional managed stands within the planning area will reach appropriate relative density for commercial thinning over the next decade. Approximately 1000 acres of commercial thinning could be planned from these stands. Buffers for stream, special habitat, sensitive species, and other resource protections generally omit 30% of the original clearcut stands.

There are approximately 5000 acres of stands that were clearcut harvested between 1980 and 1995 that will require density management in the following decades in the planning area. Variable density thinning will be implemented to improve stand characteristics for late-successional forest development.

There are about 1000 acres of private ownership involving over 30 landowners within the planning area. Patented mining claims compromise most of the private land. The timber stands were logged over to facilitate mining operations about one hundred years ago. The resulting stands are dense Douglas-fir dominated stands. Many of the stands are currently experiencing self thinning. Predicting timber harvest on private lands in this planning area is problematic.

References Cited:

Carey, A. B. 2003. Biocomplexity and restoration of biodiversity in temperate coniferous forest: inducing spatial heterogeneity with variable-density thinning. Forestry, Vol. 76, No.2, 2003

Drew, T. J. and Flewelling, J. 1979. Stand Density Management: an Alternative Approach and its Application to Douglas-fir Plantations. Forest Science 25:518-532.

Franklin, J. F., et al. 1986. Interim Definitions for Old-Growth Douglas-fir and Mixed- Conifers Forest in the Pacific Northwest and California. USDA Forest Service PNW-447

Kohm, K. A. and Franklin, J. F. 1997. *Creating a Forestry for the 21st Century.* Island Press. Covelo, CA. p.111-139.

Muir, P.S., Mattingly, R. L., Tappeiner, J. C., Bailey, J. D., Elliott, W. E., Hagar, J. C., Miller, J. C., Peterson, E. B., and Starkey, E. E. 2002. Managing for biodiversity in young Douglas-fir forests of western Oregon. U.S. Geological Survey, Biological Resources Division, Biological Science Report USGS/BRD/BSR-2002-0006. 76pp.

Oliver, C. D. and Larson, B. C. 1990. *Forest Stand Dynamics. Update Edition.* John Wiley & Sons. New York

Poage, N. J. 2001. Structure and Development of Old-growth Douglas-fir in Cen1ral Western Oregon. Ph.D. Thesis, Oregon State University, Corvallis, OR.

Smith, D. M., et al. 1997. *The Practice of Silviculture: Applied Forest Ecology, Ninth Edition.* John Wiley & Sons, Inc. New York

USDA Forest Service. 2004. Gordon Three Thin Environmental Assessment Sweet Home, OR.

Roads

The system roads in the Quartzville LSR Thin analysis area are in three main sub watersheds: Canal, Upper Quartzville and Galena. Current road densities are 2.4, 1.9 and 2.6 miles of open road per square mile respectively. Roadside brushing will be required on many of the system roads before timber haul to provide a safe sight distance. Ongoing concerns around access and travel management (Roads) include mitigating resource effects related to road use while retaining a suitable transportation system to meet access needs and achieving road maintenance objectives with reduced funding. These two issues have been addressed with Interim Directive 7710-2001-3 for the Forest Service Manual for Transportation Atlas, Records and Analysis. In general the Interim Directive requires the implementation of a forest-scale roads analysis and clarifies the local managers discretion and flexibility when implementing roads analysis. The Willamette Forest Roads Analysis was completed in October of 1998 and amended in January 2003. None of the sub watersheds in the analysis area are identified as having areas of concern in the analysis. Five of the roads in the sub watersheds are identified as Key Forest Roads, the first 2.6 miles of road 1131000 road, the first 2.1 miles road 1131101, road 1100000, road 1133000 and road 1152000.

The goal of the network of Key Forest Roads is to provide sustainable access to National Forest System lands for administration, protection, and utilization in a manner consistent with Forest Plan guidance and within the limits of current and likely funding level. (2003 Willamette National Forest Roads-Analysis Update – December 2002, page 2). The key roads will be improved with both action alternatives for timber haul.

All Forest roads were evaluated for potential road closures. Planned future use, fire access, maintenance requirements and disturbance patterns were considered.

The following tables document the specific road closures planned within the analysis area by sub watershed. The road designation is from the road management objectives for each road. ML (Maintenance Level) is the initial road objective and the OL (Objective Level) is the standard of future maintenance. The D (designator) is either S for secondary road or L for local road. The roads that show wildlife funding will be closed as fund become available; the KV funding will be collected from the sale of either action alternative.

Table 1: Canal Sub Watershed Closure Miles (see map)

Map Figure	Road#	Road Designation ML, OL, D	Closure Type	New or Existing Closure	Closure Funding Source	Road Closure Miles	New Road Closure Miles	Comments
1	1131000	3, 3, S	None	NA	NA	0		Key Forest Travel Route
2	1131000	2, 2, L	None	NA	NA	0		Maintenance Level Changes
3	1131000	2, 2, L	Berm	New	Wildlife	0.62	0.62	Close 1131 at Saddle

4	1131101	3, 3, S	None	NA	NA	0		Key Forest Travel Route
5	1131101	2, 2, L	Berm	Existing	NA	1.98		Maintenance Level Changes
6	1131105	2, 2, L	Berm	Existing	NA	2.6		
7	1131105	2, 1, L	Berm	Existing	NA	.15		Maintenance Level Changes
8	1131108	2, 2, L	Gate	Existing	NA	1.12		Storm Proofed in FY05
9	1131116	2, 1, L	With 101	Existing		0.2		
10	1131120	2, 2, L	Gate	New	KV	1.18	1.2	Storm Proof
11	1131137	2, 1, L	Berm	Existing		0.29		
12	1131202	2, 2, L	Gate	New	KV	7.98	7.98	Storm Proof
13	1131210	2, 1, L	Berm	Existing	Purchaser Replace	0.69		Storm Proof
14	1133305	2, 2, L	Berm	Existing	NA	1.2		
15	1133310	2, 1, L	Berm	Existing	NA	.48		
16	1133330	2, 2, L	Berm	New	Wildlife	1.24	1.24	Storm Proof
17	1133332	2, 1, L	With 330	Existing	NA	0.14	.	
18	1133333	2, 2, L	Berm	New	Wildlife	0.76	0.76	Storm Proof
19	1133411	2, 1, L	Berm	Existing	NA	.5		
						21.13	11.8	

Table 2:Galena Sub Watershed Closure Miles (see map)

Map Figure	Road#	Road Designation ML, OL, D	Closure Type	New or Existing Closure	Closure Funding Source	Road Closure Miles	New Road Closure Miles	Comments
1	1100720	2, 2, L	Berm	New	KV	1.61	1.61	Storm Proof
2	1142000	2, 2, L	None	NA	NA	0		Maintenance Level Changes
3	1142000	2, 2, L	Berm	Existing	Wildlife	2.45		Improve Berm
4	1142430	2, 2, L	With 1142	Existing	NA	0.57		
5	1145000	2, 2, L	None	NA	NA	0		Maintenance Level Changes

6	1145000	2, 1, L	Berm	New	KV	0.59	0.59	
7	1145320	2, 1, L	Berm	Existing	NA	0.56		
8	1100811	2, 1 L	Berm	New	KV	.17	.17	Storm Proof
						5.95	2.37	

Table 3: Upper Quartzville Sub Watershed Closure Miles (see map)

Map Figure	Road#	Road Designation ML ,OL, D	Closure Type	New or Existing Closure	Closure Funding Source	Road Closure Miles	New Road Closure Miles	Comments
1	1100735	2, 2, L	Berm	New	Wildlife	1	1	
2	1100737	2, 1, L	Berm	Existing	KV	0.58		Improve Berm
3	1100743	2, 1, L	Berm	New	KV	0.56	0.56	
4	1100745	2, 1, L	Gate	New	KV	0.68	0.68	Fix Gate
5	1100746	2, 1, L	With 745	New	NA	0.15	0.15	
6	1100750	2, 2, L	Gate	Existing	NA	2.47		Fix Gate
7	1100752	2, 2, L	With 750	Existing	NA	0.65		
8	1100752	2, 1, L	With 750	Existing	NA	1.15		Maintenance Level Changes
9	1100753	2, 2, L	With 750	Existing	NA	0.23		
10	1100754	2, 1, L	With 750	Existing	NA	0.19		
11	Spur	2, 1, L	Berm	New	Wildlife	0.15	0.15	Off 1100855
12	Spur	2, 1, L	Berm	New	Wildlife	0.15	0.15	Off 1100855
13	1100858	2, 1, L	Berm	New	Wildlife	0.33	0.33	
14	1133425	2, 1, L	Berm	New	Wildlife	0.54	0.54	
15	1133437	2, 1, L	Berm	New	Wildlife	0.39	0.39	
16	1133438	2, 1, L	Berm	New	Wildlife	0.73	0.73	
17	1133445	2, 1, L	Berm	New	Wildlife	0.3	0.3	
18	1133450	2, 1, L	Berm	New	Wildlife	0.29	0.29	
19	1133454	2, 1, L	Berm	New	Wildlife	0.42	0.42	
20	1133464	2, 2, L	Berm	New	Wildlife	0.72	0.72	
21	1133474	2, 1, L	Berm	New	Wildlife	0.21	0.21	
22	1133482	2, 1, L	Berm	New	Wildlife	0.23	0.23	

23	1133487	2, 1, L	Berm	New	Wildlife	0.15	0.15	
24	1133490	2, 1, L	Gate	Existing	NA	0.59		
25	1133491	2, 1, L	With 490	Existing	NA	0.63		
26	1145387	2, 2, L	Gate	New	KV	1.33	1.33	
27	1152000	2, 2, L	Berm	Existing	NA	0.69		Slide
28	1152510	2, 2, L	Berm	Existing	NA	1.81		
29	1152540	2, 1, L	Berm	New	Wildlife	1.17	1.17	
30	1152545	2, 1, L	Berm	New	Wildlife	0.61	0.61	
31	1152546	2, 1, L	With 545	New	Wildlife	0.3	0.3	
32	1152547	2, 1, L	With 545	New	Wildlife	0.15	0.15	
33	1152550	2, 2, L	Berm	New	Wildlife	1.04	1.04	
34	1152568	2, 1, L	Gate	Existing	NA	0.55		
35	1152572	2, 2, L	Berm	New	Wildlife	0.27	0.27	
36	1155555	2, 2, L	Gate	New	Wildlife	2.96	2.96	
37	1155559	2, 1, L	With 555	New	Wildlife	0.59	0.59	
38	1155660	2, 2, L	Gate	Existing	NA	1.11		
39	1155666	2, 1, L	Berm	New	Wildlife	0.48	0.48	
40	1155667	2, 1, L	Berm	New	Wildlife	0.2	0.2	
41	1155681	2, 1, L	Berm	New	Wildlife	0.23	0.23	
						27.03	16.33	

The new calculated road densities for the Canal, Upper Quartzville and Galena sub watersheds will be 1.7, 1.7 and 2.0 miles of open road per square mile respectively after all of the road closures have been implemented.

There are 14.27 miles of road to be closed using KV funds from the action alternatives. The road closures will be 9.18 miles in the Canal sub watershed, 2.37 miles in the Galena sub watershed and 2.72 miles in the Upper Quartzville sub watershed.

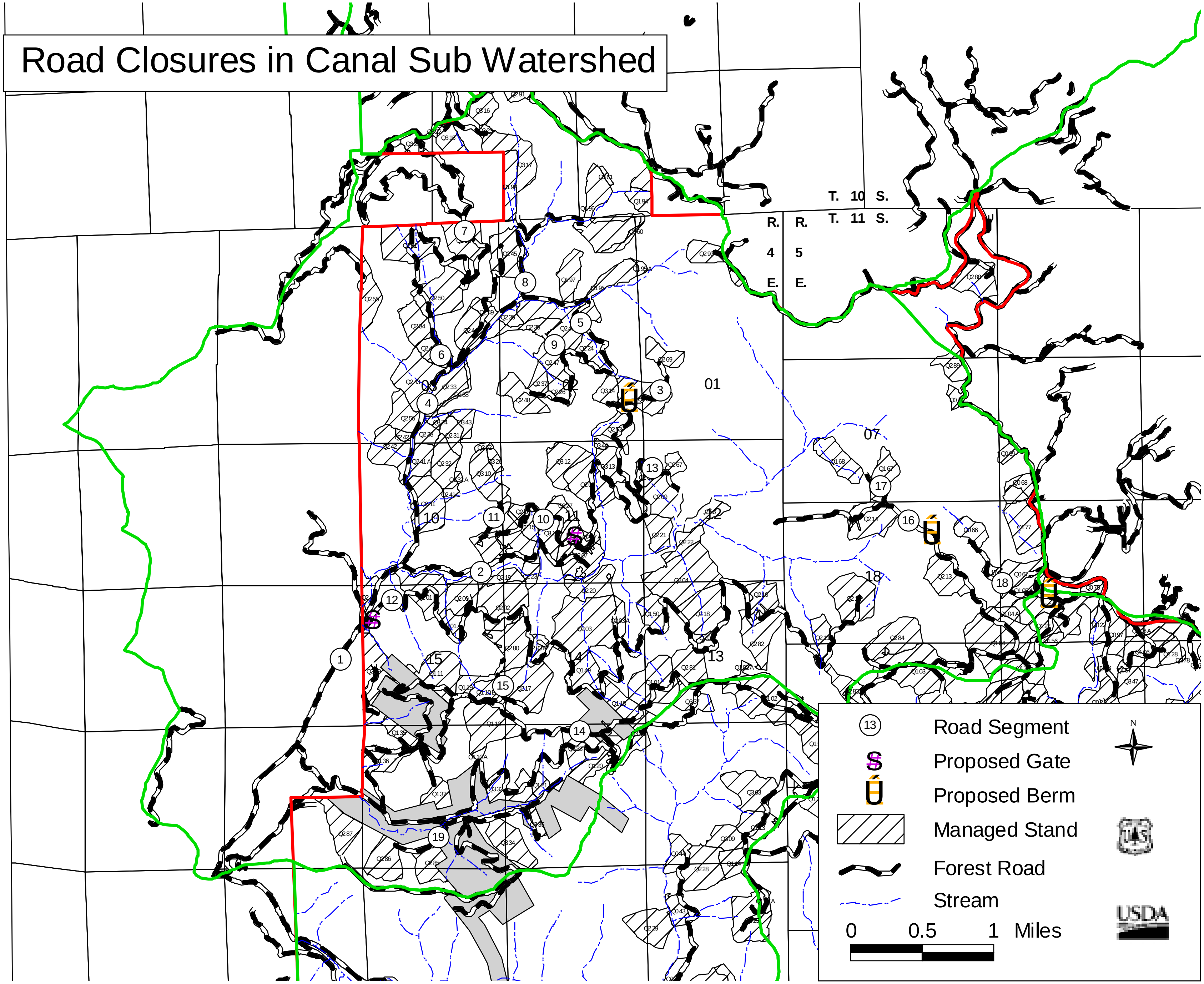
There are 16.23 miles of road to be closed using wildlife funds as they become available. The road closures will be 2.62 miles in the Canal sub watershed, 0 miles in the Galena sub watershed and 13.61 miles in the Upper Quartzville sub watershed.

A total of 23.61miles of road will remain closed and new road closures totaling 30.50 miles will bring the total of roads closed to 54.11 miles in the planning area.

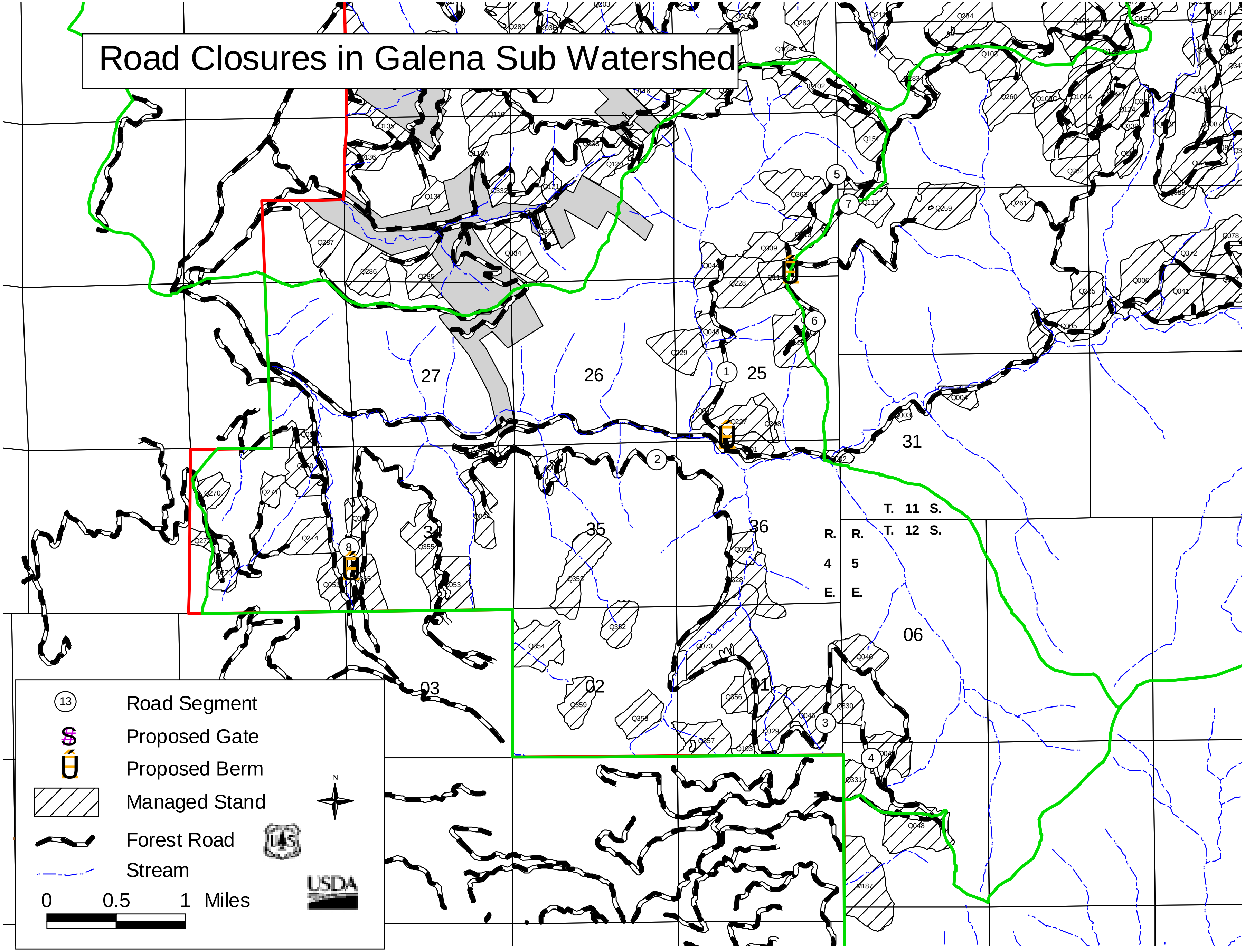
The benefits of closing roads include improved habitat conditions and reduced maintenance cost and have been evaluated at the Forest scale in Chapter VIII of the Forest Roads Analysis.

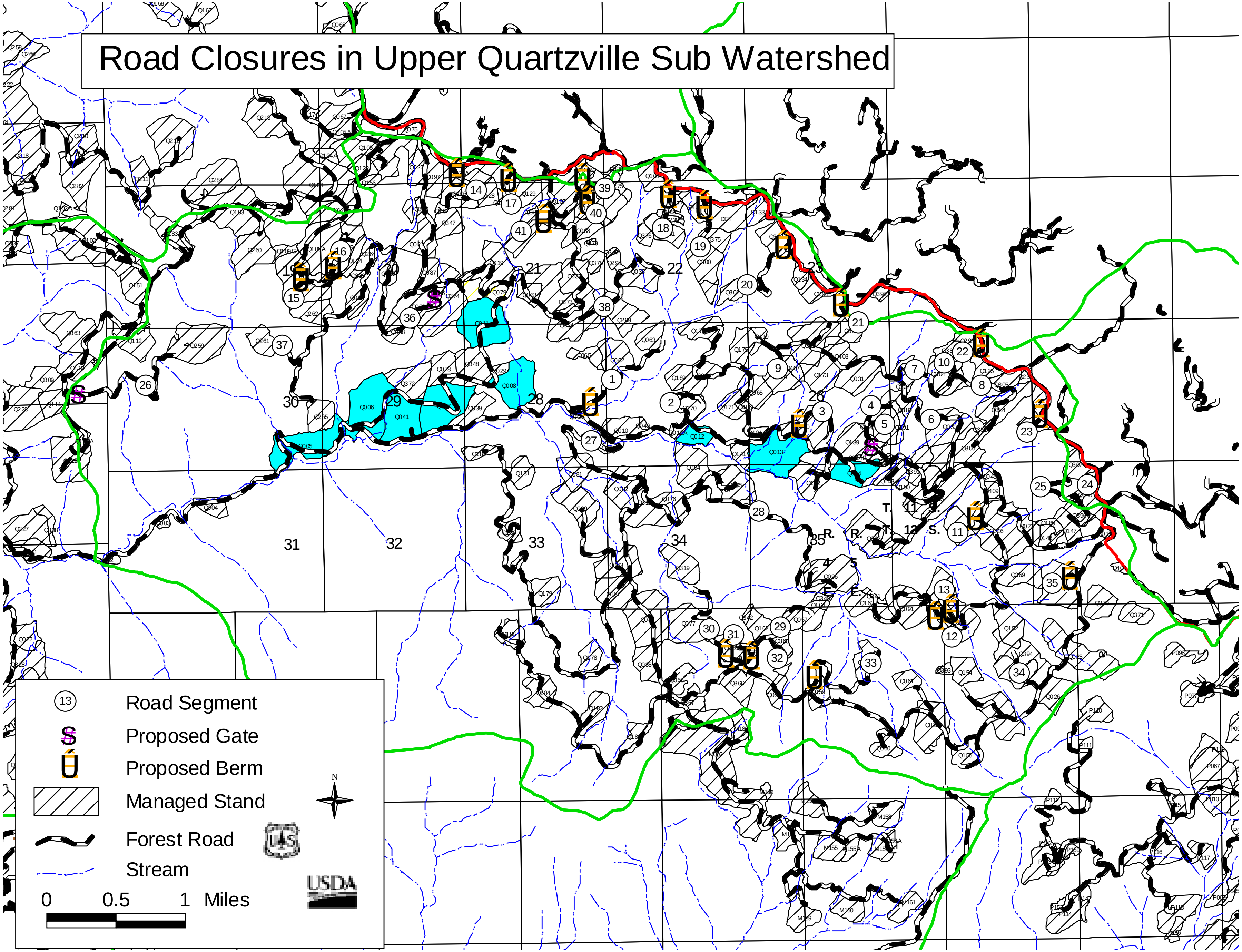
Objective Level 2 roads will be closed in a manner that will allow future management access. Objective Level 1 roads will be allowed to grow closed as time passes. Many of the roads have some level of brush encroachment currently.

Road Closures in Canal Sub Watershed



Road Closures in Galena Sub Watershed




Road Closures in Upper Quartzville Sub Watershed
Road Segment
Proposed Gate
Proposed Berm
Managed Stand
Forest Road
Stream
0
0.5
1
Miles
N
USDA

Quartzville LSR Thin
Biological Evaluation

Sweet Home Ranger District, Willamette National Forest

Prepared By:______________________ ____________
Virgil Morris Date
District Wildlife Biologist

INTRODUCTION

This analysis addresses the potential effects of Alternatives 1-3 of the Quartzville LSR Thin project on Threatened, Endangered, and Sensitive (TES) species identified on the USDA Forest Service – Pacific Northwest Region TES lists updated July, 2004. Species that are documented or suspected to occur on the Willamette National Forest are identified in Table 1. Only those species that have suitable habitat in the Quartzville LSR Thin planning area are discussed in greater detail.

Quartzville LSR Thin proposes to commercially thin 828 acres of 35-45 year old managed stands in alternative 2 and 566 acres of 35-45 year old managed stands in alternative 3. Alternative 1 is the no-action alternative. A variety of thinning prescriptions will be used in alternatives 2 and 3 to maintain a minimum 40% canopy closure after treatment. Additional projects included in these two alternatives are snag and down wood creation, road closures, stand improvement projects, sub-soiling, plus additional projects. See the Environmental Assessment for further information.

SUMMARY OF EFFECTS

The northern spotted owl (*Strix occidentalis caurina)* is a threatened species known to occur within the Quartzville LSR Thin planning area. Management activities identified in alternatives 2 and 3 may affect, but are not likely to adversely affect, northern spotted owls. This project was consulted on with the U.S. Fish and Wildlife Service and a Biological Opinion received on April 4, 2005 (FWS Reference Number 1-7-05-F-0228). The Biological Opinion concludes the finding of no jeopardy and no adverse modification of critical habitat. Seasonal restrictions on management activities are identified on page 6.

The peregrine falcon (*Falcon* p*eregrinus anatum)* is a sensitive species that may nest within or adjacent to the Quartzville LSR Thin planning area. Surveys of suitable nest cliffs will be completed prior to conducting management activities that may disturb nesting peregrine falcons. Restrictions will be required if nesting peregrine falcons are located. This project will have no impact on peregrine falcons.

The Harlequin duck (*Histrionicus histrionicus*) is a sensitive species known to nest within the Quartzville LSR Thin planning area. Seasonal restrictions on management activities are identified so there will be no direct effects to Harlequin ducks. Short-term indirect effects may occur from reducing the canopy closure in nesting habitat for 5 to 15 years.

Baird’s shrew (*Sorex bairdi permiliensis*) and Pacific shrew (*Sorex pacificus cascadensis*) are sensitive species that may occur within the Quartzville LSR Thin planning area. This project may impact individuals or their habitat.

The Oregon slender salamander (*Batrachoseps wrighti)* is a sensitive species known to occur within the Quartzville LSR Thin planning area. This project may impact individuals or their habitat. Known sites where the Oregon slender salamander was located will have a minimum 66-foot no-harvest buffer.

The Pacific fringe-tailed Bat (*Myotis thysanodes respertinu*), Pacific fisher (*Martes pennanti*), Cascade torrent salamander (*Rhyacotriton cascadae*), and Crater Lake Tightcoil (*Pristoloma arcticum crateris*) are sensitive species that may occur within the Quartzville LSR Thin planning area. There should be no impact to these species or their habitat.

Table 1: TES Species

Species	Step 1 Prefield Review	Step 2 Field Recon.	Step 3 Risk Assessment	Step 4 Analysis of Effect
Birds				
Spotted Owl	HP	Surveyed	Potential	MA-NLAA
Bald Eagle	HNP			
Peregrine Falcon	HP	Surveyed	Potential	No Impact
Least Bittern	HNP			
Bufflehead	HNP			
Yellow Rail	HNP			
Black Swift	HNP			
Harlequin Duck	HP		Potential	May Impact
Mammals				
Baird's Shrew	HP		Potential	May Impact
Pacific Shrew	HP		Potential	May Impact
Pacific Fringe-tailed Bat	HP		Potential	No Impact
Pacific Fisher	HP		Potential	No Impact
California Wolverine	HNP			
Herpetiles				
Foothill Yellow-legged Frog	HNP			
Oregon Slender Salamander	HP		Potential	May Impact
Cascade Torrent Salamander	HP		Potential	No Impact
Oregon Spotted Frog	HNP			
Northwestern Pond Turtle	HNP			
Insects				
Mardon skipper	HNP			
Mollusks				
Crater Lake Tightcoil	HP	Surveyed	Potential	No Impact

HP = Habitat present
HNP = Habitat not present
MA-LAA = May Effect, Likely to Adversely Affect
MA-NLAA = May Effect, Not Likely to Adversely Affect

AFFECTED SPECIES

NORTHERN SPOTTED OWL

The Northern spotted owl is listed as a threatened species known to occur in the Quartzville LSR Thin planning area. A critical habitat unit (CHU) has also been identified within the planning area.

Existing Condition

The Northern spotted owl occurs primarily within older timber stands with sufficient forest structure to provide food, cover, suitable nest sites, and protection from predators and weather. Suitable spotted owl habitat refers to nesting, roosting, and foraging (NRF) habitat and generally consists of forested stands over 80 years old, multi-storied with snags and down wood, and canopy closure generally exceeding 60%. Late seral forest is superior habitat and preferred by spotted owls over other habitat conditions (Thomas et al. 1990).

Habitat that only provides for dispersal generally consist of forested stands 40 to 80 years old, canopy closure of 40-60%, and average tree diameter of 11 inches or greater (USDI 2005). This habitat may also provide for some minimal foraging. Dispersal habitat is used by spotted owls to navigate between stands of suitable habitat and by juveniles to disperse from natal cores.

Spotted owls may be affected when suitable or dispersal habitat is modified within their home range, generally a 1.2-mile radius around the activity center or nest tree. Habitat modification may occur in three different ways: (1) Degrade habitat – affect the quality of suitable owl habitat or dispersal habitat without altering the functionality of such habitat, (2) Downgrade habitat – alter the functionality of suitable habitat so that it no longer supports nesting, roosting, and foraging, and (3) Remove habitat – alter suitable or dispersal habitat to such an extent that the habitat no longer supports nesting, roosting, foraging, or dispersal.

Management activities may affect spotted owls by creating noise disturbance above ambient levels during the spotted owl-nesting season March 1 – September 30. Disturbance can occur from any activity producing above-ambient noise within 0.25 miles (0.5 miles for aircraft and 1.0 mile for blasting) of owls during the nesting season.

Timber harvest and road construction may also affect spotted owls by fragmenting the remaining habitat thereby creating more favorable conditions for great horned owls, which prey on spotted owls, and barred owls, which compete with spotted owls for territories.

There are numerous historic spotted owl locations surrounding the plantations proposed for thinning. Most locations are from night responses over 10 years old with little daytime verification of the activity centers. Approximately half of these historic sites are pair locations and half single responses.

Spotted owl surveys (Region-6 Survey Protocol) were completed in 2003, 2004, and 2005 within .5 miles of the proposed thinning units. Spotted owls were located at some of the historic sites but not all. Three of the historic owl sites (0643, 0682, 4199) were adjusted to new locations based on daytime verification of activity centers. Owl pair 0643 was relocated within one mile of the historic site and produced young in 2004. Owl pair 0682 was relocated within .5 miles of the historic site, but was non-nesting in 2004. Owl 4199 was a single owl located on adjacent private land in 1993 and relocated in the same general area in 1994. These were night audio responses only. The habitat where the single owl was located was clear-cut harvested sometime after 1994. A pair of non-nesting spotted owls (now identified as site 4199) was located on public land in 2004, slightly over one mile from the original site on private land.

Canopy closure within the units is high (>80%) with tree diameters of the dominant and co-dominant trees exceeding 11 inches over portions of each unit. Large down wood in the units is very limited and most of it is well decayed. There is also some accumulation of small down wood from the existing stand. Snags are more numerous but small, less than 10 inches diameter. The stands currently provide marginal spotted owl dispersal habitat but are not suitable spotted owl habitat.

Critical Habitat
The U.S. Fish and Wildlife Service have designated Critical Habitat Units (CHU) across the range of the northern spotted owl. The physical and biological features (referred to as the primary constituent elements) that support nesting, roosting, foraging, and dispersal are essential to the conservation of the species (USDI 1992). All units proposed for thinning are within CHU OR-14.

Direct/Indirect Effects

Alternative 1
There will be no direct, indirect, or cumulative effects to spotted owls, spotted owl habitat, or spotted owl critical habitat. Habitat within the proposed units will continue to function as dispersal habitat and develop following natural succession pathways. These pathways are dependent on either natural disturbances (fire, insects, wind, pathogens) or self-thinning from lack of resources to reduce the number of trees occupying each site and allow the remaining trees to develop into late-succession habitat. It will likely take a number of years, if not decades, for this to occur, extending the recovery time for these managed stands to provide suitable habitat for spotted owls.

Alternatives 2 and 3
Light to moderate thinning planned under these two alternatives will degrade but not remove the existing spotted owl dispersal habitat. A minimum 40% canopy will remain after all logging and snag and down wood creation are completed. By maintaining and favoring a mixture of tree species, thinning will improve stand diversity, wildlife habitat, and resistance to single species insect attacks and diseases. Through reduced crowding and competition between trees, stand vigor will improve and provide bigger, taller trees and begin the development of a multistory stand. Improving diversity and increasing vertical and horizontal stand structure will accelerate the stands towards suitable spotted owl habitat.

Removal of 40-60% of the canopy in these plantations may affect, but is not likely to adversely affect, spotted owls. Dispersal habitat will be degraded but not removed. Thinning the stands now will improve dispersal habitat quality within 5 to 10 years as the canopy increases and should accelerate the stands to become suitable spotted owl habitat in 40 to 50 years. Planned snag and down wood creation will also improve habitat conditions for spotted owl prey base, like Northern flying squirrels. Alternative 2 will treat 828 acres and Alternative 3 will treat 566 acres.

Dominant Tree Release, to develop dominant trees within the stands, will aid in the development of multiple canopy layers and structural diversity, desired characteristics in LSRs. These small ¼ acre gaps will not impede dispersing spotted owls.

The new temporary road construction in Alternative 2 and the re-opening of existing spur roads in Alternative 2 and 3 should not pose a barrier to dispersing spotted owls. Temporary roads will be closed after harvest activities are complete. Trees remaining on the sides of the roads should quickly respond to the opening and fill in the gap.

Hazard trees (snags and live defective trees) will likely need to be felled within the stands, adjacent to work areas, and along haul routes in both action alternatives. All hazard trees will be retained as down wood. In addition, five plantation trees per acre will be retained as down wood during logging and five snags will be created after logging is complete. The increased levels of down wood will improve habitat conditions for spotted owl prey species.

All units proposed for treatment are located in Critical Habitat OR-14. Removing 40-60% of the existing canopy within these units may affect critical habitat by degrading existing dispersal habitat. Quality of this dispersal habitat should improve within 5 to 10 years as the canopy increases and should accelerate the stands to become suitable spotted owl habitat in 40 to 50 years.

No logging or road building activity will occur during the critical nesting season March 1 – July 15 unless the habitat is known to be unoccupied or has no nesting activity as determined by protocol survey (USDI 2005). Harvest operations will likely occur during the later part of the nesting season (July 15 – September 30) and may affect, but is not likely to adversely affect, spotted owls.

Cumulative Effects

Cumulative Effects result from the incremental impacts of past, present, and foreseeable future actions that remove or fragmented spotted owl habitat. Past timber harvest activities and road building have removed suitable spotted owl habitat and reduced interior forest habitat, due to edge effect of the created openings. This has allowed both great horned and barred owls to increase within the planning area. Both species can impact spotted owl numbers, either through predation by great horned owls or competition by barred owls for home ranges. Interior forest habitat will be buffered in Landscape Blocks B1 and B2 to maintain existing forest conditions (See Environmental Assessment). The proposed commercial thinning will improve the quality of dispersal habitat on the landscape and accelerate the development late-successional habitat, eventually becoming suitable spotted owl habitat.

There are no additional habitat altering projects in suitable or dispersal spotted owl habitat on Forest Service land at this time within the Quartzville LSR. Current and future logging on private lands to the west is expected to provide only dispersal habitat for short time periods. It is unlikely the current dispersal habitat will remain long enough to provide for suitable owl habitat.

PEREGRINE FALCON
The Peregrine falcon is a Region-6 Sensitive Species.

Existing Condition
Peregrine falcons require nest sites of sheer cliffs, usually exceeding 75 feet in height overlooking open, diverse habitat with an ample food supply. There are suitable nest sites within and adjacent to the planning area.

Direct/Indirect Effects

Alternative 1
There will be no direct, indirect, or cumulative effects to peregrine falcons under this alternative.

Alternatives 2 and *3*
Thinning proposed in these two alternatives will have no effect on suitable nesting cliffs however several of the proposed thinning units are within 3 air miles of these cliffs. Peregrine falcons will react to disturbances out to 3 air miles from the nest site (USDI 1999). Most of the cliffs were surveyed to protocol in 2004 but no peregrine falcons were detected. Surveys of potential nest sites will be completed the year of timber harvest to ensure nesting falcons are not disturbed.

The light to moderate thinning along with snag and down wood creation will increase habitat diversity for Peregrine falcon prey species. For the Peregrine falcon and habitat, a no impact determination was made for both alternatives.

Cumulative Effects
Past timber management within the Quartzville LSR has resulted in a variety of habitats surrounding suitable nest cliffs. This variety of habitats is likely beneficial in encouraging a range of bird species to provide peregrine falcon prey. This project will encourage plant and structural diversity within the units thereby improving habitat conditions for peregrine falcon prey species. There are no additional habitat altering projects on Forest Service land at this time within the Quartzville LSR. Logging on private land to the west is expected to continue on short rotations.

Harlequin Duck
The harlequin duck is a Region-6 Sensitive Species.

Existing Condition
Harlequin ducks breed along low-gradient, slower-flowing reaches of mountain streams in forested areas (Csuti et al.1997). They typically nest close to streams that are over 30 feet in width with nest selection and brooding occurring from March 15 to July 15 (Bruner 1997).

Harlequin ducks have been documented in Canal, Elk, and Quartzville Creek for a number of years. Both adults and young have been observed. The lower portions of units 1, 4, 5, 9, 10, 21, 22, 23, 24, 25, and 27 may provide suitable nesting habitat but nesting in these units has never been confirmed.

Direct Effects
Harvest restrictions of March 1 – July 15 will be imposed on the above units to eliminate direct impacts to Harlequin ducks.

Indirect Effects
Thinning proposed for the units identified above may remove overhead cover such that Harlequin ducks may not nest there until the habitat recovers. The canopy in the treated areas should begin to close back in within 5 to 15 years.

Cumulative Effects
The amount of habitat being affected by this project is a very small percentage of suitable habitat currently available within the planning area. Quality of the habitat to be treated is low, due to the lack of ground cover under the dense overstory canopy. Thinning will improve this habitat by accelerating the development of ground vegetation to provide cover for nesting Harlequin ducks. No additional habitat altering projects have been identified within the planning area on public lands.

Dispersed recreation along the lower potions of Canal, Elk, and Quartzville Creeks during the spring and summer is likely affecting use of these areas by Harlequin ducks for nesting. The amount of habitat being affected is quite small when compared to the amount of suitable streamside habitat available. Disturbance to the ducks once the broods leave the nest and are on the water is minimal; in fact Harlequins can be quite tolerant of human activity, even in-stream activity (Bruner 1996).

For Harlequin ducks, a "may impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or cause a loss of viability to the population or species" determination was made for alternatives 2 and 3. The impact will be less under alternative 3 since wider no-harvest buffers will be maintained on Canal, Elk, and Quartzville Creeks. Impacts from each alternative should be of short duration.

BAIRD'S SHREW
The Baird's shrew is a Region-6 Sensitive Species.

Existing Condition
The Baird's shrew is found in cool, moist areas, usually within coniferous or deciduous forests (Csuti et al.1997). They often utilize down wood or ground litter in riparian and upland habitats. They feed on a variety of invertebrate species. It is thought they occur on the Sweet Home Ranger District and possibly in the Quartzville LSR Thin planning area. Much of the habitat within the proposed units is likely poor for this species due to the lack of down wood and litter.

Direct Effects
Some individuals may be lost or disturbed during the implementation of this project.

Indirect Effects
Some habitat may be impacted by ground disturbance.

Cumulative Effects
It is undetermined what specific impact this project will have on individuals or the species population, but retention of no-harvest buffers, little ground disturbance, limited slash burning, and retention and creation of down wood and debris will improve habitat conditions for this species.

For the Baird's shrew and its habitat, a "may impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or cause a loss of viability to the population or species" determination was made for alternatives 2 and 3. This impact should be of short duration.

PACIFIC SHREW
The Pacific shrew is a Region-6 Sensitive Species.

Existing Condition
The Pacific shrew prefers humid forests, marshes, and thickets, often near riparian vegetation. They require down logs, brushy thickets, or ground debris for cover and hiding (Csuti et. al. 1997). They have been found in early successional forests.

It is thought they occur on the Sweet Home Ranger District and possibly in the planning area but have not been documented.

Direct Effects
Some individuals may be lost or disturbed during the implementation of this project.

Indirect Effects
Some habitat may be impacted by ground disturbance.

Cumulative Effects
It is undetermined what specific impact this project will have on individuals or the species population, but retention of no-harvest buffers, limited slash burning, and retention and creation of down wood and debris will improve habitat conditions for this species.

For the Pacific shrew and its habitat, a "may impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or cause a loss of viability to the population or species" determination was made for alternatives 2 and 3. This impact should be of short duration.

PACIFIC FRINGE-TAILED BAT
The Pacific fringe-tailed Bat is a Region-6 Sensitive Species.

Existing Condition
The Pacific fringe-tailed bat occurs in the Cascade Range and Tillamook County in forested habitat and may utilize caves for nursery colonies (Csuti et. al. 1997). It is thought they forage by picking insects off shrubs. Their distribution is patchy across their range and it is unknown if they occur on the Sweet Home Ranger District.

Direct/Indirect/Cumulative Effects
The proposed thinning should improve habitat for this species by allowing increased development of shrubs for prey habitat and improved tree growth for structural diversity. Caves located in the vicinity of the proposed units will have a no-harvest buffer to protect them from disturbance during logging.

For the Pacific fringe-tailed bat and its habitat, a "no impact" determination was made for all alternatives.

PACIFIC FISHER
The Pacific fisher is a Region-6 Sensitive Species. It is unknown if they occur on the Sweet Home Ranger District.

Existing Condition
The Pacific fisher primarily use mature, closed canopy coniferous forest containing some deciduous component. They frequently use riparian corridors. They will use cutover areas as secondary habitat. Abundant snag and down wood habitat is important.

Direct/Indirect/Cumulative Effects
Improving diversity and structure within the units through thinning while maintaining no-harvest buffers along streams will improve habitat conditions for Pacific fisher.

For the Pacific fisher and habitat, a "no impact" determination was made for all alternatives.

OREGON SLENDER SALAMANDER
The Oregon slender salamander is a Region-6 Sensitive Species.

Existing Condition
The Oregon slender salamander typically occurs under tree bark and moss on the ground in mature and second growth Douglas-fir forests (Csuti et al.1997). Bark heaps at the base of snags and down wood appears to be very important. This species has been located in units 6, 22, 23, and 24.

Direct Effects
Known sites will be protected with a 66-foot no-harvest buffer. In addition, other protection buffers will maintain areas where harvest will not occur. Outside of these protected areas, some individuals may be disturbed during the implementation of this project. Due to the type of logging being proposed, there should be very little disturbance of existing down wood.

Indirect Effects
Some habitat may be impacted by ground disturbance.

Cumulative Effects
It is undetermined what specific impact this project will have on individuals or the species population, but retention of no-harvest buffers, limited slash burning, and retention and creation of down wood and debris will improve habitat conditions for this species.

For the Oregon slender salamander and habitat, a "may impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or cause a loss of viability to the population or species" determination was made for alternatives 2 and 3. This impact should be of short duration

CASCADE TORRENT SALAMANDER
The Cascade torrent salamander is a Region-6 Sensitive Species.

Existing Condition
The Cascade torrent salamander occurs in the Cascade Range in rocks bathed in a constant flow of cold water, in cool rocky streams, lakes and seeps, usually within conifer or alder forests (Csuti et al. 1997). They are dependent on nearly continuous access to cold water and can be found moving about in forests during wet weather. They have been documented on the Sweet Home Ranger District but not in the Quarzville LSR Thin planning area.

Direct/Indirect/Cumulative Effects
Perennially wet streams and wet areas will have a minimum 50-foot no-harvest buffer, which will protect this species from disturbance. For the Cascade torrent salamander and habitat, a "no impact" determination was made for all alternatives.

CRATER LAKE TIGHTCOIL
The Crater Lake Tightcoil is a Region-6 Sensitive Species

Existing Condition
The Crater Lake Tightcoil is a small snail that occurs in perennially wet areas above 2000-foot elevation. They have never been documented on the Sweet Home Ranger District.

Direct/Indirect/Cumulative Effects
Perennially wet streams and wet areas will have a minimum 50-foot no-harvest buffer, which will protect this species from disturbance. The temporary road being opened in unit 6 in riparian habitat was surveyed in 2004. This species was not found.

For the Crater Lake Tightcoil and habitat, a "no impact" determination was made for all alternatives.

Appendix 1: References for Quartzville LSR Thin Biological Evaluation

Brown, E. R., Ed. 1985. Management of Wildlife and fish Habitat in Forests of Western Oregon and Washington. USDA Publication. 332 pp.

Brunner, H. 1996. Progress Report. Characterization of Habitat Used by Breeding Harlequin Ducks in Oregon.

Corkran C. and C. Thoms. 1996. Amphibians of Oregon, Washington, and BritishColumbia. Lone Pine Publishing, Redmond Washington. 175 pp.

Csuti, B., A.J. Kimerling, T.A. O'Neil, M.Shaughnessy, E.P. Gaines, and M..P. Huso. 1997. Atlas of Oregon Wildlife. OSU Press, Corvallis, Oregon. 492 pp.

Gilligan, J, et. al. 1994. Birds of Oregon: Status and Distribution. Cinclus Publications, McMinnville, OR. 330 pp.

Hornocher, M. G., and H. S. Hash. 1981. Ecology of the Wolverine in Norwestern Montana. Can. J. Zool. 59:1286 - 1301.

Koehler, G.M. and K.B. Aubry. 1994. Lynx. The Scientific Basis for Conserving Forest Carnivores, American Marten, Fisher, Lynx, and Wolverine in the Western United States. USDA Forest Service. Rocky Mountain Forest and Range Experiment Station. General Technical Report RM 254, pg 74-94 in Ruggiero et al. ed.

Nussbaum, R.A., E.D. Brodie, Jr., and R.M. Storm. 1983. Amphibians and reptiles of the Pacific Northwest. Univ. of Idaho Press, Moscow, Idaho. 332 pp.

Perkins, J.M. 1987. Distribution, status, and Habitat Affinities of Townsend's Big-Eared Bat (*Plecotus townsendii*) in Oregon. Oregon Department of Fish and Wildlife. Technical Report #86-5-01.

Ruediger, Bill, et al. 2000. Canada Lynx Conservation Assessment and Strategy.

Ruggiero, L. F., K. B. Aubrey, S. W. Buskirk, G. M. Koehler, C. J. Krebs, K. S. McKelvey, and J. R. Squires. 1999. Ecology and Conservation of Lynx in the United States.

U.S.D.A. Forest Service, 1989, 1991. Surveying for Northern Spotted Owls: Protocol.

U.S.D.A. Forest Service. 1992. Final Environmental Impact Statement on Management for the Northern Spotted Owl in the National Forests.

U.S.D.A. Forest Service, U.S.D.I. Bureau of Land Management, U.S.D.I. Fish and Wildlife Service, U.S.D.I. National Park Service. 1990. A conservation strategy for the Northern Spotted Owl.

U.S.D.A. Forest Service. 1994. Record of Decision and Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Related Species Within the Range of the Northern Spotted Owl. Portland, OR.

U.S.D.I. Fish and Wildlife Service. 2005. Biological Opinion for Calendar Years 2005-2006 Habitat Modification Activities within the Willamette Province.

U.S.D.I. Fish and Wildlife Service. 1999 Biological Opinion for the U.S. Forest Service Region-6 Fiscal Year Habitat Modification Program.

U.S.D.I. Federal Register, 50 CFR. Jan. 15, 1992. Endangered and Threatened Wildlife and Plants; Final Determination of Critical Habitat for the Northern Spotted Owl.

U.S.D.I. Fish and Wildlife Service. 1982. Pacific Coast Recovery Plan for the American Peregrine Falcon.

Verts, B.J. and L.N. Carraway. 1998. Land Mammals of Oregon. University of California Press. Berkley/ Los Angeles/ London. 668 pp.

Unit Number	Reforestation Number	Stand Number	Silvicultural		Fuels Treatment		Regeneration			Year of Precommercial Thinning Certification	Year Fertilized
			Type of Treatment	Year of Treatment	Type of Treatment	Year of Treatment	Type of Treatment	Year of Origin	Year Certified		
1	Q1	3000514	HCC	1959	BCB	1960	Plant	1962	1969	1975	
3	Q4	3000487	HCC	1960	BCB	1962	Plant	1962	1969	1981	
4	Q5	3000431	HCC	1961	BCB	1961	Plant	1965	1969	1976	1986
5	Q6	3000405	HCC	1961	BCB	1961	Plant	1962	1969	1975	1985
6	Q7	3000412	HCC	1961	BCB	1961	Plant	1962	1969	1975	
7	Q8	3000389	HCC	1962	BCB	1962	Plant	1963	1969	1978	
8	Q11	3000339	HCC	1961	BCB	1961	Plant	1961	1970		1985
9	Q12	3000438	HCC	1963	BCB	1963	Plant	1964	1969		1985
9	Q12A	3000440	HCC	1979	BCB	1980	Plant	1981	1983		
10	Q13	3000444	HCC	1963	BCB	1963	Plant	1965	1969	1986	1985, 1993
11	Q14	3000465	HCC	1963	BCB	1963	Plant	1965	1969	1983	1985, 1993
11	Q14A	3000466	HCC	1966	BCB	1966	Plant	1967	1974		
11	Q14B	3004250	HCC	1968	Burn deck/ concentrations	1970	Plant	1972	1979	1988	
12	Q41	3000417	HCC	1969	BCB	1969	Plant	1970	1974	1988	1985
13	Q50A	3000509	HCC	1967	BCB	1968	Natural Regen	1969	1974		
13	Q50	3000512	HCC	1964	BCB	1964	Seeded	1966	1974	1981	
14	Q51	3000604	HCC	1964	BCB	1964	Plant	1969	1974	1986	1998
15	Q70	3000522	HCC	1959	BCB	1961	Seeded	1962	1969	1980	
16	Q71	3000526	HCC	1960	BCB	1961	Seeded	1962	1969		
17	Q72	3000590	HCC	1960	BCB	1961	Seeded	1962	1969	1983	
18	Q73	3000640	HCC	1960	BCB	1961	Seeded	1962	1969	1980	2000
19	Q102	3000264	HCC	1958	BCB	1959	Plant	1960	1969	1988	
20	Q115	3000442	HCC	1965	BCB	1965	Plant	1966	1970	1983	
21	Q201	3000172	HCC	1958	BCB	1959	Plant	1962	1969	1980	
21	Q201A	3000208	HCC	1963	BCB	1963	Plant	1968	1971	1988	
22	Q202	3000186	HCC	1959	BCB	1959	Plant	1964	1969	1980	
23	Q203	3000195	HCC	1959	BCB	1959	Natural Regen	1963	1969	1980	
24	Q206	3000152	HCC	1965	BCB	1965	Plant	1965	1970		
25	Q207	3000158	HCC	1965	BCB	1965	Plant	1966	1971		
26	Q209	3000139	HCC	1965	BCB	1965	Plant	1967	1974	1978, 1987	
27	Q240	3000177	HCC	1960	BCB	1960	Plant	1961	1970		

United~d States Department of
Agriculture

Forest Service

R-6/R-5

Reply to: 2470/1920

Subject: Criteria to Exempt Specific Silvicultural Activities in LSRs and MLSAs from REO Review

To: Forest Supervisors, Owl Forests

2470/1920

Date: May 9, 1995

Enclosed is a memorandum from the Regional Ecosystem Office (REO) exempting certain precommercial thinning, release, and reforestation activities within LSRs from REO review. I am pleased about this exemption and consider it a key step toward accomplishing ecosystem management objectives in a timely manner. However, since some readers will view the criteria as unnecessarily restrictive, I ask you to keep the following points in mind.

This is the first R.EO review exemption. It is based on proposals submitted to REO for review or upon proposals REO has discussed in the field. It is, of necessity, conservative. REO continues to express a desire to expand this exemption to other types of activities at the earliest possible time.

Before this memorandum was signed, all silvicultural activities wer43 subject to REO review. Now most young stand thinning (including related sale), release, and reforestation proposals are not subject to review. This is a positive step, and there is little to be gained by discussing whether the criteria should have gone farther at this time. Since no commercial thinning proposals have ever been submitted to REO for review, for example, REO had little basis to expand these criteria at this time.

The criteria do not infer a right or wrong, or consistency or non-consistency with standards and guidelines. The criteria simply draws the line between those proposals no longer subject to REO review, and those that remain subject to review. Proposals not meeting the criteria should be submitted for review as in the past, and REO expects to continue to meet its committment to complete such reviews within 3 weeks, or less, of date received.

Note that the exemption for reforestation is in addition to the somewhat broader exemption already included in the standards and guidelines for reforestation activities required because of existing timber sales.

This exemption also applies to the Issue Resolution Team (IRT) since IRT review was only required in preparation for sending to REO. Specific questions about this exemption should be addressed to the President's Forest Plan coordinator on your unit.

/s/ **John** 1=. **Lowe**

JOHN LOWE
Regional Forester, R-o

Enclosurl9

ApPENDIX K

-2-

IslSteve Clauson (for)

LYNN SPRAGUE Regional Forester, f;~-5

MID WILLAMETTE **LSR** AS:.ESSME:NT

Regional Ecosystem Office
P.O. Box 3623 Portland, Oregon 97208 (503) 326-6265 FAX: (503) 326-6282

Date: April 20, 1995

To: Regional Interagency Executive Committee (See Distribution List)

From: Donald R. Knowles, Executive Director *Isl* Don Knowles

Subject: Criteria to Exempt Specific Silvicultural Activities in LSRs and MI_SAs from REO Review

Pages C-12 and C-26 of the Record of Decision (ROD) for the Northwest Forest Plan state that "[t]he Regional Ecosystem Office may develop criteria that would exempt some activities from review." Enclosed are criteria that exempt certain young-stand thinning, release, and reforestation projects that are proposed in Late- Successional Reserves (LSRs) and Managed Late-Successional ,Areas (MLSAs) from review by the Regional Ecosystem Office (REO). These criteria were developed by an interagency work group and the REO based on the review of silvicultural projects, field visits, and discussions with agencies and technical specialists. The REO may expand the review exemption criteria as expl3rience with additional forest management activities is gained. Please distribute the attached REO review exemption criteria to the field.

It is important to note that these criteria do not affect the kind of activitil3s the ROD permits within LSRs and MLSAs. The criteria apply only to the requirement for REO review of silvicultural activities in LSRs and MLSAs and only to a specific subset of silvicultural treatments. It should also be noted that compliance with the ROD's standards and guidelines and other statutory and regulatory requirements is not affected by these exemption criteria. For example, requireml9nts to do watershed analyses and Endangered Species Act consultation are not affected by the REO review exemption criteria.

Enclosure

cc:
IAC Members (See Distribution List) 362/ly

Subject

Date: April 20, 1995

Criteria to Exempt Specific Silvicultural Activitil9s in LSRs and MLSAs from REO Review

To: Regional Interagency Executive Committee

Anita Frankel, Director, Forest and Salmon Group, Environmental Protection Agency
John Lowe, Regional Forester, USDA Forest Service, F~-6 Stan Speaks, Area Director, Bureau of Indian Affairs
Michael Spear, Regional Director, U.S. Fish & Wildlife Service
William Stelle, Jr., Regional Director, National Marine Fisheries Service William Walters, Acting Regional Director, National Park Service
Elaine Zielinski, State Director, Bureau of Land Management, OR/WA

Other Members of Intergovernmental Advisory Committee

California
Francie Sullivan, Shasta County Supervisor
Terry Gorton, Assistant Secretary, Forestry and Rural Economic Dev., California Resource Agency

Oregon
Rocky McVay, (Curry County Commissioner
Paula Burgess, Federal Forest and Resource Policy Advisor, Office of the Governor

Washington
Harvey Wolden, Skagit County Commissioner
Amy F. Bell, Deputy Supervisor for Community Relations, WA Dept. of Natural Resources
Bob Nichols, S~9nior Executive Policy Assistant, Governor's Office (Alternate)

Tribes
Greg Blomstrom, Planning Forester, CA Indian Forest & Fire Mgmt. Council Mel! Moon, Commissioner, NW Indian Fisheries Commission
Jim Anderson, Executive Director, NW Indian Fisheries Commission (Alternate)
Gary Morishima, Technical Advisor, Intertribal Timber Council
Guy McMinds, E:xecutive Office Advisor, Quinault Indian Nation

Federal Agencies
Michael Collopy, Director, Forest and Rangeland Ecosystem ScJence
Center,
National BilDlogical Service
Eugene AndreuC(~tti, Regional Conservationist, Natural Resources Conservation Service
Bob Graham, State Conservationist, Natural Resources Conservation Service (Alternate)
G. Lynn Sprague, Regional Forester, USDA Forest Service, R-5 (Alternate) Thomas Murphy, Director, Environmental Research Laboratory, Environmental Protection Agency
Charles Philpot, Station Director, Forest Service, PNW
Tom Tuchmann, Director, Office of Forestry and Economic Developml3nlt (Ex Officio)
Ed Hastey, State Director, Bureau of Land Management, qA (Alternate)

REO Review Exemption Criteria

Backaro~

Standards and Guidelines (S&Gs) in the "Record of Decision for Amendments to Forest Service and Bureau of land Management Planning Documents Within the Range of the Northern Spotted Owl" (referred to as the ROD) provide that silvicultural activities within late-Successional Reserves (LSRs) and Managed Late- Successional Areas (MLSAs) are subject to review by the! Regional Ecosystem Office (REO). The S&Gs also state that "REO may develiop criteria that would exempt some activities; [within LSRs and MLSAs] from review."

Based upon proposals; submitted to REO for review, field visits, discussions with the agencies and technical specialists, and our understanding of L.SR objectives, REO is hereby e)(empting the following types of activities from the REO review requirement stated on pages C-12 and C-26 of the ROD. Silvicultural projects meeting the following criteria are exempted from REO review because such projects, have a high likelihood of benefitting late-successional forest characteristics,

Activities must still comply with all S&Gs in the ROD (e.g., initial LSR assessments, watershed analysis, riparian reserves) and with other statutory and regulatory requirements (e.g., National Forest Management Act, Federal Land Management Policy Act, National Environmental Policy Act, Endangered Species; A(~t, Clean Water Act). This exemption applies only to the REO review requirement found on pages C-12 and C-26 in the ROD. Silvicultural activities described in the S&Gs that do not meet the criteria listed below continue to be subject Ito REO review at this time..

Silvicultulral treatments in LSRs and MLSAs are exempted from REO review (ROD, pages C-12 and C-26), where the agency proposing the treatments finds that the following criteria are met:

1. <u>Young-Stand Thinning.</u> commonly referred to as **TSI** or precommercial thinning, where:

a.

Young stands, or the young-stand component (understory) of two-storied stands, is ovE!rstocked. Overstocked means that reac:hing the manlagement objective of late-successional conditions will be significantly dellayed, or desirable components of the stand may be eliminatecj, because of stocking levels. The prescription should be supported by ernpirical inforrnation or modeling (for similar, but not necessarily these specific, sites) indicating the development of late-successional conditions will be accelerated or enhanced.

b. Cut trees are less than 8" dbh, and any sale is incidental 1:0 the primaf)f objective.

c. Tracked, tired, or similar ground-based skidders or harvesters are nc't used.

d. Treatments promote a natural species diversity appropriate to meet late.. successional objectives; including hardwoods, shrubs, forbs, E~tC..

e. Treatments include substantially varied spacing in order to provide for some very large trees as quickly as possible, maintain arj3aS of heavy canopy closure and decadence, and encourage the growth of a variety of species appropriate to the site and the late-successional objective.

f. Treatments minimize, to the extent practicable, the nee!d for future entries.

g. Cutting is by hand tools, including chain saws.

2. **Release**, also commonly referred to as TSI, where:

a. There is undesirable vegetation (competition) which delays attainment of the management objective of late-successional conditions, or desirable components of the stand may be eliminated, because of such competition. The prescription should be supported by empirical information or modeling (for similar, but not necessarily these specific, sites) indicating the development of late-successional conditions will be accelerated or enhanced.

b. Cut material is less than 8" dbh, and any sale is incidl3ntal to the primary objective.

c. Tracked, tired, or similar ground-based skidders or harvesters are not used.

d. Treatments promote a natural species diversity appropriate to meet late-successional objectives, including hardwoods, shrubs, forbs, etc.

e. Cutting is by hand tools, including chain saws.

3. Reforestation and Revegetation. including incidental site preparation, release for survival, and animal damage control, where:

a. **No site preparation is required other than hand scalping.**

b. Reforestation is necessary to quickly reach late-successional conditions, protect site quality, or achieve other ROD objective:;.

c. Treatments promote a natural species diversity appropriate to meet late-successional objectives, including hardwoods, shrubs, fortis, et(~.

d. Treatments, either through spacing, planting area designation,! or expected survival or growth patterns, result in substantially v8lried spacing in order to provide for some very large! trees as quickly as possible, create areas of heavy canopy closure and decadence, and encourage the growth of a variety of species appropriate to the! site and the late-successional objective.

e. Treatments minimize, to the extent practicable, the need for fu'ture entries.

Regional Ecosystem Office
333 SW 1 st
P.O. Box 3623
Portland, Oregon 97208-3623
Phone: 503-326-6265 FAX: 503-326-6282

Memorandum

Date: **July** 9, 1996

To: Regional Interagency Executive Committee (RIEC)
Ken Feigner, Director, Forest & Salmon Group, Environmental Protection Agency
Robert W. Williams, Regional Forester, R-6, Forest Service Stan M. Speaks, Area Director, Bureau of Indian Affairs
Michael J. Spear, Regional Director, U.S. Fish & Wildlife Service William Stelle, Jr., Regional Director, National Marine Fisheries Service
William C. Walters, Deputy Field Director, National Park Service Elaine Y. Zielinski, State Director, Oregon/Washington, Bureau of Land Management

From: Donald R. Knowles, Executive Director

Subject: Criteria to Exempt Specific Silvicultural Activities in Late-Successional Reserves and Managed Late-Successional Areas froJ1n Regional Ecosystem Office Review

Enclosed are criteria that exempt certain commercial thinning projects in Late- Successional Reserves (LSRs) and Managed Late-Successional Areas (MLSAs) from review by the Regional Ecosystem Office (REO), pursuant to pages C-12 and C-26 of the Northwest Forest Plan (NFP) Record of Decision (ROD). These criteria were developed by an interagency work group and the REO based on review of silvicultural projects, field visits, and comments from agencies, researchers, and technical specialists.

We believe we are ready for these exemptions. Several versions of these criteria have been distributed to your agencies and others for review over the last several months. The comments received have been used to help clarify and focus the criteria. Use of the criteria will expedite implementation of beneficial silvicultural treatments in LSRs and MLSAs. We suggest that you transmit them to your field units at your earliest convenience.

It is important to note that these criteria do not affect the kind of activities 1:he ROD permits within LSRs and MLSAs. The criteria simply exempt a specific subset of silvicultural treatments from the requirement for project level REO review of silvicultural activities within LSRs and MLSAs. Please also note that compliance with the ROD's standards and guidelines and other statutory and regulatory requirements is not affected by these exemption criteria. For Example, requirements to do watershed analyses and Endangered Species Act consultation are not affected by the

We expect implementation monitoring procedures of the Northwest Forest Plan to select enough silvicultural projects within LSRs and MLSAs, both exempted and reviewed, to determine if actual projects meet standards and appropriate criteria. Obviously I if any of you have questions or comments about the attached, please call me directly at 503-326-6266, Dave Powers at 503-326-6271, or Gary S. Sims at 503-326-6274.

cc: **IAC, RMC, LSR Workgroup**

Enclosure

694/ly

Criteria Exempting Certain Commercial Thinning Activities From REO Review

Background

Standards and Guidelines (S&Gs) in the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (ROD) provide that silvicultural activities within Late-:Successional Reserves (LSRs) and Managed Late-Successional Areas (MLSAs) are subject to review by the Regional Ecosystem Office (REO). The S&G~, also state that the REO may develop criteria that would exempt some activities (within LSRs and MLSAs) from review.

Baselj upon projl3ct proposals submitted to the REO for review, field visits, discussions with the agencies, researchers, and technical specialists, and our understanding of L.SR objectives, the REO is hereby exempting certain commercial thinning activities (sometimes referred to as density management activities from the REO review requirement (ROD, pages C-12 and C-2.6). Silvicultural projects meeting the criteria below are exempted from REO review because such projects have a high likelihood of benefiting late-successional forest conditions. Many of the Commercial thinning proposals reviewed thus far by the REO have met these criteria.

In some cases the criteria refer to the prescription. All silvicultural treatments within lSRs will be conducted according to a silvicultural prescription fully meeting agency standards for such documents. A descriptiorl of the de~jired future condition (DFC), and how the proposed treatment is needed to achieve the DFC, are key elements in this prescription. The description of desired future condition should typically include desired tree species, canopy layers, overstory tree size (e.g., diameter breast height), and structural components such as the range of coarS~9 woody debris (CWO) and snags.

Some elements of these exemption criteria may seem prescriptive, and reviewers suggested several changes to accommodate specific forest priorities. While such suggestions may have been within the scope of the S&Gs, there .3re several reasons they are not included here:

These criteria are based on numerous submittals already reviewed by the REO and found to be consistent with the S&Gs. Other treatments, such as thinning with fire, may be equally appropriate. The REO simply has not hajj sufficient experience with such prescriptions within LSRs to write appropriate exemption criteria at this time. Agencies are encouraged to develop and submit such prescriptions for review. The REO will consider supplementing or modifying these criiteria over time.

These Criteria apply range wide. It may be more appropriate to seek exemption at the time of LSR assessment review where specific vegetation types, provincial issues, or objectives do not fit within these criteria or where silvicultural prescriptions are needed other than as described below.

These exemption criteria are not standards and guidelines, and projects meeting L:SR objectives but not fitting these criteria should continue to be forwarded to the REO for review.

Four other key points about thinning are important to consider when developing thinning prescriptions:

1. We urge caution in the use of silvicultural treatments within LSRs. Silvicultural treatments within old habitat conservation areas (HCAs) and designated conservation areas (DCAs) were extremely limited, and many of the participants in the Forest Ecosystem Management Assessment

   Team/Supplemental Environmental Impact Statement (FEMA T/SEIS) process advanced good reasons for continuing such restrictions. Only high eastside risks and a case made that late-successional conditions could clearly be advanced by treatments in certain stand conditions led decision makers toward the current S&Gs. Note that the examples for the westside (S&Gs, page C-12) are for even-age stands and young single-species stands. Agencies must recognize when younger stands are developing adequately and are beginning to become valuable to late-successional species. Such stands should be left untreated unless they are at substantial risk to large-scale disturbance.

2. Thinning can easily remove structural components or impede natural processes such as decay, disease, or windthrow, reducing the stands Value to late-successional forest-related species. Thinning prescriptions that Sc3Y leave the best, healthiest trees could eliminate structural components important to LSR objectives.

3. While historic s1:and conditions may be an indicator of a sustainable forest, they are not the de facto objectives. The S&Gs require an emphasis toward latel-successional conditions to the extent sustainable.

4. Treatments need to take advantage of opportunities to improve habitat corlditions beyond natural conditions. For example., exceeding natural levels of CWO within 'a 35-year-old stand can substantially improve the utility of these stands for late-successional forest-related species. Treatments must take advantage of opportunities to optimize habitat for late- successional forest-related species in the short term.

Relation to S&Gs and Other Exemption Criteria

Exempted thinnings must still comply with all pertinent S&Gs in the ROD (e.g., initial LSR assessments, watershed analyses, riparian reserves) and with other statutory and regulatory requirements (e.g., National Forest Management Act, Federal Land Management Policy Act, National Environmental Policy Act, Endangered Species Ac.1, Clean Water Act). Interagency cooperation, monitoring, and adaptive management are key components of the ROD aruj were key assumptions underlying the development of these criteria. Additionally, field units are strongly encouraged to engage in intergovernmental consul1:ation when developing projects. This exemption applies only to the REO review requirement (ROD, pages C-12 and C-26). Many treatments not meeting these exemption criteria may be appropriate within LSRs and MLSAs, and these treatments remain subject to REO review. These exemption criteria are in addition to criteria issued April 20, 1995, for Young Stand Thinning, Release, and Reforestation and Revegetation, and are in addition to exemption criteria adopted through the LSR assessment review process.

EXEMPTION CRITERIA

Silvicultural treatments in LSRs and MLSAs are exempted from F~EO review (ROD, pages C-12 and C-26) where the agency proposing the treatments finds that ALL of the following criteria are met:

Objec:tives

1. The objective or purpose of the treatment is to develop late-successional conditions or to reduce the risk of large-scale disturbance that would result in the loss of key late-successional structure. Further, the specific treatment would result in the long-term development of vertical and horizontal diversity, snags, CWO (logs), and other stand components benefiting late- successional forest-related species. The treatment will also, to the extent practicable, create components that will benefit late-successional forest- related species in the short term.

Timber volume production is only incidental to these objectives and is not, in itself, one of the objectives of the treatment. Creation or retention of habitat for early successional forest-related species is not a treatment objective.

2. Negative short-term effects to late-successional forest-related species are outweighed by the long-term benefits to such species and will not lessen short-term functionality of the LSR as a whole.

3. The leave-tree criteria provide for such things as culturing individual trees specifically for large crowns and limbs and for the retention of certain characteristics that induce disease, damage, and other mortality or habitat, consistent with LSR objectives. Healthiest, best tree criteria typical of matrix prescriptions are modified to reflect LSR objectives.

4. Within the limits dictated by acceptable fire risk, CWD objectives should be based on research that shows optimum levels of habitat for late-successional forest-related species, and not be based simply ,on measurements within natural stands. For example, recent research by Carey and Johnson in young stands on the westside indicates owl prey base increases as CWD (01'/er 4") within Douglas-fir forests increases, up to 8- to 10..percent groundcover south of the town of Drain, Oregon, and 15-percent groundcover north of Drain, increasing to 15 to 20 percent in the Olympic Pel1insula and Western Washington Cascades. Other references that could help identify initial considerations involving natural ranges of variability in C~'D include Spies and Franklin, for discussions on Washington Cascades, Oregon Cascades, and Coast Ranges; and Graham, et al., for east of the Cascades.

   If tree size, stocking, or other considerations preclude achievement of this objective at this time, the prescription includes a description of how and when it will be achieved in the future.

5. Agencies having an interest in LSR projects proposed under these criteria should continue to be given the opportunity to participate in project development.

Stand Attributes

1. The stand is currently **not** a complex, diverse stand that will soon meet and retain late-successional conditions without treatment.
2. West of the Cascades outside of the Oregon and California Klamath Provinces, the basal-area-weighted average age of the stand is less than 80 years. Individual trees exceeding 80 years in those provinces, or exceeding 20-inches dbh in **any** province, shall not be harvested except 1for the purpose of creating openings, providing other habitat structure Such as downed logs, elimination of a hazard from a standing danger tree, or cutting minimal yarding corridors. Where older trees or trees larger than 20..inches dbh are cut, the~' will be left in place to contribute toward meeting the overall C""D objective. Thinning will be from below, except in individual circumstances where specific species retention objectives have a higher priority. Cutting older trees or trees exceeding

20-inches dbh for **any** purpose will be the exception, not the rule.

3. The stand is overstocked. Overstocked means that reaching late- successional conditions will be substantially delayed, or desirable components; of the stand will likely be eliminated, because of stocking levels.

Treatment Standards

1. The treatment is primarily an intermediate treatment designed to increase tree size, Crown development, or other desirable characteristics (S&Gs, page 8-5, third paragraph); to maintain vigor for optimum late-successional development; to reduce large-scale loss of key late-successioni3.1 structure; to increase diversity of stocking levels and size classes within the stand or landscape; or to provide various stand components beneficial to late-successional forest-related species.

2. The prescription is supported by empirical information or modeling (for similar, but not necessarily these specific sites) indicating that achievement of late-successional conditions would be accelerated.

3. The treatment is primarily an intermediate thinning, and harvest for the purpose of regenerating a second canopy layer in existing stands is no more than an associated, limited objective as described below under openings and heavily thinned patches.

4. The treatment will increase diversity within relatively uniform stands by including areas of variable spacing as follows:

   Ten percent or more of the resultant stand would be in unthinned patches to retain processes and conditions such as thermal and visual cover, natural suppression and mortality -small trees, natural size differentiation, and undisturbed ,debris.

   Three to 10 percent of the resultant stand would be in openings, roughly 1/4 to 1/2 acre in size to encourage the initiation of structural diversity.

   Three to 10 percent of the resultant stand would be in heavily thinned patches (eg. less than 50 trees per acre) to maximize individual tree development and encourage some understory vegetation development.

   The treatment does not inappropriately simplify stands by removing layers or structural components, creating uniform stocking levels, 01' removing broken and diseased trees important for snag recruitment, nesting habitat, and retention of insects and diseases important to late-successional development and processes.

5. To the extent practicable for the diameter and age! of the stand being treated, the treatment includes falling green trees or leaving snags and existing debris to meet or make substantial progress toward meeting an overall CWO objective.

6. Snag objectives are to be identified as part of the DFC~. Prescriptions must be designed to make substantial progress toward the overall snag objective, including developing large trees for future snag recruitment and retaining agents of mortality or damage. To the extent practicable for the diameter and age of the stand being treated, each treatment includes retention and creation of snags to meet the DFC. Publications useful in identifying snag- related DFCs include but are not limited to Spies, et al.

   To the extent snag requirements for late-successional species are known, one objective is to attain 100 percent of potential populations for all snag- dependent species.

7. The project-related habitat improvements outweigh habitat losses clue to road construction.

Ciited Re1:erences:

Carey, A"B., and M.L. Johnson. 1995. Small mammals in managed, naturally young, and old-growth forests. Ecological Applications 5:336-352.

Graham, R.T., A.E. Harvey, M.F. Jurgensen, T.B. Jain, J.R. TIDnn, and D.S. Page-DumroesEI. 1994. Managing coarse woody debris in forests of the Rodky Mountain~~. Res. Paper INT -RP-477. USDA Forest Service, Intermountalin Research Station, Ogden, UT. 12p.

Spies, T.~). and J.F. Franklin. 1991. The structure of natural young, mature, and old-growth Douglas-fir forests in Oregon and Washington. Pages 19-121 in: Ruggiero, L.F °, KB. j~ubry, A.B. Carey, M.H. Huff (tech. a:>ords). Wildlife and Vegetation on Unmanaged Douglas-fir Forests. Gen. Tech. Rep. GTR..PNW-285. USDA Forest Service,
Pacific Northwest Research Station, Portland, OR.

I. COVER INFORMATION

Reply to: 2550 Soil Management
2520 Watershed Protection and Management

Subject: Soil and Watershed Report
Quartzville LSR Thin,

To: District Ranger, Sweet Home Ranger District
ATTN: Sale Planner

By: Douglas C. Shank, District Geologist

Date: February 16, 2005

II. INTRODUCTION

A. Summary

The Sweet Home Ranger District of the Willamette National Forest has determined that a need exists to conduct silvilcultural management in older plantations within the Quartzville for the purpose of:

1) Reducing current stocking levels to lessen competition for nutrients, sunlight, and growing space;

2) Improving the growth and vigor of the remaining trees resulting in healthier stands of trees that are more resistant to insects and disease and to reduce future losses from fire;

3) Accelerating the attainment of late-successional stand characteristics (larger diameter trees), and to enhance the development of habitat diversity for wildlife;

4) Thinning the smaller diameter, suppressed trees before they die for use as commercial wood products and to reduce long-term fuel buildup and fire risk.

Intensive field reconnaissance of the proposed units revealed no significant concerns for the protection of the soil and geology resource. The potential for management related slope instability was present, but actions have been proposed to reduce the risk or eliminate that hazard. With the recommended soil protection measures and mitigations, all appropriate standards and guides can be met.

B. Proposed Action & Connected Actions

The District Ranger for the Sweet Home Ranger District of the Willamette National Forest proposes to implement the following actions during the several years on up to1000 acres within various management allocations in Upper Quartzville, Canal, and Galena Creeks. The project includes the following proposed actions:

- Twenty-nine older plantations of varying size could be treated with a thinning removal in order to improve the growth and vigor of the remaining trees.

- Harvested trees would be removed under a timber sale contract primarily with skyline or helicopter logging systems. A few small areas are available for ground-based systems. No new roads would need to be constructed. Reconstruction of selected sites on existing system roads may be required.

- Slash would either be retained for nutrient development or treated by under burning. Small areas of hand piling may occur along more heavily used road systems. Most piles would be burned.

C. Regulatory Framework

1. Laws and Regulations -- 36 C.F.R. 219.14(a) directs the Forest Service to classify lands under their jurisdiction as not suited for timber production if they fall into any of four categories: 1) Non-forest, 2) Irreversible soil or watershed damage (from NFMA 6(g)(3)(E)(i)), 3) No assurance of reforestation within five years, and 4) Legislatively or administratively withdrawn. This report considers the first three categories of land. On the Willamette National Forest these areas are defined by landtype, which will be explained later in this report.

2. Regional Guidelines -- Forest Service Manual R-6 Supplement No. 2500.98-1 (Title 2520 – Watershed Protection and Management) clarifies direction for planning and implementing activities in areas where soil quality standards are exceeded from prior activities; redefines soil displacement; provides guidance for managing soil organic matter and moisture regimes. In addition, the USDA FS Pacific Northwest Region handbook on General Water Quality Best Management Practices (November, 1988) provides a guide about practices which are applicable in conducting land management activities to achieve water quality standards to ensure compliance with the Clean Water Act, as amended, and Oregon Administrative Rules.

3. Forest Plan Direction – Chapter IV of the Willamette Forest Plan states the Forest-wide Standards and Guidelines for a variety of resources and activities. Soil and Water Quality protection are addressed in the section from FW-079 to FW-114. Based on direction in the Forest Wide Standards and Guides, FW-079 and FW-080 and BMP T-1, T-2 and T-3, the following activities were performed as part of the planning process: A. verifying the present SRI land type boundaries; B) determining the location of unsuited and unmanageable landtypes; C) prescribing slash treatment and suspension objectives for the possible units; and D) evaluating potential watershed impacts from management of the timber resource.

D. Procedures and Methodology

On scattered field days throughout the 2000 to 2003 field season and April 5 and 7, May 4, 5, 24, 25, and 28, and July 15 and 16 in 2004, I conducted a field reconnaissance of potential harvest units and surrounding areas for a planned timber sale at the request of Suzanne Schindler, Silviculturist and Planner, or Ken Loree, Logging Systems Specialist.

The primary purpose of this field investigation was to: 1) verify the SRI land type boundaries in each unit; 2) determine appropriate logging systems; 3) evaluate the potential soil and watershed effects of the proposal; and if needed, 4) propose additional mitigation efforts to protect the soil and water resource.

1) Field investigation standards

A major portion of this aspect of the field investigation was directed at distinguishing the various identifiable landtype components within the study area and mapping them on the photo overlays. Some of the landtype analysis referenced in this report was originally conducted for previous watershed analysis or timber sale planning activities. Much of that earlier work was reevaluated and updated with this project. The information was then transferred to registered overlays in order to represent the data on a standard map base. The data has not yet been digitized, and only hard copy maps are available. Too large to be included with this report at a meaningful scale, a complete copy of the remapped SRI landtypes for this particular project area is on file at the Sweet Home Ranger District.

In general, the field investigation confirmed some of the original 1973 SRI designations and much of the previously mapped work. However, considerable refinement and subdivision of the various boundaries were noted because of the in depth field reconnaissance with this project. Many of the landtypes have several components that were not separated initially because of the mapping scale that was utilized. My field investigation of landtypes and their specific attributes formed the basis for the site-specific recommendations and mitigations that follow in this report.

2. Description and discussion of landtypes

a. Unsuited and unmanageable landtypes have been delineated within the project area as part of the landtype mapping process (FW-180). Unsuited and unmanageable landtypes occur in two basic categories - those acres that are un-regenerable and those where harvest will cause irreversible impacts. Those landtypes which are considered to have regeneration difficulties (BMP T-20) could include 1, 2, 3, 4, 5, 6, 7, 62, 210, 310, 610, and 710 or combinations of these landtypes. Almost all have numerous rock outcrops and cliffs, shallow gravelly soils with rock fragment content generally greater than 70%, and talus. Landtypes 6 and 7 are wet and dry meadows, respectively, and most areas of

Landtype 6 are considered "wetlands" (BMP T-17 and W-3). All are currently considered noncommercial forest land or non-reforestable in the five-year time frame. Officially, 210, 310, and 610 are defined as marginally reforestable at least to extensive levels on easterly and northerly aspects, and non-reforestable in the five-year time frame on southerly and westerly aspects. However, almost no successful timber management has ever occurred on any aspect related to these specific landtypes on the McKenzie River Ranger District. Consequently, the north and east aspects of 210, 310, and 610 are considered unmanageable (no sufficient assurance of regeneration within the five year time frame) land in this report.

b. Landtypes considered unsuited because harvest will result in irreversible resource damage are primarily those that are actively unstable or potentially highly unstable (FW-105, BMP T-6). They could include the primary Landtypes 25 and 35, and the complexes of 255 (25 plus 35), 256, and 356. Landtypes 256 and 356 have actively unstable areas very closely associated and generally in direct contact with stream riparian areas or stream courses. These areas all commonly display slump type topography and include such features as tension cracks, bare soil scarps, leaning and fallen trees, sags and depressions, seeps, and disrupted drainages. Failure depths are such that root strength probably has little affect. However, the instability problem can be aggravated by timber harvest, as removing the trees tends to raise ground water levels due to the loss of evapotranspiration. This in turn reduces the soil strength and can cause increased or renewed instability. Other landtype complexes that contain elements of 25 or 35, such as 251 which is prone to debris chute, need to be evaluated on a case-by-case basis as management activities are proposed.

c. Landtype complexes, such as 212-213 or 303-603 have elements of both (or all) landtypes that were either not differentiable at the photo scale, or sufficient field time was not available to distinguish the various components.

d. The remaining landtypes are adequately discussed in the Soils Resource Inventory (Legard and Meyer, 1973). This document, first developed in 1973 and updated in 1990, was made to provide some basic soil, bedrock and landform information for management interpretations in order to assist forest land managers in applying multiple use principles. The 1973 text and descriptions are used here. A copy is on file at the Sweet Home Ranger District.

In summary, several units border or contain areas of unsuited land. Larger areas of unsuited, unregenerable terrain have been designated and will be avoided with unit layout. Also,two small areas of unstable terrain will be excluded from proposed harvest units. Some units may contain small areas of rocks, talus or cliffs (generally less than one quarter acre) that may be thinned through. Almost all the acreage in the proposed units is located on Soil Resource Inventory (SRI) Landtyps that are considered stable and productive.

III. EXISTING CONDITION and AFFECTED ENVIRONMENT

The Quartzville Thin project area sets squarely within the Western Cascades physiographic province. Rocks, often included in the Little Butte Volcanic Series, are primarily andesitic tuffs and breccias of volcanic origin and are generally Eocene or Oligocene in age (around 32 to 17 million years) (Walker and Duncan, 1989). Topographically, the area can be divided into two distinct regions: A) the western side with sharp relief on steep, shallow-soiled, highly dissected side slopes, and B) an eastern side with more rolling terrain and large expanses of gently sloping ground separated by sharp slope breaks.

B. Western Side - STEEP ROCKY CANYONS

The Canal Creek, Galena Creek, and lower Quartzville systems forms a distinctive trellis drainage pattern where sharp upland ridges plunge rapidly on long steep uniform side slopes into deep gorges and V-shaped canyons. Elevation ranges from about 1600 feet at the western Forest boundary to almost 5000 feet (4965) at Chimney Peak on the south boundary. The steep valley walls are mantled with shallow rocky soils from 1 to 3 feet thick on side slopes from 60% to over 90%. Derived directly from the volcanic residuum and colluvium, soils are generally non-plastic silty sands and gravels. Though the horizons are often not well developed, they are still very productive, likely as a result of the inherent chemistry of the parent bedrock. Small patches of high rock fragment content are common, but this volcanic rock type does not form extensive areas of rock outcrop and talus. The various soils are well to excessively well drained, and permeability is rapid both in the surface soil and subsoil. Because of high infiltration rates and steep side slopes, overland flow almost never occurs. Springs are few and stream fluctuations can be rapid during heavy rainfall events. Stream down cutting of the volcanic formations that comprise the Western Cascades has been the principal slope forming process active in this area. All most all mining activity in Quartzville takes place in this block.

The principal sediment delivery system in operation is down slope movement of the soil mantel by creep or colluvial process. This process is accelerated during large-scale fire events and much of the basin had major fire activity approximately 500 years ago and again 100-200 years ago. Some localized areas of instability are present with debris chutes in the lower canyon, especially in past decades from road sidecast failures. Rotational soil failures or slump type earth flow terrain is very uncommon to almost non existant in this steep rocky landscape. Debris chute activity likely was episodic in nature and peaked during periods when large fires were followed by intense storm events. In the last several decades, slope instability has primarily been associated with sidecast road construction and road drainage problems. Several road-related debris chutes were noted in this general area with the intense rainstorms from 1996 to 2000, and recent failures tracts are present in proposed units Q102, Q201, Q202, Q206, and NS5. Older sidecast failure scars are evident in Units Q1, Q5, Q71, Q73, Q203 and Q207.

Road development in these drainages was extensive, especially during the 1960's and early 1970's. For the most part, these roads were located mid-slope on the steep side slopes and constructed using the sidecast techniques, appropriate at the time. More recent road construction in the upper part of the basin is much more oriented to ridge top locations and utilizes end haul of excess excavation to stable waste areas. The improved construction standards instituted from about 1975 onward were readily apparent from the failure patterns generated by the intense rainstorms of the late 1990's. As would be expected, almost all road related slope failure was associated with the older road systems.

Even on these older roads, heavy ravel and slough from the steep cut banks is still common in many areas. With decreasing dollars in the last decade or so, road maintenance standards have shifted along many sections from in-slope and ditch line to outslope with water bars. Interestingly, FS Rd. 1131202 was one of the first roads to be storm proofed with water bars on the Sweet Home Ranger District, almost a decade ago. Though we will never know for sure, post storm monitoring and this specific field review seemed to indicate that the storm proofing effort proved successful, and far fewer road related failures occurred on that system than might have resulted if no work had been done prior to the major rain-on-snow storms of 1996 and 1997.

B. Eastern side – BENCHES AND MODERATE SLOPES

Elevation ranges from about 2400 feet at the confluence of Little Meadows Creek and Quartville Creek to about 4835 feet at Swamp Mountain. Early to Mid Pleistocene (?) glaciation has left numerous stable upland bench areas and small cirque basins. A geomorphically diverse and complex area, this block contains landforms that range from highly glaciated upland benches and flats, to the occasional stabilized slump/earthflow complex, to steep, shallow soiled, highly dissected headlands with rock scarps and bluffs. Relatively gently sloping, deep and stable glacial soils are common to much of the ridgeline separating the eastern part of the Quarztville from both the Middle and North Santiam River Basins. Larger stabilized slump / earthflow terrain is common to both upper and lower slopes, especially along Road 1155. These have stabilized over time, and little active instability remains except in one site of several acres northwest of Unit Q6. The major slope forming process has been stream incision into highly weathered volcanic strata, glacial deposits, and slumped deposits of the previously mentioned material. The major sediment mover over time is likely creep and colluvial processes that are constantly at work and accelerate during periods of large-scale fire events.

All the proposed "Q" units are managed plantations that originated as clear cuts, which were harvested almost entirely with cable or skyline logging systems. Portions of Units Q 6, 7, 13, 14, 41, and 240 were harvested with ground base systems. Except in a very few cases, skyline or cable corridors are no longer visible. A few old logging spurs and tractor fire lines are still evident on the main ridges, and some well-used skid roads are still visible in the ground-based units. However for the most part, even these heavily disturbed areas have extensively revegetated with conifer and brush. Old landings often contain piles of decomposing logs that provide habitat for a host of species. Considerable brush and regeneration now cover most of these units, and almost no exposed soil remains. Disturbance and erosion from the logging and burning are no longer a concern.

For the most part, compaction from the ground-based equipment logging equipment was limited in extent because of the steep sideslopes. Portions or all of Units Q 6, 7, 13, 14, 41, and 240 were harvested with ground base systems. Some portions of these units may have been at the upper limit or exceeded Regional and current Forest standard at one time. Transects were run in Units Q7, Q13, Q14, and Q41, which were the most extensively logged with ground based systems. They currently show compaction levels of 10%, 7-10%, 14%, and 8% respectively. Some of that compaction has been naturally ameliorated over time by root growth, animal borrowing, and freeze/thaw; some likely remains, although finding it is difficult. Cumulative adverse effects from excessive compaction are not now considered a concern.

IV. ISSUES and CONCERNS

A. Key Issues

Key issues are those that will drive alternative formulation. Given that, no soils or geology issues exist for the proposed action. All action alternatives will contain the same soil protection measures.

B. Concerns

The proposed units are generally located on stable, productive terrain with few regeneration problems. However, debris chute failures from old roadside cast construction and other road related drainage problems are common in most units. The potential for additional management induced slope instability is possible. The field review indicated that previous adverse impacts of harvest from compaction are present in a few units. There is a potential for cumulative significant adverse effect from ground-based systems with this proposed entry. Evidence of adverse impacts from previous cable and skyline yarding was not apparent. The potential for cumulative significant adverse impact from addional skyline yarding, since it affects less than 1% of the ground, is not a concern. All units show considerable regeneration of conifer and brush. Given the retention of a live intact root mat with thinning and standard mitigation measures, the potential for excessive disturbance and off site erosion from logging and harvest is not a concern

This entry will also provide the opportunity to replace, reconstruct or remove drainage structures or road fills and to rehabilitate areas adversely affected by the previous road sidecast construction techniques.

V. DIRECT and INDIRECT EFFECTS

The major short-term impacts to soil productivity from harvest activity, as discussed in the Willamette National Forest Final Environmental Impact Statement (FEIS 1990), include displacement, compaction, nutrient loss, and instability. In most situations, preventing soil impacts is the most effective and feasible way of ensuring long-term soil productivity. The following sections discuss in more detail (1) how the proposed action may effect the soil resource or (2) mitigations that can be utilized to avoid potentially undesirable effects. In summary, the direct effects by the any action alternative on the soils resource are limited in scope. Concerns from a cumulative effect standpoint are excessive compaction and increased slope instability, and mitigations are in place to ensure that that does not occur.

Alternative 1. No Action Alternative

Stands will continue to develop. Intermediate and suppressed trees would slowly be removed from the stand through mortality and decay. In areas of heavy stocking, stands would stagnate. Overstocked stands will rapidly see density increase, growth slow, and mortality rise. Fuel accumulations from blow down, snow down, and bug kill would continue to increase. With bio-turbation and freeze/thaw, compaction would slowly be reduced. Side cast soils will continue to become more stable as plantation trees increase in size, and storm-proofing efforts are maintained. Short-term impacts from harvest, such as soil disturbance, dust, noise and slash accumulation, would not occur.

Action alternatives:

These alternatives were designed to reduce stem density and encourage growth on the leave trees. On a per acre basis, where an activity is proposed, any action alternative requires the use of same existing road and landing system, and the effects to the soils are considered nearly identical.

A. Displacement

To maintain long-term soil productivity, Willamette National Forest Land and Resource Management Plan (LRMP) Standards and Guides require that the total acreage of all detrimental soil conditions not exceed 20% of the total land within each harvest unit, including roads and landings. The logging suspension requirement for a proposed unit is mandated in the LMRP to protect the soil from excessive disturbance or displacement (FW-081 and BMP T-12). The area near tail trees and landings is generally excluded from this suspension constraint. Unless otherwise stated or mitigated, all designated streams require full suspension or yarding away from the stream course during the yarding process (FW-092). Because of the abundance of steep side slopes, the primary yarding objective for all units except Units 6, 7, 13, 14, 41, and 240, is skyline with one end or partial suspension. On some units, helicopter yarding may be required contractually 1) to avoid expansion of the transportation system, or 2) to avoid downhill skyline yarding and the potential associated stand damage. Helicopter yarding will provide an increased level of soil protection, but it is not required as an essential soil mitigation measure.

In Units 6, 7, 41, and 240, ground based harvest systems are suitable on these relatively gentle side slopes. In Units 13 and 14, a mix of ground based and skyline yarding will be utilized, depending on side slope. In addition, small areas within other units, generally along existing roads or at small benches and flats near landings, have side slopes gentle enough for ground based harvest systems.

B. Compaction

The major source of compaction (and also much disturbance) is ground based skidding equipment. <u>Unrestricted</u> tractor yarding and tractor piling are <u>not</u> considered an option on those landtypes where sideslopes are gentle enough (generally less that 30%) to support tractor usage (BMP T-9 and VM-1, and FW-083). The silty nature of the fine-grained soils, and evidence that significant soil moisture is available most of the year indicate that any type of unrestricted tractor yarding and piling (even low ground pressure) would lead to unacceptable soil compaction and/or disturbance. Restricted tractor yarding from predesignated skid roads is considered an option if the adversely affected area is less than 20% of the activity area (BMP T-11). With tractor yarding, skid roads are predesignated, approved in advance of use by the Timber Sale Officer and generally 150 to 200 feet apart. With a processor/forwarder system the skid roads are usually only about 50 to 60 feet apart, but the number of trips for each individual road are substantially less than with skidding.

Monitoring has shown that when designated skid roads are properly utilized in conjunction with line pulling and directional falling, compaction from ground based tractor operations generally remains at about 9 to 12%. Skyline operations in thinning units with small wood and intermediate supports usually impact much less than 1% of the unit area. Residual compaction from the original harvest of Units 6, 7, 13, 14, 41, and 240 needs to be considered. The evident skid roads will be reutilized in this unit. For the most part, few new skid roads will be required. Consequently, compaction is not considered a cumulative concern.

Finally, at the completion of harvest activities, heavily used tractor skid roads and landings (existing or created) that are not part of the dedicated transportation system, may be subsoiled with a "Forest cultivator" or an equivalent winged ripper in order to reduce compaction and return the site to near original productivity. Subsoiling is intended to lift and separate the compacted layers, while minimizing the disruption to the soil horizons or burying organic material. Compacted skid roads often show overland flow during periods of high rainfall and snowmelt. Subsoiling greatly enhances water infiltration into the soil, and reduces the potential for overland flow and subsequent erosion. Subsoiling may be curtailed in areas of 1) heavy regeneration in order to prevent excessive root pruning, or 2) in areas with extensive slash and brush to reduce unnecessary disturbance.

C. Nutrient Loss:

One aspect of long term nutrient availability and ectomycorrhizal formation is the amount of larger woody material retained on site. These stands were harvested 30 to 40 years ago when utilization requirements were much less intense than in more recent decades. Extensive concentrations of down logs are present in numerous areas. Management activities will be planned to 1) minimize disturbance to the existing concentrations of large down woody material, and 2) maintain recruitment of woody debris (dead and down) to provide for a healthy forest ecosystem and ensure adequate nutrient cycling (FW-085) over time. Site specific needs will be considered commensurate with wildlife objectives as outlined in FW-212a and FW-213a (as amended).

Another aspect of nutrient availability is the amount of duff and litter present. After the original clear cuts were harvested, broadcast burning was utilized in these units to remove logging slash, and it is likely that little ground cover (duff and litter) remained. In the several decades since the original harvest and broadcast burn, duff and litter have begun to redevelop across most of the units. Duff Retention is the percent of effective ground cover (generally considered the duff and litter layer and based on the existing pre-management condition) that needs to remain after cessation of management activities (FW-084 and FW-085) in order to minimize nutrient loss, and to protect against erosion (BMP T-2 and F-3). Duff Retention standards will be set for each unit.

Some hand piling may occur along the primary system roads. On typical thinning, hand piles number about 40 per acre and occupy about 20 square feet per pile for a total of about 800 square feet per acre or about 1.8% per acre. Burning the piled slash may develop sufficient heat to affect the underlying soil. However, pile burning is usually done in the spring or winter months when duff and soil moistures are higher, and this helps reduce the heat effects to the soil. Consequently, burning in this manner is considered a minor effect when considering the limited overall acreage involved.

D. Instability

The Quartzville Thin project area, located in the West Cascades physiographic province, lies on steep, stable, shallow-soiled side slopes of eroded Tertiary volcanic strata. Rotational soil failures or slump type earth flow terrain is not common, and that which is present is relatively old and long stabilized. Debris chute type slope instability is an active agent in the down slope movement of soil in most of the analysis area. Several small debris chute type soil failures were noted in this general area with the recent intense rainstorms from 1996 to 2000. Field reconnaissance also indicated the presence of several older debris chute scars, likely the result of intensive rainstorms in the 1960s. Almost all this debris chute activity is related to road drainage problems or road fill failures, primarily from side cast construction techniques. Potentially unstable zones or actively unstable terrain, not associated with road construction or drainage, were not noted in any unit for this thinning proposal, except Units Q6 and Q12.

Consequently thinning, the cutting and removal of trees, is not anticipated to increase the risk of slope instability. Thinning promotes tree growth. Crowns increase in size; root systems expand; and evapotranspiration rates increase. These factors all promote greater slope stability. Field review of previously thinned units has shown no increase in slope instability in either the uplands or riparian reserves. Thinning within and through riparian reserves improves long-term slope stability as stand conditions change with release and increased tree growth. Thinning should emphasize the retention of a well-distributed stand of larger trees, both conifer and hard wood. These larger trees also provide the stream, as well as the entire unit, the opportunity to better withstand the assaults of windstorms and floods over time.

As was mentioned previously, roads constructed through the proposed thinning units were constructed with side cast methods. A mantle of side cast soil and rock now blankets the slopes below most the road cuts for a slope distance of one or two chains. Extensive conifer regeneration has occurred in this belt, and root strength now plays an important role in limiting ravel and maintaining slope stability. Excessive timber harvest could adversely affect that situation. On the other hand, not harvesting, as was discussed in the previous paragraph, is not prudent either. Caution needs to be exercised. Several road-related debris chutes were noted in this general area with the intense rainstorms from 1996 to 2000, and recent failures tracts are present in proposed units Q102, Q201, Q202, Q206, and NS5. Older sidecast failure scars are evident in Units Q1, Q5, Q71, Q73, Q203 and Q207. Consequently, for one to two chains below roads in these Units, leave trees will be designated such that the larger trees with extensive root mats, and especially those trees with pistol butt trucks (indicative of sidecast creep) will be maintained. As was mentioned before, it is essential for long term slope stability, that thinning emphasize the retention of a well-distributed stand of larger trees, both conifer and hard wood.

In unit slope instability was mapped in Units Q12 ,Q14 and Q6. With Units Q12 and Q14, the potentially unstable area involves less than an acre and involves steeper slopes directly above Quartzville Creek or a major tributary. It is recommended that both these areas be deleted from their respective units. With Unit Q6, the area is a band of a couple of acres of steeper soils within the central part of the plantation. The failures here are shallow debris chutes, and root strength plays an important role in maintaining long term slope stability. Consequently, it is recommended that this area be thinned through at the same prescription as the rest of the unit in order to promote tree growth.

E. TRANSPORTATION SYSTEM

Existing, rocked roads access almost all units though some of these are overgrown with vegetation. Ditches and culverts are common, though they need cleaned out and maintained because of continuing heavy ravel and slough from the steep cut banks. Road maintenance standards have shifted along many sections from in-slope and ditch line to outslope with water bars. Most of these roads have solid subgrades, which are suitable for dry season haul with perhaps a little spot rocking in a few critical areas. Extended season or wet weather haul may require additional rocking of some access roads. At the completion of logging activities, these roads should be storm proofed with water bars as appropriate to control seepage or storm run off.

This entry will provide an opportunity to evaluate the haul system. Active management of the road system is essential in reducing the risk of further road related slope failure in the future. Inadequate drainage structures may be replaced, reconstructed or removed. Critical side cast areas can be removed or stabilized. In summary, reconstruction and utilization of the existing transportation system for this sale will maintain or improve slope stability, will produce little or no off site erosion, and will provide options to rehabilitate or remove old road courses.

VI. INDIRECT AND CUMMULATIVE EFFECTS ASSESSMENT

The effects by the action alternatives on the soils resource are very limited in scope. At this time, no single unit of measure of long-term soil productivity is widely used. Information on the survival and growth of planted seedlings may indicate short-term changes in site productivity. However, the relationship between short-tern changes and long-term productivity is not full understood at present. Experience indicates that the potential impacts on soils are best evaluated on a site specific, project-by-project basis. The major soils concerns –compaction, nutrient loss, displacement, and instability – are most effectively evaluated, for both short, long term and cumulative effects, at the project level. With proper project implementation, as specified by my recommendations, unacceptable cumulative effects on the soils resource are not anticipated form any action alternatives. Consequently, the utilization of soil protection measures and best management practices as defined in this report, will generally preclude the need for additional cumulative effects analysis. Deviations from the standards and guidelines would be the primary trigger for additional cumulative effects review, and no deviations are planned.

VII. MITIGATION MEASURES, by unit and common to all action alternatives

These recommendations were developed based on direction in the Forest Wide Standards and Guides (primarily FW-079, FW-090 and FW-179) to maintain or enhance soil productivity and stability, and to reduce or eliminate off site erosion. This data table addresses suspension requirements and duff retention objectives, as well as pertinent specific comments for particular units (where necessary).

UNIT	SRI	SUSPENSION	DUFF RETENION	COMMENT
Q1	201, 202	Partial, some Grnd	60-80%	
Q2	16, 201	Partial, some Grnd	60-80%	Yarding system depends on side slope.

Q4	303-603	Partial	60-80%	
Q5	201, 132, 233	Partial, some Grnd	60-80%	Bench below Rd. 11.
Q6	13, 251, 201-212	Partial and Grnd	40-60%	Potentially unstable area north part of unit – thin.
Q7	13	Ground, some partial	30-50%	Some steep pitches
Q8	201	Partial	60-80%	Rock at N Bndry
Q11	122, 212 132-233	Partial and Grnd	30-50%	Unsuited rocky area above road – old rock pit
Q12 Q12A	162-164, 212	Partial, some Grnd	40-60%	Unstable area SE Corner - Delete
Q13	201, 231- 233-236	Grnd and Partial	20-40-%	Some steep areas
Q14 Q14A Q14B	231-233-236 313	Grnd and Partial	30-50%	Some steep areas. Unstable area at east tip - delete
Q41	13	Ground, some partial	30-50%	Some steep pitches
Q50 Q50A	167, 303-603	Partial, some Grnd	60-80%	
Q51	303-603	Partial, some Grnd	60-80%	
Q70	303	Partial, some Grnd	60-80%	
Q71	303	Partial	60-80%	Unsuited rocky area in SW corner. Delete from Unit. Short areas of side cast pull back recommended along road.
Q72	603	Partial	60-80%	
Q73	164, 614, 603-614	Partial	60-80%	
Q102	201, 212-213	Partial	60-80%	Add slash to debris chute scar
Q115	203, 233	Partial, some Grnd	60-80%	

Q201	16, 201	Partial	60-80%	
Q201A	201	Partial	60-80%	Delete rocky areas below road
Q202	201	Partial	60-80%	Delete rocky areas below road
Q203	201, 204	Partial	60-80%	Delete rocky areas along stream
Q206	201	Partial	60-80%	
Q207	201	Partial	60-80%	
Q209	201	Partial	60-80%	
Q240	162	Grnd	20-40%	
Q241 Q241C	201, 16	Partial	60-80%	
NS1	201, 23	SKL	60-80%	
NS2	201,212	HEL	60-80%	Avoid rocks NW, N, NE boundary
NS5	201, 212	SKL, HEL	60-80%	Avoid rocks along south boundary

GRND – ground based yarding system. SKL – skyline cable yarding system with one end suspension.

IMPORTANT NOTES:
1) Some possible units may not be proposed in any action alternative.
2) All ground-based harvest requires LTSR – Locate tractor skid road, in the contract.
3) On many units, helicopter yarding may be required contractually to reduce stand damage or the need for an expanded transportation system. This is desirable because it minimizes soil disturbance, but it is not required for adequate soil protection.

The following mitigation measures are common to all Action Alternatives:

1. Ground-based equipment should generally operate in the dry season, usually considered May through October, unless otherwise restricted by other resource concerns or agreed to by Forest Service personnel.

2. Harvested trees should usually be topped and limbed in the units in order to provide for nutrient recycling and control of ravel and slough on steep side slopes.

3. Ground -based equipment shall generally be limited to slopes less than 30%, unless otherwise directed by Forest Service personnel.

4. Ground-based skidding equipment or forwarders shall stay on designated skid trails. Ground-based skid trails will be predesignated and preapproved before use (LTSR). They should generally be about 10 feet wide and should not usually exceed 15 feet in width, and where practical the skidder, cat or processor/ forwarder should travel on slash. Traveling on slash will help reduce off site soil erosion or lessen soil compaction.

6. Partial or one end suspension is required on skyline units, except at tail trees and landings. Given the uneven terrain in some units, small areas of ground lead may occur along ridge lines or benches.

7. Unless otherwise approved, the reopening of temporary, unclassified roads should occur in the dry season, usually June through October to avoid surface erosion from exposed soil. Open roads should be storm proofed if they have to set through extended periods of wet weather.

8. Where practical, at the completion of harvest activities, limbs and woody debris should be placed on areas of exposed soil to reduce the potential for off site soil erosion.

9. Unclassified or temporary haul roads used outside the standard operating season, should generally be rocked to reduce erosion.

10. Cable corridors spacing should be set to both minimize damage to vegetation as well as the underlying soil.

11. Trees, not designated for harvest in riparian buffers that need to be cut to facilitate harvest operations, should be dropped into the stream to aid in woody debris recruitment.

12. Avoid disturbance to the existing down woody debris concentrations from the initial entry as much as practical.

13. At the completion of harvest activities, heavily used, tractor skid roads (existing or created) that are not part of the dedicated transportation system, should be adequately subsoiled with a "Forest cultivator" or an equivalent winged ripper in order to return the site to near original productivity, unless otherwise waived by the Forest Service. This can be accomplished either by the contractor or through the KV process.

Prescriptions for soil protection, watershed considerations and riparian needs of the sub-basin take into account past and predicted future land management activities. The soil mitigation measures, as well as the streamside management zones, are designed to provide a level of riparian habitat protection and erosion control that is consistent with the standards and guidelines of the Willamette National Forest's Land and Resource Management Plan. On site sedimentation is anticipated to be within National Forest and Oregon State Guidelines. All prescriptions or mitigation measures discussed in this report are designed to meet or exceed the requirements outlined in the General Water Quality Best Management Practices Handbook (Pacific Northwest Region, November 1988). Standard contract language should provide for sufficient erosion control measures during timber sale operations (BMP T-13). Revegetation of areas disturbed by harvest activities (such as landings, temporary roads, and equipment storage areas) is required with an appropriate grass seed mix (BMP T-14, T-15, and T-16).

VIII. MONITORING REQUIREMENTS

Other applicable Standards and Guides and/or Best Management Practices may exist which were not directly referenced in this document. Their exclusion does not indicate that they were overlooked or are inapplicable. As project development proceeds, appropriate constraints or mitigations may be added or changed in order to better meet the intent of adequate resource protection or enhancement as directed in the Willamette LRMP. As the proposed project is initiated, it will be monitored to evaluate implementation efficiency, prescription adequacy, and to update sale area rehabilitation needs or protection.

The Timber Sale Officer will conduct implementation monitoring at the contract administration phase of the project. The logger will be required to maintain adequate suspension during the harvest process. In addition, numerous other contract requirements dealing with such items as erosion control, hazardous material use, fire restrictions, etc. will be enforced. Duff retention will be monitored as part of any post sale activity that affects the soil resource.

IX. IDENTIFICATION OF IRREVERSIBLE OR IRRETRIEVABLE RESOURCES

No irreversible and /or irretrievable use of the soils or geology resource is anticipated, beyond that which has been previously identified in the Willamette National Forest Land and Resource Management Plan, as amended.

X. REFERENCES

Legard, Harold A. and Meyer, LeRoy C., 1973: Willamette National Forest Soil Resource Inventory, Pacific Northwest Region, 167 p.

Walker, George W. and Duncan, Robert A., 1989, Geologic Map of the Salem 1 (degree) by 2 (degree) Quadrangle, Western Oregon: Miscellaneous Investigations Series, U. S. Geological Survey, 1989G.

XI. CONSULTATION WITH OTHERS - Ken Loree, Logging Systems Specialist.

DOUGLAS C. SHANK, District Geologist

USDA United States Department of Agriculture | Forest Service | Willamette National Forest | 211 East 7th Avenue Eugene, Oregon 97401

File Code: 1950 NEPA
2670 Threatened, Endangered, or Sensitive Plant and Animals
Date: March 6, 2006

Subject: Quartzville LSR Thin, Biological Assessment, TES Fish Species

To: Sweet Home District, Quartzville LSR Thin Analysis File

The Quartzville LSR Thin project has the potential to affect stream habitat within the Upper Quartzville Creek, Galena Creek, and Canal Creek HUC6 watersheds. These watersheds historically provided habitat for Threatened Upper Willamette River (UWR) Chinook salmon and UWR steelhead, but these species are not currently utilizing this habitat due to the construction of Green Peter dam in 1967. This dam blocked the free upstream migration of anadromous fish to the habitat within the project area. The passage facility on Green Peter dam is ineffective and upstream movement of adult anadromous fish has not occurred through this facility since 1987. Steelhead have not been moved over the dam. In 2004 and 2005 ODFW stocked juvenile spring chinook salmon above Green Peter Reservoir in Quartzville Creek and other tributaries. ODFW released 80,000 fry and 100,000 Chinook salmon pre-smolts in 2004, and 140,000 fry and 100,000 Chinook salmon pre-smolts in 2005. It has yet to be determined if Chinook salmon will be released above Green Peter dam in 2006. Monitoring conducted by ODFW indicate that these transplanted fish do not stay in the stream reaches where they are released, but likely migrate downstream to Green Peter Reservoir within a few months of their release. It is uncertain if out-year transplanting will continue. If it is not continued, the Chinook salmon would likely only be found in Green Peter reservoir, 7 miles downstream from the project area.

If the out-planting does continue during the life of the Quartzville LSR Thin project, the project area would be located within ¼ mile of the nearest Chinook salmon release site.

However, the analysis of effect to water quality for this project indicated only minor, site-specific negative effects would be realized. These effects will not of sufficient magnitude to be transmitted downstream and result in any discernible negative effects or result in negative cumulative effects.

Streams above Green Peter Dam were not included as critical habitat for UWR Chinook salmon or UWR steelhead in the 2005 designation.

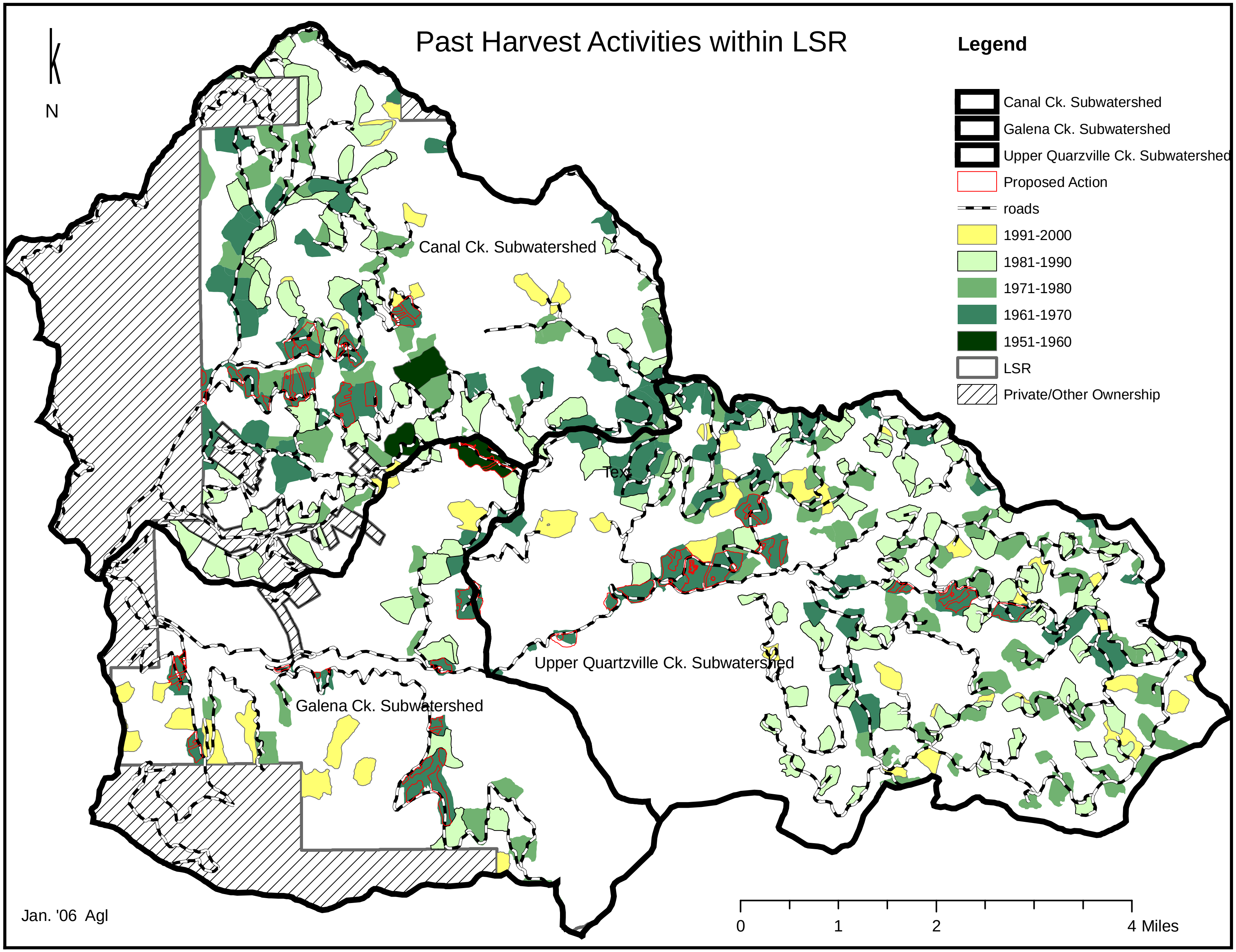
Therefore, there is a zero probability that the implementation of this project will result in any discernible effect to the ESA-listed fish species which are found at least 1/4 mile downstream from the project area. It is determined that this project will have No Effect on UWR Chinook salmon, No Effect on UWR steelhead, No Effect on UWR Chinook salmon designated critical habitat, and No Effect on UWR steelhead designated critical habitat.

Wade E Sims

Wade E. Sims

ESA Consultation Biologist (Fisheries), Willamette National Forest

The following is a map of past harvest activities in the planning area as well as a list of past activities here.



Appendix M: Activities Potentially Contributing to Cumulative Effects		
Past/Present/Future	**Activity**	**Effects**
	Wildlife	
1992-Present	Designation of Critical Habitat Unit	Management activities have changed to be more in line with development and maintenance of late-successional habitat here.
1994- Present	Designation of Late-Successional Reserves	Management activities have changed to be more in line with development and maintenance of late-successional habitat here.
	Surveys of wildlife populations (i.e. spotted owls, etc.)	Have better idea what impacts that management activities have on some species.
	Fisheries	
2004-2005	Planted spring Chinook salmon above dam	Pre-smolts and fry released above dam
mid-1990's	Placed large woody structures in about 1 mile of stream	Improved fish habitat- stored sediments and spawning gravels, increased pools
	Vegetation	
Past 1950'-1980's	Clearcutting almost 10,500 acres in analysis area since 1950's	Changed stand structure and seral stage distribution
		Decreased patch sizes of late-successional habitat
		Removed snags
		Increased forage for big game, reduced prey base for spotted owls
		Loss of interior habitat
		Increase in edge more likelihood of blowdown
		Loss of snags and coarse woody material
		Increase in peak flows
		Removed suitable spotted owl habitat
		Creation of a variety of habitat that is good for some species
		Affected visual quality
1950's-Present	Yarding Operations	May displace dispersed recreation activities during operations
		May displace and/or disturb wildlife during operations
		Could disturb heritage sites
1950's-Present	Use of ground-based yarding equipment	Soil compaction
		Soil displacement
		Runoff channeled down skid roads

Vegetation		
1950's - Present	Firewood cutting	Reduced snags and down woody material
1950's - Present	Reforestation	Planted trees densely. Early on plantings had less variety of species than more current plantings.
1960's - Present	Pre-commercial thinning	Increased tree growth and size on plantations
1950's to present	Harvest of private land in western portion of analysis area	Likely to only ever develop into spotted owl dispersal habitat
		Hard to manage on landscape level with varied ownership and management philosophies
1994-Present	Timber harvest	Annual volume of timber reduced. Types of harvest changing such as variable density thinning.
1994-Present	Harvest of special forest products	Increased demand for special forest products
1950's to Present	Noxious weeds spread	Travel on roads whether for recreation or commercial purposes has contributed to the spread of noxious weeds
		Identification and treatment of noxious weed sites has helped to curb the introduction and establishment of new noxious weed populations
1960's to present	Thinning	Increase tree sizes
		Increase light to forest floor - stimulate growth of understory species - increase forage
		Increased slash build up - increasing risk of fires, creating habitat, insect
1990's	Harvest of yew bark for taxol	Loss of yew trees in watershed
		Affected lichens that grow on yew trees
2005-2015	Variable density thinning	In next decade about 1000 additional acres will be ready for thinning
		Accelerate development of late-successional stand conditions in LSR, by perhaps decades, on the thinned areas.
1990 - Present	Protection of sensitive plant species	Maintain species diversity
1990	Retention of snags and down woody material in harvest units	Beginning to improve snag and down wood habitat
Continually	Vegetation growth	Reduction in peak flows
		Increase in hiding cover for big game
		Reduction in big game forage and forage quality
		Stabilized soil - reduced erosion and sediment to streams
		Stabilization of some road sidecast areas
		Increased shade to stream channels - begin to lower stream temperatures
		Hydrologic recovery

		Habitat is growing into spotted owl dispersal habitat
Hydrology/Stream Channels/Water Quality		
1994-Present	Implementation of NW Forest Plan Aquatic Conservation Strategy Objectives (*including Riparian Reserves, watershed analysis and standards and guidelines*)	Beginning to see improvement in riparian habitat, stream shade and stream structure.
1964, 1996	Floods	
Soils/Geology		
1980's - Present	Sidecast pullback	Reduce slope failures
1980's to Present	End-hauling used in road construction	Reduce potential for slope failures
1990's to Present	Subsoiling	Reduce soil compaction
Fire/Fuels		
Past	Large-scale fires both stand-replacing and underburning	Reduced snags and down wood in watershed
Past 1950's - 1980's	Broadcast burning	Removed coarse woody material
		Depletes soil
		Reduces duff layer
		Loss of snags
Late 1980's - Present	Grapple piling, hand piling, etc.	Better protection of soil resource
1900's - Present	Fire suppression	Changes in natural fire regime, but not outside range of natural conditions. High fuel loadings so possible elevated risk of high-severity fire due to the continuity of vertical and horizontal fuels exists across the landscape
		Snags felled - loss of habitat

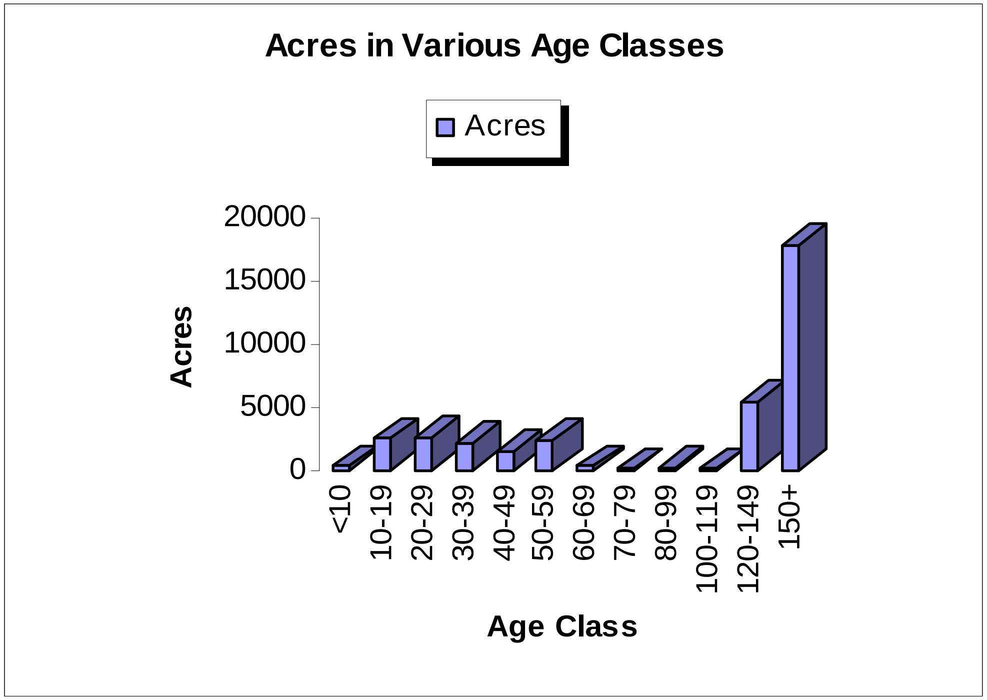
Transportation and other infrastructure		
1950's to 1980's	Road construction and transportation development using sidecast road-building techniques	Increased sediment affects beneficial uses
		Stream crossings - affect fish habitat
		Increased peak flows
		Extension of drainage network
		Vegetation loss affects habitat
		Reduction in effectiveness of habitat near roads for deer and elk
		Removed suitable spotted owl habitat
		Disturb heritage sites
		Better recreational, administrative and fire suppression access
1950's-1980's	Sidecast road construction techniques	Slope failures
1980's to Present	End-haul road construction techniques	More stable roads
		Less erosion
1950's to present	Road use - traffic	Introduction of exotic species
		Direct mortality of animals
		Increased noise and disturbance to wildlife
		Snags near roads felled to protect public safety - loss of habitat
1950's to present	Road surfacing	Rock use irretrievable
		Spread of noxious weeds
		Minimize erosion
1950's to present	Road maintenance activities	Sediment
1990's to Present	Road decommissioning, obliteration, and closures	Reduced road maintenance costs
		Storm-proof and/or store roads
		Less access for recreation, commercial and administrative activities
		Less traffic on roads
		helps direct flow to natural drainage pattern
		Reduced wildlife disturbance
1990's to Present	Lack of road maintenance due to funding and no timber sales	Some roads beginning to brush in and close on own
		Less access for recreation, commercial and administrative activities
1994- Present	Culvert replacement	Improve ability of road to handle large amounts of water during flood events
1960's	Construction of Green Peter and Foster Dams	Blocked upstream migration of fish including spring Chinook salmon and winter steelhead in many areas

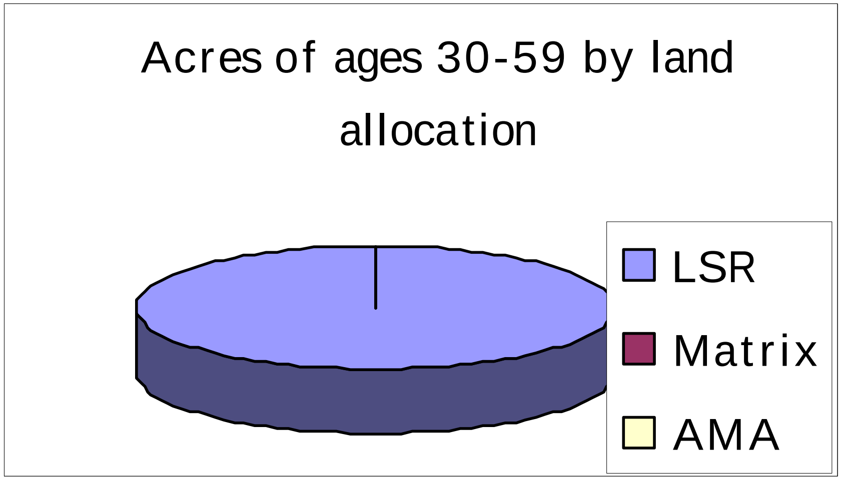
Recreation		
1950's - Present	Dispersed recreation sites near streams	Some soil compaction from vehicles and foot traffic
		In some areas, recreaton affects nesting use by Harlequin ducks
1950's - Present	Recreation use	Contributes to weed populations
1970's - Present	Middle Santiam Roadless Area designation	Precludes road construction in roadless area so little management has occurred here
1990's - Present	Installation of Port-a-Potties at dispersed sites	Minimice human waste contamination of water
1990's - Present	Armor dispersed sites	Minimize soil compaction
Mining		
Pre-`996	Mine on McQuade Creek	Sedimentation
		Channel destabilization
		Increase in stream temperature

Table 1

LMP	Total Acres	Plant Association	Stand Age											
			<10	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-99	100-119	120-149	150+
Late-Successional Reserve	12410	silver fir	173	895	1207	799	415	824	88	25	65	24	1923	5972
		grand fir												
	44	Douglas-fir		5	6	4	10						5	14
	22034	western hemlock	69	1507	1253	1218	1021	1457	145	17	106	4	3429	11808
	76	mountain hemlock		1	24	29	4	1						17
	65	ND		20	6	5	8						6	20
	34629		242	2428	2496	2055	1458	2282	233	42	171	28	5363	17831
Matrix		silver fir										1		8
		grand fir												
		Douglas-fir												
		western hemlock												8
		mountain hemlock												
		ND												
	34629		**242**	**2428**	**2496**	**2055**	**1458**	**2282**	**233**	**42**	**171**	**29**	**5363**	**17847**

Age Class	<10	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-99	100-119	120-149	150+
Acres	242	2428	2496	2055	1458	2282	233	42	171	29	5363	17847


Acres in Various Age Classes
Acres
20000
15000
10000
5000
0
Acres
<10
10-19
20-29
30-39
40-49
50-59
60-69
70-79
80-99
100-119
120-149
150+
Age Class


Acres of ages 30-59 by land allocation
LSR
Matrix
AMA