Quartzville Watershed Analysis

September 2002

Quartzville Creek Wild and Scenic River

UNITED STATES
DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Salem District-Oregon
Cascades Resource Area

UNITED STATES
DEPARTMENT OF AGRICULTURE
U.S. Forest Serivce
Willamette National Forest - Oregon
Sweet Home Ranger District

Quartzville Watershed Analysis

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Executive Summary

This executive summary provides an overview of the Quartzville Watershed Analysis. It summarizes major elements contained within the document, including a brief description of the analysis area, watershed analysis purpose and process, issues and key questions, and findings and recommendations of the analysis.

Watershed Analysis Area

The Quartzville Watershed is located in northwest Oregon, and falls entirely within Linn County. The watershed is 95,468 acres in size and extends from Green Peter Dam along the Middle Santiam River on the west end, to the vicinity of Scar Mountain on the extreme east end of the watershed (See Map #1: Location Map). Sweet Home is the closest community to the Quartzville Watershed, located approximately five miles southwest from the western boundary of the watershed.

Elevations range from about 1,000 feet at Green Peter Dam, to 4,974 feet at Galena Mountain, the highest peak, located on the south end of the watershed. The watershed is stratified into seven Sub Watershed Basins (SWBs) including South Green Peter, Whitcomb Creek, Moose Creek, Packers Gulch, Canal Creek, Lone Star, and Upper Quartzville. The watershed is located within Western Oregon Cascades Physiographic Province.

The Quartzville Watershed is bounded by several other watersheds, including Crabtree Watershed to the west, Thomas Creek and the Middle North Santiam River Watersheds to the northwest, Detroit Reservoir/Blowout Divide Creek Watershed to the north, and the Middle and South Santiam Watersheds to the south. Watershed analysis has been completed for all of these watersheds.

The majority (72 percent) of the watershed is federally managed. Of those public lands, the U.S. Forest Service (FS) manages 34,629 acres (36 percent), the Bureau of Land Management (BLM) manages 30,783 acres (32 percent) and the U.S. Army Corps of Engineers (ACOE) manages 3,613 acres (four percent). The state of Oregon manages 14 acres of land and the remaining 26,429 (28 percent) is privately owned.

Excluding ACOE lands, federal lands in the watershed are managed according to the standards and guidelines of *the Salem District Resource Management Plan (May, 1995)* for BLM Lands and *Willamette National Forest Land and Resource Management Plan (1990)* for FS Lands. Both of these plans are in compliance with the *Northwest Forest Plan (1994*). Most of the private lands in the watershed are managed as industrial forest land under the Oregon Forest Practices Act (OFPA).

Watershed Analysis Purpose and Process

The purpose of a watershed analysis is to provide federal agencies a comprehensive and systematic analysis to guide planning and management of federal lands within the watershed. It is intended to guide planning and land management activities to successfully meet the intent of the *Northwest Forest Plan* as it applies to the watershed.

Watershed analysis develops and documents a scientifically based understanding of the ecological structures, functions, processes, interactions and historical conditions within a watershed. This analysis process identifies current conditions, trends, findings, recommendations and data/inventory gaps. The information contained in this document will help in making sound resource management decisions for federal lands contained within the watershed. The watershed analysis will serve as the framework for developing site-specific proposals, monitoring and restoration needs. Cooperation with other landowners is necessary since the analysis addresses the entire watershed. The analysis is designed as a tool for federal agencies and will not be used to direct other landowners on the management of their lands.

Watershed analysis is an ongoing and dynamic process. It will be revised and updated as conditions, assumptions, or resource plans change and new information becomes available. Watershed analysis is **not** a decision-making process. It is a stage-setting analytical process that offers constraints and provides guidance for future management decisions.

The watershed analysis process begins by identifying significant resource issues which focus on a basic analysis of ecological conditions, processes, and interactions in the watershed. These issues are addressed by asking basic and fundamental key questions. Key questions focus the analysis on cause-and-effect relationships and on conditions as they relate to the ecological processes occurring in the watershed. The key questions have been grouped into three resource categories: Terrestrial, Aquatic and Human Uses. While there are considerable overlap and interaction between the various ecosystem components and processes in a natural system, these broad categories serve as an organizational aid to facilitate analysis of complex systems. This organization is carried through the entire document for ease of reading and organization.

Issues and Key Questions

The watershed analysis process begins by identifying significant resource issues which focus on a basic analysis of ecological conditions, processes, and interactions at work in the watershed. These issues are addressed by asking basic and fundamental key questions. Key questions focus the analysis on cause-and-effect relationships and on conditions as they relate to the ecological processes occurring in the watershed. The interdisciplinary team (IDT), with comment from the public, identified and distilled basic issues and key questions on which to focus the analysis. The following describes the primary issues and key questions that directed the analysis process.

Terrestrial Resources

Issue: What management opportunities exist for protecting, maintaining, and/or improving terrestrial resources in the Quartzville Watershed?

Discussion: Terrestrial resources include vegetation, plant communities, forest health, wildlife habitat and Special Status/Special Attention plant and animal species. Land management activities have altered the watershed, resulting in changes in distribution and patterns of occurrence of habitat and species. Terrestrial resources are also affected by natural processes such as natural succession and disturbance processes. How can federal land management objectives associated with managing terrestrial resources best be met in this watershed?

Key Questions:

* What is the current condition of the terrestrial resources in the watershed?

* What are the dominant natural processes and how do they affect terrestrial resources?

* How have private and public land use practices influenced terrestrial resources and how will they in the future?

Aquatic Resources

Issue: What management opportunities exist for protecting, maintaining, or improving aquatic resources in the Quartzville Watershed?

Discussion: Aquatic resources include water quality and quantity, flood control, private and municipal water rights, fish species and instream habitat. Aquatic resources are affected by both physical conditions and natural processes such as hydrology, riparian condition, soils, erosion, and slope stability. Land management activities have altered the watershed resulting in declining fish runs, water quality and aquatic habitat degradation. Of specific concern is Quartzville Creek, which is listed by DEQ as water quality limited for summer stream temperature (as stated in the 303(d) report). Demands for aquatic resources are increasing and so are conflicts with other resource uses. How can federal land management objectives associated with managing aquatic resources best be met in this watershed?

Key Questions:

* What is the current condition of aquatic resources in this watershed?

* What are the dominant physical conditions and natural processes affecting aquatic resources?

* How have private and public land use practices influenced aquatic resources and how will they in the future?

Social

Issue: What developments or other management opportunities exist to meet the demand for recreational and natural resource commodities in this watershed, while still providing resource protection consistent with federal land management objectives?

Discussion: Social resources consider human uses including forest products, transportation, minerals, and recreation. The demands on watersheds to provide for a variety of human uses and products is increasing. This analysis will focus on the role that federal lands currently play in the watershed and what future opportunities may be possible.

Key Questions:

* What are the major or human uses and where do they occur?

* What are the main concerns related to human uses?

* What are the current and future trends related to human uses?

* What future opportunities exist for meeting the needs of those directly or indirectly using the watershed or products from the watershed?

Findings and Recommendations

The following Findings and Recommendations describe the types of actions or activities that the Bureau of Land Management (BLM) and the U.S. Forest Service (FS) could implement in the Quartzville Watershed to improve conditions and positively influence trends. These findings and recommendations along with the rest of this document can help provide a base of resource information necessary to guide agencies in identifying site specific projects and determining priorities for projects both within the Quartzville Watershed and in comparison to other watersheds

Terrestrial

Findings:

Terrestrial Finding #1- Mature and Old-Growth (Late Seral or Late Successional) Forest Habitat: The analysis of current conditions shows 47 percent late seral forest across all ownerships. Approximately 33 percent in is old growth forests more than 200 years of age. Ninety-three percent of the late seral forest in Quartzville Watershed is on federal lands. Late seral forests comprise 60 percent of the federal ownership in the watershed. Approximately 46 percent of the federal ownership in the watershed is in old-growth forests.

Acres of late seral forest in the Quartzville Watershed was further broken down by ownership and Sub Watershed Basins (SWBs). The Lone Star, Upper Quartzville, Canal Creek, and Packers Gulch SWBs are the most viable SWBs in terms of the amount of late seral forest habitat, all with over 50 percent in late seral conditions. The amount of late seral in Moose Creek and Whitcomb SWBs is limiting with 34 percent and 24 percent, respectively. The amount of late seral forest in the South Green Peter SWB is the lowest in the watershed at 18 percent.

About 50 percent of the late seral forests in the watershed are functioning as interior late seral forest habitat. The Quartzville Watershed has a lot of potential to support a fairly solid matrix of older forest across the landscape. Ownership patterns are not as disrupted as adjacent watersheds to the north, west and south, where scattered federal ownership has limited potential to contribute to late seral conditions across the landscape over time. As Riparian Reserves and Late Successional Reserves (LSRs) on federal lands are allowed to mature, the entire watershed (all ownerships) has the potential to support about 64 percent late seral forest habitat within 80 years under current management.

Terrestrial Finding #2 - Standing Dead/Down Coarse Woody Debris (CWD): Overall, there is not enough large, harder material as either snags or down CWD in younger stands that will persist in the long term. The inventory and stand exam data for the watershed show that snags are scarce in most of the younger stands less than 40 years old. There are adequate numbers of

snags present in closed sapling, mature and old growth stands. Since mature and old growth (late seral) stands are scattered throughout the watershed mostly on the federal land, there is currently an adequate amount and quality of standing dead material over the most of the watershed.

The amount and condition of down CWD appears to be fairly good in the short term, with over half of the inventory plots meeting the Northwest Forest Plan (NFP) standard of 240 lineal feet per acre of hard material over 20 inches in diameter. Most of the younger stands have down CWD left from previous logging in the more advanced stages of decay, much of which is smaller diameter material. In the long term, there will be a lack of large down CWD as these stands mature, due to the current lack of standing dead material available for recruitment. The closed sapling and late seral stands have snag components that will contribute down CWD in the long term. According to the Mid-Willamette LSR Assessment (LSRA), CWD should cover 10-15 percent ground cover of all diameters and tree species in the LSR. Most of the stands in the LSR currently fall below this recommendation..

Over the long term, the amount of standing dead material and down CWD on federal lands is expected to exceed 60 percent of potential cavity dwelling wildlife populations as LSRs and Riparian Reserves mature and green tree retention guidelines are implemented. There would be a slight increase of standing dead/down CWD on private/state lands as relatively new OFPA requirements continue to be implemented.

Terrestrial Finding #3 - LSR Boundaries: LSR boundaries in the vicinity of Harry Mountain Ridge, and Green Peter Peninsula delineated by the Salem District RMP follow interior section lines rather than topographic features and/or known Special Status/Special Attention Species occurrence. Managing along legal boundaries irrespective of ecological features and species occurrence would be inconsistent with the management of these LSRs as ecosystems and protection of known Special Status/Special Attention Species. Adjustment of LSR boundaries along topographic features, type changes, or even roads rather than legal boundaries would make the LSRs more ecologically sound.

Terrestrial Finding #4 - Special Habitats: Small natural forest openings such as wet meadows, dry meadows, ponds, dry grass hillsides with shallow soils, Sitka alder/brush patches, cliffs, crevices and talus slopes are present and scattered throughout the watershed. The most prevalent special habitats in the Quartzville Watershed include rock/outcrops/cliffs (2500+ acres), dry meadows (800+ acres), and talus slopes (300+ acres). These types of special habitats are most commonly associated with the major peaks and ridges, and many are shared with adjacent watersheds. Wet meadows and ponds (25+ acres) are not as prevalent due to the steepness of the landscape. They are often associated with headwaters of major tributaries such as Boulder Creek and Little Meadows Creek.

The majority of the identified special habitats on federal lands within the Quartzville Watershed are within LSR and/or located on very steep hillsides and would be protected from most human intrusion.

However, encroachment in the form of growth and establishment of trees and invading brush is evident in some of the meadows due to fire exclusion. In the past, disturbance caused by wildfires have helped maintain these systems. This process can be expected to continue unless prescribed fire or other means is used to limit forest encroachment on meadow ecosystems.
Terrestrial Finding #5 - Road Densities: There are approximately 586 total miles of road on all ownerships within the watershed. Currently, the average total road density across all ownerships is estimated at about 4 miles per section. The highest road densities occur in the Packers Gulch and Whitcomb Creek SWBs. The lowest road densities occur in the Lone Star SWB.

Of the 586 total road miles in the watershed, 362 miles are on federal lands (62 percent). Average total road density on federal lands is estimated at about 3.35 miles per section. Road densities on federal lands are highest in the Canal Creek and Packers Gulch SWBs on BLM lands. Road densities on federal lands are lowest on Forest Service (FS) lands in the Lone Star SWB and on BLM lands in South Green Peter SWB.

Terrestrial Finding #6 - Special Status/Special Attention Plant Species: There are four known populations of BLM special status plant species populations and numerous known survey and manage species sites in the watershed. These species include tall bugbane (*Cimicifuga elata),* fir clubmoss *(Huperzia occidentalis),* meadow sidalcea (*Sidalcea campestris),* and noble fir polypore fungus *(Bridgeoporus nobilissimus).* A FS Sensitive Species is Thompson's mistmaiden (*Romanzoffia Thompsonii).*

Terrestrial Finding #7 - Noxious Weeds: New invader and established infestation noxious weed species are present along many roadsides in the watershed. These noxious weeds are present and will continue to invade native plant habitats if no action is taken. Noxious and invasive weeds will continue to be a concern over time because of the increased human use of the watershed, especially at lower elevations and in travel corridors.

Terrestrial Finding #8 - Special Status/Special Attention Animal Species: There is one Survey and Manage mollusk species that is documented to occur in the Quartzville Watershed. The Oregon megomphix *(Megomphix hemphilli),* a Survey and Manage Bureau Sensitive species, is found in moist conifer/hardwood forests with big-leaf maple in association with duff and leaf litter at low to mid elevations.

The red tree vole, a Survey and Manage species, is likely to occur in the Quartzville Watershed. This arboreal vole is found in mid to late seral forests with closed canopies, primarily below 3500 feet elevation. The Quartzville Watershed is 72 percent federal ownership, of which 65 percent is suitable habitat for the red tree vole. Red tree vole habitat occurs in all SWBs, but surveys for this species are lacking in the Quartzville Watershed.

Four bat species identified in the NFP as species in need of additional protection are highly likely to occur in the Quartzville Watershed. They are the silver-haired bat, long-legged myotis, long-

eared myotis, and Townsend's big-eared bat.

Ten Bureau Sensitive and/or FS Sensitive species have been documented or are highly likely to occur in the watershed. These include the harlequin duck, peregrine falcon, goshawk, common nighthawk, and the fisher (See Appendices C-1 and C-2).

There is one peregrine falcon eyrie in the vicinity of Rocky Top in the South Green Peter SWB. In addition, the peregrine falcon is highly likely to occur as a migrant and winter visitor and could occur elsewhere in the watershed as a nesting species. Suitable cliff habitat for nesting is present in the Quartzville Watershed, especially in the Upper Quartzville, Lone Star and South Green Peter SWBs.

The harlequin duck, a FS and Bureau Sensitive species, is a common breeding species on Quartzville Creek and some of its major tributaries, where it occurs in good numbers on private, BLM and FS lands.

Terrestrial Finding #9 - Bald Eagles: There are two known bald eagle nest sites in the watershed in the vicinity of Green Peter Reservoir. Both nest sites are located on BLM lands on Green Peter Peninsula. Associated with these bald eagle sites is a Bald Eagle Management Area (BEMA) of approximately 935 acres in size. The BEMA is located in both LSR and the matrix in the Connectivity (CONN) Land Use Allocation (LUA). Less than one third of the BEMA is in LSR and the remainder is in CONN.

Terrestrial Finding #10 - Nesting Spotted Owls/Habitat: Currently, approximately 47 percent of the Quartzville Watershed is considered to be suitable habitat for nesting and/or foraging (suitable), 57 percent is functional as dispersal and 43 percent is non-habitat. Of the non-habitat, 88 percent is capable of becoming suitable habitat over time. All of the SWBs were found to be viable for nesting spotted owls with the exception of Whitcomb, Moose Creek and South Green Peter SWBs. Whitcomb and Moose Creek SWBs were found to be limiting and the South Green Peter SWB is possibly non-viable for nesting spotted owls. The Lone Star and Upper Quartzville SWBs were found to be highly viable for nesting spotted owls.

Of the 35 known spotted owl sites (KOS) in Quartzville Watershed, 23 are currently considered to be viable, 10 are limiting and two are possibly non-viable. With improvements in late seral conditions in LSRs over time, the number of viable KOSs is expected to increase.

Terrestrial Finding #11 - Connectivity/Dispersal and the LSR Network: The Quartzville Watershed was found to be viable for dispersal of spotted owls. The Quartzville LSR (RO213) and Middle Santiam Wilderness complex is about 92,400 acres in size and spans four major watersheds from Crabtree to the west, through Quartzville, into the North Santiam to the north towards Detroit Reservoir, and south and east into the Middle Santiam Watershed. This very large reserve is an integral and important link in the predominant north-south LSR/wilderness network where the majority of dispersal between known spotted owl sites in the Cascades Range

takes place. Dispersal is most limiting in the South Green Peter, and Whitcomb SWBs, in the vicinity of Green Peter Reservoir.

Contained within the Quartzville Watershed is the majority of the Quartzville LSR/wilderness complex (61 percent). Within the Quartzville LSR there are several thousand acres of non-federal lands in early seral stages, completely surrounded by LSR and Critical Habitat. Most of this non-federal land is capable of becoming suitable habitat in the future. It is expected that these non-federal lands will be managed primarily for timber production, and will not contribute suitable habitat to the surrounding LSRs and Critical Habitat over time.

Contained within the Quartzville Watershed is the Whitcomb LSR (RO212). This LSR is 3,450 acres in size and is located about two to three miles to the southwest of the Quartzville LSR. Connectivity between the Quartzville and Whitcomb LSRs is somewhat disrupted by the ownership pattern, but there is a contiguous connection of BLM lands in the Moose Creek SWB across matrix lands. Connectivity between the Quartzville LSR and Whitcomb LSR is expected to remain viable over time. In addition, there is a small LSR 352 acres in size on the tip of the Green Peter Peninsula in the vicinity of the Bald Eagle Management Area.

Spotted owl dispersal out of the Quartzville Watershed is limited by the scattered federal ownership and the North Santiam River Corridor to the north and west, the South Santiam River Corridor to the southwest and the Willamette Valley to the west. The Quartzville Watershed is significant for spotted owl dispersal because it contains the bulk of the Quartzville LSR, which is an integral and important link in the predominant north-south LSR/wilderness network where the majority of dispersal between known spotted owl sites in the Cascades Range takes place. Dispersal is especially significant on the east end of the watershed in the Upper Quartzville, Lone Star and Canal Creek SWBs.

Terrestrial Finding #12 - Critical Habitat for the Northern Spotted Owl: Most of the federal lands in the Quartzville Watershed are designated as Critical Habitat for the spotted owl in Critical Habitat Unit OR-14. There is a total of 62,435 acres of Critical Habitat in the Quartzville Watershed, spread across all SWBs. Approximately 91.5 percent (57,124 acres) is in LSR and 8.5 percent (5,311 acres) is in the Matrix LUAs. Approximately 48 percent of the Critical Habitat in the matrix is in General Forest Management Area (GFMA) and 52 percent is in CONN. In addition, there are 1,932 acres designated as LSR under the NFP that are not designated as Critical Habitat.

Most of the Critical Habitat in the Matrix is in the Moose Creek and Whitcomb SWBs between the Whitcomb LSR and the larger Quartzville LSR to the east. The percentage of suitable habitat in LSR Critical Habitat was not found to be significantly different than in adjacent Matrix Critical Habitat. However, the condition of the suitable habitat in LSR versus the Matrix was found to be considerably better. Critical Habitat in LSR was found to be viable for both nesting and dispersal of spotted owls. However, Critical Habitat in the Matrix was found to be limiting for nesting, but viable for dispersal of spotted owls.

Terrestrial Finding #13 - Fire and Fuels: Opportunities to reintroduce fire into the ecosystem on FS lands in the Quartzville Watershed are desirable for several reasons. The tribes of the Grande Ronde and Siletz are interested in reestablishing major travel routes and cultural burning patterns. This would open up the stands, provide more and better huckleberry habitat, and more big game forage. In addition, sugar pine habitat could be enhanced.

Recommendations:

Terrestrial Recommendation #1 - Density Management/Thinnings (Terrestrial Findings #1, 2, 10, 11 and 12): Density management and thinnings should emphasize enhancement and restoration opportunities that target stands in Riparian Reserves, LSR, CONN and GFMA lands in Critical Habitat that have been managed primarily for timber in the past. 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.

Criteria for Density Management/Thinnings: Objectives in all stands would be to develop and maintain late seral forest conditions, meet Aquatic Conservation Strategy (ACS) Objectives and maintain and enhance existing habitat for the spotted owl. Density Management would be prescribed primarily in mid-seral stands in the stem exclusion stage to encourage the development of late seral conditions. Priorities for density management to accelerate the development of late seral forest conditions would be high in Riparian Reserves, LSR, CONN and GFMA lands in Critical Habitat.

The Quartzville portion of the LSR assessment provides the framework for identifying which areas are critical to improve habitat in the earliest time frame possible. Commercial thinning in the LSR is exempted from REO review where all of the following criteria are met (REO Review Exemption Criteria, Page 13, Appendix K of the Mid-Willamette Late Successional Reserve Assessment, August 24th 1998).

> The objective is to develop late successional conditions or reduce the risk of large scale disturbance that would result in loss of key late successional structure. Treatments would in the long term, result in the development of snags, coarse woody debris and other late successional stand characteristics.
>
> Negative short term effects are outweighed by the long term benefits and will not lessen the short functionality of the LSR as a whole.
>
> The leave tree criteria provide for such things as culturing individual trees for large crowns and limbs, retaining characteristics that induce disease, damage and other mortality or habitat that is consistent with LSR objectives.

Within limits of acceptable fire risk, CWD objectives should be based on research that shows optimum levels of habitat for late successional forest species. Timber is a by product and not in and of itself an objective of the thinning prescription.

Density management treatments should be done with caution in stands experiencing moderate infestations of Swiss needle cast (SNC) or drainages where there is a high incidence of this disease. Caution is advised in SNC infected areas because a 30 tree per acre retention treatment in a highly infected area of the Oregon Coast Range resulted in greatly reduced tree growth because of accelerated SNC development. SNC infections can reduce diameter and height growth because of decreased photosynthetic ability due to the loss of older needles. Severe SNC infestations may result in near cessation of Douglas-fir growth, or mortality from competition by non-susceptible species, pathogens or insects and sometimes directly from the disease itself. Initial indications in the Coast Range are that stocking levels greater than 60 trees per acre may allow stand development with minimal growth reductions.

A. FS Lands:

Precommercial Thinning: During the last decade, about 1,200 acres of FS lands have been precommercially thinned in the watershed. The Quartzville Watershed is all LSR on Forest Service land. Currently, there is a backlog of stands that are ready for precommercial thinning. As a result, FS will be precommercially thinning about one thousand acres per year over the next eight years if funds through the receipts to county dollars are attained. Stands will be thinned with species diversity in mind with a variety of thinning density prescriptions. Thinning will allow stands to develop larger diameter trees in a shorter time frame for riparian and spotted owl habitat benefits.

The LSR assessment encourages thinning to create small gaps, with variable densities, that promotes species diversity and will create structural components. Trees to be thinned will be less than eight inches in diameter. No ground based harvesters will be used, and thinning will be only by hand with chain saws. Thinning will be prescribed for those stands that are over stocked. The overstocked conditions could cause a significant delay of reaching the management objective of late successional conditions or where desirable components of the stands may be eliminated because of stocking levels (REO Review Exemption Criteria, Page 6, Appendix K of the Mid-Willamette Late Successional Reserve Assessment, August 24th 1998).

Commercial Thinning: Over the next few decades, the stands that were created by timber harvest over the last fifty years will be ready for commercial harvest. Stand exam information suggests that FS could commercially thin about 2,500 acres a decade for the next 40 years. Some portions of the original stands will not be ready to commercially thin, and other portions are in areas that are set aside from timber harvest.

All proposed thinning projects would comply with REO Review Exemption Criteria. Creating openings may not occur during the first commercial thinning in some stands, especially in riparian areas or stands where future flexibility needs to be maintained.

B. BLM Lands

In young stands less than 30 years of age generally having less than commercial diameters, additional criteria for identifying and implementing projects include:

a. Use a range of residual tree densities. Consider creating small isolated openings, less than 1/4 to ½ acre in size, over less than 5 percent of the area, and leaving 10 percent unthinned.

b. Stocking control: Highest priority are overstocked even-aged stands in excess of 250 dominant/co-dominant trees per acre or 20 percent over target levels of 200-250 trees per acre.

c. Species composition control: favor minor species including hardwoods by increasing growing space around them.

d. Retain developing understories that do not interfere with the development of dominant and co-dominant trees in the stand.

e. Standing dead/down CWD recruitment: retain enough green tree capital for recruitment in future stands.

f. Identify stands for treatment through GIS queries, aerial photo interpretation, stand exams, riparian surveys and/or stocking surveys.

g. These projects could be implemented through restoration funding and/or accomplished collaterally with timber stand improvement projects on GFMA and/or CONN lands.

In 30 to 80 year old aged stands: These age classes generally provide the greatest opportunities for acceleration of tree diameter growth and understory development through density management. Criteria for identifying projects include:

a. Maintain average 40 to 50 percent crown closures. Use a wide range of residual tree densities. Density management leaving 30 to 60 trees per acre residual stocking should occur over 5 to 15 percent of the area. Consider creating small isolated openings, less than 1 acre in size, over 5 to 15 percent of the area, and leaving 10 percent unthinned.

b. Stocking control: Highest priority are overstocked even-aged stands of over 40 Relative Density (Curtis, 1982). Relative Density is a measure that estimates stocking density of stands using stand basal area and tree diameters.

c. Species composition control: maintain minor species in treatment areas including hardwoods.

d. Enhance developing understories where present by reducing overstory stocking to allow for understory growth.

e. Understories can be developed by natural regeneration, planting in openings or beneath density management treatments.

f. Standing dead/down CWD recruitment: retain enough green tree capital for recruitment in future stands. Consider creating smaller standing/down dead material to meet criteria as outlined in Recommendation #2 and the LSRA.

g. In LSR, openings larger than 10 acres in size created by stand replacement events such as insects, disease and/or windthrow can be treated where canopy closure is less than 40%. Retain all standing live trees likely to survive. In other LUAs, openings created by disease and/or windthrow can be treated where canopy closure is less than 40%. Timber harvesting followed by site preparation may occur in any LUA, provided standing dead/down coarse woody debris recruitment requirements are met to the degree possible. Native disease resistant conifer and/or hardwoods can be planted. Highest priority for disease/windthrow treatment would be on GFMA lands.

h. Identify stands for treatment through GIS queries, aerial photo interpretation, stand exams, riparian surveys and/or stocking surveys.

i. These projects can best be implemented through commercial timber sales. Logs may be removed provided standing dead/down CWD recruitment goals and ACS objectives are met to the degree possible.

Mature stands 80 to 150 years of age: Density management treatment of stands over 80 years of age is expected to be rare. Such stands would normally qualify as late seral forest habitat suitable for the spotted owl. However, age is a less important factor than the forest structure present. Late seral characteristics may be lacking in some stands due to timber management activities in the past which simplified forest structure. Past timber management practices such as salvage operations targeting dead, down and dying trees have removed important elements of late seral forest and habitat suitable for the spotted owl. High stocking levels may delay the attainment of late seral forest conditions in some stands due to small tree sizes and poor understory development.

In stands where late seral characteristics are lacking, treatment to create structure and/or reduce high stocking levels could occur. The primarily objectives of such treatments would be to create standing dead/down CWD, develop layering of understory vegetation and increase diameter growth and structure of the residual trees. Commercial timber sales would not occur in stands over 80 years of age in LSR, with the exception of (g) below, stand replacement events in excess of 10 acres. The primary objectives would be achieved through standing dead/down CWD creation without removal of commercial forest products. Criteria for identifying projects include:

a. Enhance suitable spotted owl habitat conditions. Variable density management silviculture treatments could occur in stands previously managed for timber production, to create more natural, late seral conditions, where elements of suitable habitat for spotted owls are lacking.

b. Highest priority are single story overstocked even-aged stands that lack components of late seral structure, such as standing dead/down coarse woody debris, large limby/cull trees, and multilayered canopies, and do not qualify as habitat suitable for the spotted owl.

c. Species composition control: Manage for species diversity in treatment areas.

d. Enhance developing understories where present by reducing overstory stocking to allow for understory growth.

e. Understories can be developed by natural regeneration or planting in openings or beneath density management treatments.
f. Create enough large, hard material to achieve standing dead/down coarse woody debris criteria (see Recommendation #2). Large material could be created adjacent to streams for recruitment as large woody debris and/or placed in streams.
g. In LSR, openings larger than 10 acres in size created by stand replacement events such as insects, disease and/or windthrow can be treated where canopy closure is less than 40%. Retain all standing live trees likely to survive. In other LUAs, openings created by disease and/or windthrow can be treated where canopy closure is less than 40%. Timber harvesting followed by site preparation may occur in any LUA, provided standing dead/down coarse woody debris requirements are met to the degree possible. Native disease resistant conifer and/or hardwoods can be planted. Highest priority for disease/windthrow treatment would be on GFMA lands.
h. Identify stands for treatment through GIS queries, aerial photo interpretation, stand exams and/or riparian surveys.
i. Projects outside LSR can best be implemented through commercial timber sales or topping/falling contracts to create standing dead/down CWD in LSR. Logs may be removed provided standing dead/down coarse woody debris requirements goals are met to the degree possible.

Terrestrial Recommendation #2 - Standing Dead/Down CWD (Terrestrial Findings #1 and 2): Implement NFP and Salem District RMP standards and guidelines for green tree retention for the recruitment and development of standing dead/down CWD and to contribute to the development of late seral forest stand characteristics. Protect existing material and leave additional green trees in future harvest units to make up for deficiencies in current conditions.

Criteria: For **GFMA and CONN**, leave trees should be over 12 inches dbh and represent the current range of conifer species, size and diameters. In GFMA, leave 6 to 8 green trees per acre; and in CONN, leave 12 to 18 trees per acre for recruitment of standing dead/down CWD and development of a large green tree component in future stands. Leave additional green trees in areas where standing dead/down CWD does not meet Northwest Forest Plan (NWFP) and Salem District Resource Management Plan (RMP) standards. Typically, up to four additional trees per acre are left in areas where standing dead/down CWD is lacking. Create enough large, hard standing material to meet the 40 percent level of potential cavity dwelling wildlife populations. It is anticipated that natural decay/falldown and blowdown of green tree retention will meet or exceed NWFP requirements for down CWD.

For **Riparian Reserves and LSR**, standing dead/down CWD requirements should approximate those cited in the Mid-Willamette LSRA. Treatment objectives in these allocations would be for individual tree growth and/or stand structure enhancement for the purposes of accelerating late seral forest development in younger age classes. Landscape level considerations include connectivity for species, past management and natural disturbances such as fire, insects, and disease. The long term landscape level goal is for 15 percent ground cover of all decay classes of

down wood . Twenty-five percent of that cover is expected to be represented by sound wood. When decayed logs are deficient, compensation in sound logs can be achieved over time. Snag levels range from 10 to 50 trees per acres of which 50 percent are in the soft stage and 50 percent are the largest available. In general, small snags will not persist as long as large snags, nor provide the same wildlife habitat. Leaving trees to grow and become snags later is appropriate in early to mid seral stands.

Terrestrial Recommendation #3 - Adjust LSR Boundaries (Terrestrial Findings #3, 9 and 10): Adjust boundaries of LSRs to better protect Special Status/Special Attention Species in the Green Peter Peninsula and Harry Mountain Ridge areas.

Criteria:

Use more ecologically meaningful features to define LSR boundaries such as watershed boundaries, topographic features, roads, forest type breaks, and Special Status/Special Attention Species buffers and management areas rather than interior section lines.

Adjust the Green Peter Peninsula LSR on to coincide with the Bald Eagle Management Area (BEMA), established to protect two existing bald eagle nest sites, as shown on Map #20: Proposed BLM Land Use Allocation Changes. As a result of this proposed change, there would be an net increase in LSR and protected acres of 583 acres, all of which would be in the Quartzville Watershed.

Adjust the Quartzville LSR boundary to approximate the Harry Mountain ridge which separates Thomas Creek Watershed from Quartzville and Crabtree Watersheds. For simplicity and clarity, the new proposed boundary could follow Harry Mountain Road between Crabtree/Quartzville and Thomas Creek as shown on Map #20: Proposed BLM Land Use Allocation Changes. Adjusting this LSR boundary to approximate the topography would make this LSR more ecologically sound and better protect adjacent known spotted owl sites. As a result of this proposed change, there would be an net increase in LSR and protected acres of 1,212 total acres, of which 539 acres are in the Quartzville Watershed and 38 acres in the Crabtree Watershed to the west and 635 acres are in the Thomas Creek Watershed to the north.

With the completion of Quartzville Watershed Analysis, the majority of the watersheds in the Cascades Resource Area of the Salem District BLM has been completed. A number of recommendations for LUA changes have been made in various watershed analyses. Consider balancing recommended LUA changes to achieve no net gain or loss of LSR/Matrix LUAs across BLM ownership in the Cascades Resource Area.

Terrestrial Recommendation #4 - Special Habitats (Finding #4): Some special habitats in the Quartzville Watershed are exhibiting evidence of encroachment in the form of growth and establishment of trees and invading brush due to fire exclusion. This is particularly true of meadow habitats, such as those present on the ridge separating Quartzville and Crabtree

Watersheds. Restore meadow and other special habitats where encroachment is evident through prescribed fire, manual control or other means.

Terrestrial Recommendation #5 - Road Densities: 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. On BLM lands, allow motorized vehicle use on designated roads only, especially in LSRs to reduce disturbance effects to wildlife, particularly the spotted owl. Highest priorities for reducing road densities would be in Canal Creek and Packers Gulch SWBs.

Future commercial thinning projects will provide opportunities to reconstruct or maintain roads that will be required for future thinning entries and decommission or close those roads that will not be needed in the future. Some of the stands were logged downhill and will need to have a helicopter system used for commercial thinning to avoid building new system roads. A roads analysis will be completed during the assessment of those stands as they become commercial in size and volume.

Terrestrial Recommendation #6 - Noxious Weeds (Terrestrial Finding #7): Use the principles of integrated weed management to eradicate, control, and prevent the spread of established and new invader noxious weed infestations. Integrated weed management means using all suitable methods (cultural, physical, biological, chemical) in a compatible manner to reduce weed populations.

Past management efforts to eradicate the knapweed infestations included hand pulling of the plants. This method has not been effective at any of the sites. Chemical treatments followed by hand pulling and establishing competitive native vegetation may be more successful.

Control established infestations primarily by biological control agents and by revegetating disturbed ground with desirable species. Make biological control releases in the Quartzville Watershed as new agents become available.

Encourage washing of ground disturbing equipment from off site to limit the spread of all exotic and noxious weed species.

Terrestrial Recommendation #7 - Land Acquisition (Terrestrial Findings #8, 10, 11 and 12): Pursue Land exchange/acquisition opportunities with willing private landowners to acquire private parcels contained within the Quartzville LSR. These parcels are key private land inholdings within the Quartzville LSR and designated Critical Habitat (CHU OR-14), which provide habitat for the spotted owl. The portion of Quartzville Creek within this parcel also provides key breeding habitat for the highest known concentration of harlequin ducks (BLM/FS Sensitive Species) in Oregon. The acquisition of private parcels is consistent with the Salem

BLM RMP and is recommended in the Quartzville WSR Management Plan and Mid-Willamette LSR Assessment (Mid-Willamette LSRA, Quartzville LSR Summary, April, 1998, p. 162).

Terrestrial Recommendation #8 - Fire and Fuels (Terrestrial Finding #13): Opportunities to reintroduce fire into FS lands in Quartzville Watershed are desirable for several reasons. The tribes of the Grande Ronde and Siletz are interested in reestablishing major travel routes and cultural burning patterns. This would open up the stands, provide more and better huckleberry habitat, and more big game forage. In addition, sugar pine habitat could be enhanced.

Aquatic

Findings:

Aquatic Finding #1 - Riparian Condition: Current riparian vegetation on federal lands in all of the SWBs is composed of greater than 50 percent mature timber (>80 years), while riparian vegetation on private lands in all of the SWBs is composed of less than 25 percent mature timber. The SWBs with the highest proportions of federal land (Lone Star and Upper Quartzville) have the highest percentages of late seral timber within riparian areas, while the SWB with the lowest proportion of federal land (South Green Peter) has the lowest.

Aquatic Finding #2 - Large Woody Debris (LWD): The combination of a lack of large woody structure in streams and several torrential flow events in the early 1970s and 1996, resulted in some channelization of the streams in the watershed, and a further reduction of LWD in the system. Generally, LWD is severely lacking in the watershed. Downstream of the National Forest boundary, streams with the highest LWD loading levels are Moose Creek, Trout Creek and the East and West Forks of Packers Gulch. Streams with the lowest LWD loading levels are Mainstem Quartzville Creek, Boulder Creek and the Thomas Fork of Packers Gulch.

Aquatic Finding #3 - Stream Flows: August and September have the greatest potential for conflict between consumptive uses and instream water needs with only 34 and 31 cfs (cubic feet per second) of water discharge available for other uses, respectively, at an 80 percent exceedence flow. This total amount of consumptive use and instream water need is still below the total water available.

Aquatic Finding #4 - Water Quality: In the Oregon Department of Environmental Quality (ODEQ) publication, *1988 Oregon Assessment of Non-point Sources of Water Pollution* (ODEQ 1988), also known as the *319 Report*, Quartzville Creek water quality is listed as being moderately impacted, supported by data in the upper reaches. Problems identified include sediment, nutrients, and insufficient stream structure. The probable causes were listed as vegetation removal, and riparian vegetation and bank disturbance. Impacted values were identified as fisheries, aquatic life, water recreation, wildlife, and downstream municipal water

supply. Packers Gulch SWB is listed as having greater than 15 percent steam channel expansion due to roads, which is considered moderately high.

Aquatic Finding #5 - ODEQ 303(d) listing: In the *Oregon Department of Environmental Quality's 303(d) List Of Water Quality Limited Waterbodies*, also known as the *303(d) report*, Quartzville Creek is listed as water quality limited for summer stream temperature, from river mile 5 upstream to its headwaters. Summer temperatures have been found to be above the 64 degrees F. threshold for fish rearing for notable periods of time.

Aquatic Finding #6 - Stream Temperatures: Summer water temperatures in Quartzville Creek were above the standard for extended periods of time at all temperature gaging stations. Because the data represent a seven day running average, it is apparent that water temperatures are high for extended periods of time during the summer. In early summer, water temperatures, generally, increase in a downstream direction which is expected.

Aquatic Finding #7 - Slope Stability and High Water Flows: The flood of February 1996 affected much of northwest Oregon, and effects were especially notable in Quartzville Creek. 1998 aerial photos of Quartzville Creek display an open riparian canopy, and the creek appears to have suffered high flows and large sediment loads. Sediment has been deposited on the flood plain, removing vegetation and allowing direct solar input.

Aquatic Finding #8 - Non-point Pollution: Tetra Tech (1993) estimated non-point pollution annual loads of nitrogen, phosphorous, and total suspended solids for watersheds in the Willamette River basin. Results suggest the non-point pollution levels are 5 to 20 percent higher in the Santiam sub-basin than the Willamette basin average, however sources have not been identified. Quartzville Creek Watershed appears to be within State standards.

Aquatic Finding #9 - Soils: Several major geologic hazards exist in the Quartzville Watershed which affect streams and water quality. Earth flows and slumps occur in large scattered areas of the watershed, and result in the delivery of soil material to streams through streambank erosion of the toe of the failure. Slope failures occur in steeply sloping, rocky mountainous terrain and include rockslides, debris avalanches and earth flows. Stream erosion and deposition are common within portions of the watershed resulting in higher turbidity, siltation of salmon spawning gravels, and a decrease in channel stability. Lone Star and Packers Gulch SWBs appear to have the greatest acreage of upland in an unstable condition. The SWBs with the most extensive BLM ownership classified as unstable are Packers Gulch and Moose Creek sub-watersheds (231 and 208 acres, respectively).

Aquatic Finding #10 - Fisheries: No anadromous fish are found within the watershed. All of the reaches of Mainstem Quartzville Creek and many tributary reaches have low habitat complexity and would benefit from instream restoration, generally placement of LWD. Any instream restoration

projects implemented would generally be intended to benefit resident populations of cutthroat trout and mountain whitefish.

Recommendations:

Aquatic Recommendation #1 - Riparian Condition and LWD on federal lands (Aquatic Findings #1 and 2): 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. Criteria for treatment are included under Recommendation #1, of the Terrestrial Section. Improve and restore riparian habitat through planting and seeding with native vegetation. Activities could include planting, density management, thinning, road decommissioning, culvert replacement/removal and erosion control in Riparian Reserves, such as seeding or planting.

Aquatic Recommendation #2 - Riparian Condition and LWD on non-federal lands (Aquatic Findings #1 and 2): Improve riparian conditions, and promote large conifer development in riparian areas through density management and thinnings. Work with the South Santiam Watershed Council and other landowners in the watershed to improve riparian condition and overstory by implementing projects designed to accelerate growth of riparian conifers to improve potential for LWD recruitment. Bringing in and anchoring large logs and rootwads in channels may work in some areas to improve fish habitat and stream structure.

Aquatic Recommendation #3 - Stream flows (Aquatic Finding #3): Cooperate with Oregon Department of Fish and Wildlife to ensure instream flows are protected in summer and fall during extremely low flow years.

Aquatic Recommendation #4 - Water Quality (Terrestrial Finding #6, Aquatic Findings #4 and 7): Reduce roaded miles that contribute flow or sediment to streams. Reclaim/decommission roads to reduce road densities in the watershed. Where roads cannot be decommissioned, close and storm proof unnecessary roads. Pursue road reconstruction and improvement projects on permanent access roads to reduce sediment to streams or prevent future water quality problems. Highest priorities for reducing roaded miles would be in Canal Creek and Packers Gulch SWBs. Existing roads in the watershed were evaluated using Transportation Management Objectives and additional criteria and the results are displayed in Appendix H.

Aquatic Recommendation #5 - Water Quality (Aquatic Findings #4, 7 and 11): Cooperate with state and private landowners to improve water quality. Improve drainage from existing roads and replace culverts that do not meet 100- year flood standards, to reduce loss of roads during large storms and addition of sediments and rock materials to streams. Divert runoff off from unstable slopes and stabilize slide areas.

Aquatic Recommendation #6 - ODEQ 303(d) listing (Aquatic Findings #4 and 5): ODEQ is scheduled to set the Total Maximum Daily Load for temperature in Quartzville Creek during 2002. After ODEQ sets the maximum load, BLM is expected to produce a Water Quality Restoration Plan (WQRP) for BLM lands within the watershed. The plan must include detailed

restoration activities and time lines. The FS has the same criteria for the lands that they manage in Quartzville Creek.

Aquatic Recommendation #7 - Stream Temperatures (Aquatic Findings #4 and 6): Develop projects to improve stream shade on BLM lands. Work with other landowners and the South Santiam Watershed Council to increase effective stream shade, expand the temperature monitoring network and locate sources of high water temperatures. Expanded temperature monitoring would provide data for development of the WQRP discussed above.

Aquatic Recommendation #8 - Soils, Slope Stability and High Water Flows (Aquatic Findings #4, 7 and 11): Conduct an assessment of landslides and erosion problems in the watershed. The pending WQRP for the Quartzville Watershed should address erosion problems and restoration actions. Stabilize slides where possible, by seeding, diverting water from unstable slopes, installation of erosion matting, and unweighting slides at the top. Improve road drainage, and replace culverts where needed. Improve riparian cover where possible. Restore vegetative cover on bare slopes. Work on joint projects with other landowners to improve upland conditions on lands in all ownerships.

Aquatic Recommendation #9 - Non-point Pollution (Aquatic Finding #9): Support the South Santiam Watershed Council, and ODEQ efforts to quantify non-point sources of pollution.

Human Uses

Findings:

Human Uses Finding #1 - General: Public lands in the Quartzville Watershed are an important resource to those living within rural and urban communities in the mid-Willamette Valley for a variety of commodity and non-commodity values. Finding a balance between providing commodity based products such as timber with other values such as water quality, fish, wildlife, recreation, and visual resources will be an ongoing challenge that will only increase as rural and urban communities in the mid-Willamette continue to grow. These issues are further complicated by the intermixed ownership pattern of private and BLM-administered lands. The BLM's ability to develop partnerships with interested groups and adjacent landowners on a variety of issues and projects will be a key component of successful public land management in this watershed.

Human Uses Finding #2 - Timber Management: Timber harvest activities on federal lands under current land use allocations would likely be relatively limited. For BLM lands, timber harvest activities will continue to occur at various levels in compliance with the Salem District RMP, relative to the land use allocations in the Quartzville Watershed. Timber harvest activities will include regeneration harvest, thinnings, density management and salvage operations conducted according to the NFP. Greater harvest would be expected on BLM lands with a

GFMA or CONN land use allocation. Habitat enhancement projects in LSRs that involve some timber management are also expected on BLM and FS lands in the watershed. Timber harvest is also expected to continue on private industrial forest lands in the watershed.

Human Uses Finding #3 - Roads and Access: Speeding, reckless driving and driving under the influence along Quartzville Road is an ongoing concern among all the road's managing agencies.

In general motorized access to both public and private lands in the Quartzville Watershed would most likely decrease in the long term. This is due to efforts to meet other resource objectives and as a result of declining road maintenance funding. Vehicle access on private lands may also decrease if problems with garbage dumping, erosion, damage to vegetation, vandalism, theft, long term occupancy, and reckless fire and firearm use continue to increase. The restriction of vehicle access to both private and public forest lands is a growing trend in many of the watersheds in western Oregon that are near rural and urban areas.

The FS does not currently have a formal designation for their portion of the Quartzville Back Country Byway.

Human Uses Finding #4- Minerals: The Quartzville Recreational Mining Corridor that the BLM manages in partnership with private landowners, is a popular area and provides many recreational miners with a place to prospect without conflicts associated with private mining claims. Some resource damage has been observed as a result of the removal of soil and vegetation from river banks. Visitor contact and patrols have helped to significantly increase compliance with obtaining the state permits required for dredging. No major issues associated with recreational mining were identified.

There are private land in-holdings within the National Forest Boundary in the Quartzville Watershed that are associated with patented claim blocks. Acquiring these lands (on a willing seller basis) would be beneficial for several reasons. If acquired, these lands provide the FS with opportunities for interpretation of mining history and protection of the remaining items of historical value. It would also help minimize the fragmentation of dispersal habitat for the spotted owl. Many of the plantations associated with the claims are now commercial thinning size and over stocked. Without thinning, these stand may contribute to increased fuel loads.

Human Uses Finding #5 - Off-highway Vehicle Use: Due to concerns associated with erosion, vegetation damage, water quality and fisheries, wildlife disturbance, off-road use by four wheel drives, all terrain vehicles, and motorcycles is not compatible with resource management objectives on BLM-administered lands in the Quartzville Watershed. However, use of these vehicles would still be allowed on roads, consistent with the Oregon Revised Statues and BLM regulations in the Code of Federal Regulations related to off-road vehicle use and designations. More work in implementing these off-highway vehicle designations is stilled needed.

Motor vehicle regulations on National Forest Lands are governed by the State under the Oregon

Revised Statues (ORS). ORS provisions allow non-street legal off-highway vehicles (OHV) to operate on most forest roads, unless the Forest Supervisor specifically prohibits them. A FS policy is currently being developed to provide consistent guidance for All-Terrain Vehicles (ATV), Off-Road Vehicles (ORV), Off-Highway Vehicles (OHV), or non-highway vehicles on roads authorized for such use. ATV, ORV and OHV use is often not compatible with resource management objectives on many FS lands.

Though not expressly authorized, use of private forest land may currently occur unless the area is physically restricted.

Human Uses Finding #6 - Green Peter Reservoir: Managing the recreational use along Green Peter Reservoir is probably the greatest recreational issue in the Quartzville Watershed. While use densities on the reservoir itself are not high, existing use during peak periods already exceeds the capacity of both developed and undeveloped recreation areas along Green Peter Reservoir. Given that water-based recreation is one of the fastest growing activities, along with the development of new technologies like personal water crafts, the challenges associated with managing this reservoir are likely to increase. The undeveloped nature of the recreational use, the large size of many groups, and crowding issues associated with camping along the reservoir also contribute to problems with higher levels of undesirable activities such as litter, underaged drinking, irresponsible campfire use, drug use and manufacturing, and domestic violence and fighting. Long-term occupancy is also an ongoing management issue along the reservoir. The lack of publicly owned sites that are suitable for facility development only further limits management options currently available for reducing or resolving these management concerns.

Human Uses Finding #7 - Quartzville Creek Wild and Scenic River: The main issue associated with the Quartzville Wild and Scenic River is the management of undeveloped camping along the river. The BLM faces many of the same challenges as Army Corps of Engineers faces along Green Peter Reservoir, but to a lesser degree. With growing demand, the establishment of new sites on both public and private lands is a concern. Minimizing the impacts (trash, fire rings, sanitation, etc.) associated with existing use is also an ongoing concern. The fact that much of the undeveloped camping occurs on private land further complicates the BLM's ability to manage undeveloped camping as a whole. The planned removal and restoration of the road maintenance shop site along Quartzville Creek will greatly enhance the visual appearance of the area.

Human Uses Finding #8 - Recreation: Even with decreases in road densities in the Quartzville Watershed, there will still be opportunities for dispersed recreational activities on federal lands such as hunting, fishing, target shooting. Private lands in the watershed may also provide similar opportunities to the extent allowed by individual landowners. There may be potential for improving opportunities for non-motorized uses by developing a trails for hiking, mountain biking, and horseback riding utilizing

existing roads and trails and constructing new trails. This could include the development of a trail leading from Crabtree Lake to Green Peter Peninsula, as proposed in the RMP.

Human Uses Finding #9 - Visual Resources: There are approximately 16 acres of BLM-administered land in the Quartzville Watershed with a Class I rating, requiring the highest level of protection under the Visual Resource Management system. These lands include the outer edges of both the Shafer Creek and Crabtree Lake Areas of Critical Environmental Concern (ACEC). Most of these ACEC's are in the Crabtree Watershed. Also included are a few waterfalls scattered in the watershed. There are approximately 4,802 acres of BLM-administered land in the Quartzville Watershed with a Class II rating, requiring that low levels of change to the characteristic landscape. Most of the Class II lands in the watershed are located along Green Peter Reservoir and Quartzville Creek. The remaining 25,908 acres of BLM-administered land within the watershed fall into a Class III or IV rating. Outside of Class I lands, the most sensitive visual resources in the watershed would be those lands observable from Green Peter Reservoir, Quartzville Creek, or Quartzville Access Road.

The viewshed on federal lands is expected to improve on federal lands in LSR, as past harvest activities mature into older forests. Harvest activities are expected to continue to be observable on private lands in the watershed. The removal and restoration of the road maintenance shop would enhance the visual appearance of the area.

Human Uses Finding #10- Prohibited Uses: The occurrence of prohibited uses such as speeding, driving under the influence, underage drinking, poaching, littering, unauthorized long-term occupancy, drug manufacturing and use, vandalism, garbage dumping, domestic violence and other physical altercations is increasing on both public and private in the Quartzville Watershed. Cooperative management and law enforcement efforts between public and private landowners in the watershed will continue to play a critical role in addressing these problems. Additional law enforcement assistance in 2002 from Linn County, through the "Secure Rural Schools and Community Self-Determination Action of 2000," may also help address these problems. However, the additional law enforcement assistance is only funded through 2002, so continued support would be necessary if any long term reductions in these problems is to be accomplished. If the closure of private lands to motorized access by the public increases, the incidence of these prohibited uses on public lands may increase.

Recommendations:

Human Uses Recommendation #1 - Visual Resource Management (Human Uses Findings #2 and 9): Below is a list of mitigating actions that could be taken to reduce the visual impacts of timber

harvest activities on BLM-administered lands, depending on the proposed action and the site specific characteristics.

* Early in project planning, consider reducing visual or other disturbance factors in designing the

size, shape, and location of the timber harvest units or project. Consider small patch cuts, thinnings, or uneven aged management to better maintain forest cover.

* Where possible utilize green retention trees and riparian reserves to buffer the visual impacts from view. Consider leaving additional trees for added buffering were needed.

* Where possible, consider using alternative reforestation site preparation prescriptions to broadcast burning.

Human Uses Recommendation #2 - Minerals (Human Uses Finding #4): Continue to provide recreational mining opportunities in manner that reduces resource impacts and is in compliance with state laws and regulations. Continue to provide information on mining guidelines and user ethics.

On a willing-seller basis, pursue private land inholdings associated with patented claims, within FS lands in the Quartzville Watershed.

Human Uses Recommendation #3 - Roads and Off-Highway Vehicle Use (Human Uses Findings #3 and 5): In an effort to reduce speeding and reckless driving , conduct a speed analysis along the BLM portion of Quartzville Road and post a speed limit along the road that could be enforced by law enforcement officers. Also work to provide better signing, maps, and information about appropriate off-highway vehicle use on BLM-administered lands in the Quartzville Watershed and coordinate this information with FS and adjacent private landowners.

Human Uses Recommendation #4 - Quartzville Back Country Byway (Human Uses Finding #3): Its recommended that the BLM and FS work with Linn County to submit the Quartzville Back Country Byway for State of Oregon "Tour Route" designation to formally recognize the entire route.

Human Uses Recommendation #5 - Green Peter Reservoir (Human Uses Finding # 6): Continue to work with the Army Corps of Engineers on managing boat-in camping on BLM lands along Green Peter Reservoir.

Human Uses Recommendation #6 - Quartzville Creek Wild and Scenic River (Human Uses Finding #7): In the short term the BLM should work with the private landowners along the Wild and Scenic segment of Quartzville Creek to establish a designated campsite system. In the long term the BLM should work with willing private landowners on acquiring the private land within the Quartzville Creek Wild and Scenic River Corridor boundaries. No significant issues were identified, that would warrant the need for an immediate update of the Quartzville Creek Wild and Scenic River Management Plan, November 1992. However, if significant private lands are acquired, the Quartzville Creek Wild and Scenic River Management Plan should be updated to reflect the new opportunities that such an acquisition would represent.

Human Uses Recommendation #7 - Recreation (Human Uses Finding #8): Evaluate the potential of establishing multi-use, non-motorized trails in the on BLM lands in the Quartzville Watershed including the trail leading from Crabtree Lake to the Green Peter Peninsula as proposed in the RMP.

Human Uses Recommendation #6 - Partnerships and Coordination (Human Uses Findings #3, 4, 5, 6, 7, 8, and 10): To the extent possible work in partnership with private, local, state and federal entities that manage lands or have interest in the Quartzville Watershed on managing public use in a consistent, safe, and efficient manner.

Chapter 1 Introduction

Watershed Analysis

The purpose of a watershed analysis is to provide federal agencies with a comprehensive and systematic analysis to guide planning and management of Bureau of Land Management (BLM) and U.S. Forest Service (FS) lands within the watershed. It is also intended to help guide planning and land management activities to successfully meet the intent of the *Northwest Forest Plan, Final Supplemental Environmental Impact Statement (FSEIS) and Record of Decision (ROD) For Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl (April, 1994)* as it applies to the watershed.

Watershed analysis is ecosystem analysis at the watershed scale. This analysis is one of the principal analyses for application of the Aquatic Conservation Strategy (ACS) addressed in the *Final Supplemental Environmental Impact Statement (FSEIS) and Record of Decision (ROD) For Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl (April, 1994).* It is also a principal means used to meet ecosystem management objectives identified in the *Salem District Resource Management Plan/Final Environmental Impact Statement (May, 1995)* for BLM lands and the *Willamette National Forest Land and Resource Management Plan (1990)* for FS lands.

Watershed analysis develops and documents a scientifically based understanding of the ecological structures, functions, processes, and interactions within a watershed. By developing and documenting a scientifically based understanding of the processes and interactions occurring within a watershed, a common framework for evaluating and managing the federal land within the landscape can be established. The watershed analysis will serve as a framework for developing site-specific proposals, monitoring and restoration needs. The analysis will also be used in making resource management decisions for federal lands contained within the watershed. This analysis identifies current and historical conditions, trends, findings, recommendations and data/inventory gaps. Adjustment of Riparian Reserve widths is not addressed in this document.

Information from other land ownerships in the watershed was used, since this analysis addresses the entire watershed. While this analysis does not direct other landowners on the management of their lands, it can provide background information on potential partnership opportunities that may exist in the watershed.

Watershed analysis is an ongoing and dynamic process. It will be revised and updated as conditions, assumptions, or resource plans change and new information becomes available. This document summarizes a large quantity of information and detailed analysis of complex issues and interrelationships. Watershed analysis is **not** a decision-making process. It is a stage-setting analytical process that offers constraints and provides guidance for future management decisions.

The results of the watershed analysis can be used to:

* Develop ecologically sustainable programs to produce water, timber, recreation, and other commodities.
* Help program and budget development by identifying and setting priorities for social, economic, and ecological needs within and among watersheds.
* Establish a consistent, watershed-wide context for project-level National Environmental Policy Act (NEPA) analyses, management activities evaluation, Endangered Species Act application, and water quality issues.

Document Organization

The watershed analysis process begins by identifying significant resource issues which focus on a basic analysis of ecological conditions, processes, and interactions in the watershed. These issues are addressed by asking basic and fundamental key questions. Key questions focus the analysis on cause-and-effect relationships and on conditions as they relate to the ecological processes occurring in the watershed. The key questions have been grouped into three resource categories: Terrestrial, Aquatic and Human Uses. Terrestrial resources include vegetation, plant communities, forest health, wildlife habitat and Special Status/Special Attention plant and animal species. Aquatic resources include water quality and quantity, flood control, private and municipal water rights, fish species and instream habitat. Human uses addresses forest products, transportation, minerals, recreation and visual resources. While there are considerable overlap and interaction between the various ecosystem components and processes in a natural system, these broad categories serve as an organizational aid to facilitate analysis of complex systems. This organization was carried through the entire document for ease of reading and organization.

The organization of this document was based on guidance contained in the document *Ecosystem Analysis at the Watershed Scale: Federal Guide for Watershed Analysis* August 1995, version 2.2, and is as follows:

Executive Summary - Overviews of the scope of analysis and findings of this watershed analysis.

Chapter 1 - Introduction. A description of watershed analysis, its purpose and intent. Overview of how the document is organized.

Chapter 2 - Characterization. A brief description of the watershed ecosystem.

Chapter 3 - Issues and Key Questions. Establishes the issues and key questions to be considered during the analysis.

Chapter 4 - Historical Conditions. Presents a historical perspective of the past influences and processes that occurred in this ecosystem.

Chapter 5 -Current Conditions. Describes the current condition of the resources of the watershed, according to terrestrial, aquatic, human uses, and other issues.

Chapter 6 - Future Conditions and Trends. Projects possible future trends of ecosystem processes in the watershed with application of resource management plans and assumptions on private land management.

Chapter 7 - Management Recommendations. Recommends guidelines for ecosystem management within this watershed based on the findings of the analysis.

Chapter 8 - Data Gaps, Inventory, Monitoring. A list of where information gaps were found during the analysis and what information should be collected in the future.

Appendices. Include additional reports by specialists, lists, tables, charts, and maps that are not specific to the issues but provide other useful information and other reference information cited in the analysis.

Scoping

The issue identification and scoping process are a two-phased approach. The first step involved scoping through an interdisciplinary team of resource professionals. Primary team members were staff from within the Bureau of Land Management, Cascades Resource Area. Additional input was provided by staff from the U.S. Forest Service, Sweet Home Ranger District. The second phase involved sending letters of interest and questionnaires to watershed landowners, other local, county, and state agencies, and other interested individuals and organizations. These individuals, groups, and organizations were encouraged to complete our questionnaire and return it to our office. In addition, notification regarding ongoing watershed analyses was published in the Salem District Project Update, with contact email addresses and phone numbers. See Appendix A for summary of the comments received.

Not all issues initially identified were carried through the analysis process. Some issues were deferred due to lack of information. Other issues were not addressed because they are not covered by federal law or jurisdiction or appropriate to this scientific analysis of the condition and trends of the Quartzville Watershed.

Chapter 2 Characterization

This chapter describes the dominant physical and biological processes and features, and human influences in the Quartzville Watershed that affect ecosystem functions or conditions. This narrative is intended to give the reader a quick overview of the watershed. More detailed analysis is contained in other chapters of this document, particularly in Chapter 5, Current Conditions.

Location and Setting

The Quartzville Watershed is located in northwest Oregon, and falls entirely within Linn County. The watershed is 95,468 acres in size and extends from Green Peter Dam along the Middle Santiam River on the west end, to the vicinity of Scar Mountain on the extreme east end of the watershed (See Map #1: Location Map). Sweet Home is the closest community to the Quartzville Watershed, located approximately five miles southwest from the western boundary of the watershed.

Elevations range from about 1,000 feet at Green Peter Dam, to 4,974 feet at Galena Mountain, the highest peak, located on the south end of the watershed. The watershed is bordered by Gordan Peak, Swamp Peak, Knob Rock, and Chimney Peak on the southeast side of the watershed; to Galena Mountain, along Galena Ridge to Rocky Top, across Green Peter Reservoir to High Deck on the south. Along the western border of the watershed is Green Peter Dam, Green Peter Peak, Bald Peter, Yellowstone Mountain, and Crabtree Mountain. Along the northern border is Harry Mountain Ridge, Slate Rock and Pinnacle Peak. The watershed is located within Western Oregon Cascades Physiographic Province.

The Quartzville Watershed is bounded by several other watersheds, including Crabtree Watershed to the west, Thomas Creek and the Middle North Santiam River Watersheds to the northwest, Detroit Reservoir/Blowout Divide Creek Watershed to the north, and the Middle and South Santiam Watersheds to the south. Watershed analysis has been completed for all of these watersheds.

Ownership

The Quartzville Watershed is 95,468 acres in size and includes 69,025 acres (72 percent) under federal land management, 26,429 (28 percent) of private land, and 14 acres (less than one percent) of state land (See Table 2-1: Land Ownership and Map#2: Ownership).

OWNER	ACRES	PERCENT
BLM	30,783	32
FS	34,629	36
ACOE	3,613	4
STATE	14	0
PRIVATE	26,429	28
TOTAL	95,468	100

Table 2-1: Land Ownership.

Land Management Objectives

Land use on BLM and FS lands is allocated according to the BLM's *Salem District Resource Management Plan (May, 1995)* and the FS's *Willamette National Forest Land and Resource Management Plan (1990).* Land use on BLM and FS lands in the plans is divided into Land Use Allocations (LUA). The primary LUA's within this watershed are Matrix, Late-Successional Reserve, and Riparian Reserves. The management of Late-Successional Reserves on BLM and FS lands also receive guidance from the *Mid Willamette Late Successional Reserve Assessment (August, 1998).* The BLM further defines Matrix into General Forest Management Areas and Connectivity.

Land Use Allocation	Acres Outside Riparian Reserves	Acres Inside Riparian Reserves	Total Acres	Percent
Lands Managed by Bureau of Land Management				
GFMA	1,662	1,015	2,677	9%
CONN	1,595	2,252	3,847	12%
LSR	11,405	12,854	24,259	79%
Total	**14,662**	**16,121**	**30,783**	**100%**
Lands Managed by U.S. Forest Service				
LSR	**15,259**	**19,370**	**34,629**	**100%**

Table 2-2: Federal Land Use Allocations.

Below is a summary of each land use allocation in the Quartzville Watershed (See Table 2-2: Federal Land Use Allocations and Map #4: Federal Land Use Allocations):

BLM Lands

General Forest Management Area (GFMA): Management objectives for GFMA lands include producing a sustainable supply of timber and other forest commodities while emphasizing ecosystem management. The BLM manages 1,662 acres of GFMA outside of riparian reserves in the Quartzville Watershed.

Connectivity (CONN): Management objectives for CONN lands include producing some timber products, while helping to provide connectivity between Late Successional Reserves. Intensive management practices are permitted on a 150-year rotation while maintaining 25 to 30 percent of each block in older forest conditions at any one point in time. The BLM manages 1,595 acres of CONN outside of Riparian Reserves in the Quartzville Watershed.

Riparian Reserves (RR): Management objectives for RR lands include helping to maintain and restore riparian structures and functions, benefit fish and riparian-dependent nonfish species, enhance habitat conservation for organisms dependent on the transition zone between uplands and riparian areas, improve travel and dispersal corridors for terrestrial animals and plants and provide for greater connectivity of late-successional forest habitats. This LUA overlays and takes precedence over the three LUA's described above. The BLM manages 1,152 acres of RR within GMFA, 1,794 acres of RR within CONN, and 13,141 acres of RR within LSR (See Map #3: BLM Land Use Allocations with Riparian Reserves/FPA Stream Buffers).

BLM and FS Lands

Late-Successional Reserve (LSR): Management objectives for LSR lands include protecting and enhancing conditions of late-successional and old-growth forest ecosystems, which serve as habitat for late-successional and old-growth forest-related species. The BLM manages 11,405 acres of LSR outside of Riparian Reserves in the Quartzville Watershed.

The FS manages 15,259 acres of LSR outside of Riparian Reserves and 19,370 acres of LSR within Riparian Reserves (See Map #3: BLM Land Use Allocations with Riparian Reserves/FPA Stream Buffers).

Other Lands

Lands managed U.S. Army Corps of Engineers are associated with the Green Peter Dam and Reservoir Project area and do not have the land use allocations described above. Most of the private land is managed as industrial forest land.

Terrestrial

The array and landscape pattern of plant communities and their seral stages are a result of natural

processes and human-caused disturbances. Fire has been the major short-term natural process. Human-caused disturbances are most commonly logging, fire, agriculture, mining, recreation facilities, and residential development.

The Quartzville Watershed is located in the Western Oregon Cascades Physiographic Province. Approximately 90 percent of the Quartzville Watershed are conifer forest types consisting mostly of Douglas-fir, western hemlock and Pacific silver fir. Hardwood and mixed hardwood/conifer types consisting mostly of big leaf maple, red alder, fir and hemlock comprise about five percent of the watershed, primarily at lower elevations and in riparian zones of larger order streams. The remaining five percent of the watershed consists of non-forest types that include man-made developments such as roads, rock quarries, and Green Peter Reservoir. Meadows, rock, cliff/talus, and other natural openings in the forest environment are also included as non-forest types.

The most prevalent special habitats in the Quartzville Watershed include rock/outcrops/cliffs, talus slopes, and dry meadows with shallow soils. These types of special habitats are most commonly associated with the major peaks and ridges of the watershed.

Native plant and animal species are typical of those found in the Western Oregon Cascades Physiographic Province. Lists of plant and animal species including Special Status Species (SSS) which are known or highly likely to occur in the Quartzville Watershed are included in Appendices B: Botanical Species and C: Wildlife Species. Included on the animal species lists are the bald eagle and northern spotted owl, both federally listed threatened species, which are known to occur in the Quartzville Watershed.

Aquatic

Hydrology and Water Quality

Quartzville Creek flows into the Middle Santiam River, which empties into the South Santiam River which, in turn, merges with the North Santiam River to form the Santiam River two miles south of the town of Jefferson. The Santiam River flows into the Willamette River north of Albany. The Willamette River Basin (WRB) is the largest river basin in Oregon, and drains 11,100 square miles, and is part of the Columbia River subregion. A large percentage of the state's population and major cities are located in the WRB, including Portland, Salem, Corvallis and Eugene. The United States Geologic Survey (USGS) has divided the WRB into hydrologic units and assigned each a Hydrologic unit code. The Quartzville Creek Watershed is located within the southeast section of the WRB, and is synonymous with the USGS fifth field unit 1709000604.

Although recent improvements in water quality have been achieved, the Oregon Department of Environmental Quality publication, *1988 Oregon Assessment of Non-point Sources of Water Pollution* (ODEQ), also known as the 319 report, identified the protection and enhancement of

water quality in the WRB as one of the most critical long-range resource management issues currently facing the State of Oregon (Tetra Tech 1993). According to the ODEQ, water quality in Quartzville Creek and Gold Creek (a tributary of Quartzville Creek) are listed as being moderately impacted by nutrients, insufficient stream structure, and sediment. The affected beneficial uses are fisheries, aquatic life, water recreation, aesthetics, and downstream municipal water supply.

The Quartzville Watershed includes Quartzville Creek and its tributaries which include (but are not limited to) Moose Creek, Trout Creek, Panther Creek, Four Bit Creek, Yellowstone Creek, Packers Gulch, Boulder Creek, Yellowbottom Creek, Canal Creek, Gregg Creek, McQuade Creek, Gold Creek, Green Creek, Savage Creek, Galena Creek, Little Meadows Creek, Bruler Creek, Butte Creek, Freezeout Creek, Beade Creek, Little Bottom Creek, Big Alder Creek, Green Peter Creek, Thistle Creek, Rumbaugh Creek, Fools Canyon Creek and Whitcomb Creek. For the purposes of this analysis, the Quartzville Watershed was stratified into seven sub-watershed basins (SWB), which will be used for future cumulative effects analyses (See Map #5: Sub-Watershed Basins). SWBs include South Green Peter, Whitcomb Creek, Moose Creek, Packers Gulch, Canal Creek, Lone Star, and Upper Quartzville which are all in the Western Oregon Cascades Province.

The climate in the upper elevations of the Quartzville Watershed is characterized by cool temperatures and heavy winter snowfall, while the lower elevation portion is more closely related to Willamette Valley weather and is characterized by wet and generally mild winters, and dry moderately warm to hot summers. Average annual precipitation ranges from approximately 62 inches in the lower elevations to 120 inches in the mountains, with the greatest precipitation occurring November through January, and the least occurring June through September (Taylor 1992). Snow pack plays a minor role in overwinter storage of precipitation in the Quartzville Watershed, except for the highest elevations, which make up approximately a third of this watershed's land base.

Riparian and stream adjacent vegetation along many sections of Quartzville Creek has been removed by high flows and movement of sediment, large cobbles and boulders down the channel. Overstory vegetation along the upper reaches of Quartzville Creek are dominated by mature and old-growth stands with some open sapling/brush mixed stands. The lower reaches of Quartzville Creek are dominated by younger conifer stands. The current riparian vegetation, especially on federal lands, is skewed towards mature stands (80 years plus in age). This results in larger material being available for recruitment as large woody debris. Large conifers are necessary for long-term stream structure and they are fairly available in the Quartzville Watershed. However, several torrential flow events in the mid 1960's and in 1996 resulted in some channelization of the streams in the watershed, and a reduction of existing woody debris in the system. Channelized streams generally have higher high flows and greater velocity, lower low flows, few meanders, incised banks, uniform streambeds, and a shorter overall stream length.

Soils

Typical soils in the watershed were formed in colluvium (material rolling downhill) from sedimentary or basic igneous rock, tuffaceous rock, and volcanic ash. Soils in the lower elevation portion of the Quartzville Watershed (Moose Creek, Whitcomb Creek and South Green Peter sub-watershed basins) include Blachly, Kliciitat, Harrington and Kinney soil series. The Soil Conservation Service (SCS) publication *Soil Survey of Linn County Area, Oregon* (Langridge, 1987) described these series as deep and moderately deep, well drained soils, gently sloping to very steep, cobbly loams, stony loams and gravelly loams soils. Upland soils in the higher elevations include series such as Keel gravelly silt loam, and Henline very stony sandy loam. These soil series are described as shallow to deep, well drained, cold soils of the western part of the Cascade Range.

Slope stability and mass movement hazards exist in the Quartzville Watershed which have affected streams and water quality (See Map #15: Precipitation Zones/Slope Stability Hazard). Slope stability was based on slope hazard and stand age. Less than two percent of the forested acres in the watershed is considered to be unstable or potentially unstable (See Table 5-21: Slope Stability Assumptions). Earth flows and slumps occur in scattered areas of the watershed, and result in the delivery of soil material to streams through streambank erosion and slope failures. Slope failures occur on steep rocky mountainous terrain and include rockslides, debris avalanches and earth flows. These failures are capable of delivering large quantities of unconsolidated materials to major drainages in a short period of time, and are often associated with roads. Slope erosion occurs on exposed slopes, producing increased sediment loads and higher turbidity. Stream erosion and deposition are common within portions of the watershed resulting in higher turbidity, siltation of salmon spawning gravels, and a decrease in channel stability.

Fisheries

No anadromous fish are found in the Quartzville Watershed due to fish passage problems at Green Peter Dam. Winter steelhead trout and spring chinook salmon existed in the watershed prior to the completion of Foster and Green Peter Dams. Planting of hatchery stocks of both species (including summer steelhead) had been extensive in the South Santiam Basin, including Green Peter Reservoir and Quartzville Creek up until the 1980's. Resident fish, including cutthroat and rainbow trout are found in approximately 233 miles of streams within the watershed.

Stream habitat in the basin is generally in a degraded condition from decades of land management practices such as timber harvest, road building and stream cleaning. Streams are lacking large woody debris (LWD) which serves to create and maintain habitat complexity, increases the retention of spawning gravel and nutrients, reduces the velocity of high flows, provides instream and overhead cover for aquatic organisms, and provides a nutrient base and/or preferred substrate for many taxa of aquatic invertebrates.

Human Uses

Today, human uses of land within the Quartzville Watershed are primarily associated with timber production and recreation. Industrial forest production is the predominant private land use in the watershed. Timber harvest on BLM and FS lands is more limited, given that 95 percent (62,155 acres) of these federal lands fall within a Late Successional Reserve or Riparian Reserve Land Use Allocation, which significantly restricts timber harvest activities.

There is gold mining activity on federal lands in the watershed. Currently these activities include recreational gold panning and extensive small scale placer (suction dredge) operations. No underground hardrock mining or large commercial operations currently occurs. The BLM manages a recreational mining area on the lower portion of Quartzville Creek that has been designated a National Wild and Scenic River (See Map #17: Special Management Areas). The FS manages several placer claims on both the main stem of Quartzville Creek, upstream of the BLM recreational mining area and along numerous tributaries in the central Quartzville area. Several patented claims are present in Dry Gulch area on lands within the Willamette National Forest Boundary.

Green Peter Reservoir is the most significant recreational feature in the Quartzville Watershed, in terms of visitation. Green Peter Reservoir receives over 125,000 visitors a year. Whitcomb Creek Campground and Thistle Creek Boat Ramp are the only fully developed recreation facilities along the reservoir. Both of these sites are were built by the U.S. Army Corps of Engineers (ACOE), but are currently managed by the Linn County Parks Department. The ACOE manages two small day-use areas at Green Peter Dam and most of the undeveloped use that occurs in several places along the reservoir. The high use season for the reservoir begins Memorial Day weekend and extends through Labor Day weekend. The majority of the recreational use is associated with motorized boat use, water skiing, and personal water craft use. Camping and fishing are also popular activities and non-motorized boat use occurs to a lesser extent.

The lower 9.66-mile segment of Quartzville Creek, is managed by the BLM and was designated a National Wild and Scenic River in 1988 for the outstanding scenic driving, recreational mining and white water boating opportunities it offers. The BLM manages the only three developed recreation facilities along Quartzville Creek including Yellowbottom Recreation Site (overnight use and day-use), Dogwood Recreation Site (day-use only), and Old Miner's Meadow Group-use Area (group overnight use only). The upper segment of Quartzville Creek, which is managed by the FS, has been found to be eligible for designation as a National Wild and Scenic River. Scenery, Recreation, Geologic and Hydrologic, and potential Fish Habitat were identified as outstandingly remarkable values. Both segments of Quartzville Creek also offer opportunities for camping, fishing, swimming, and scenic driving. Visitors can also explore old-growth forests up close in several locations on federal lands in the watershed.

Quartzville Access Road (Road 11 on FS) which connects U.S. Highway 20 (just east of Sweet Home) to State Highway 22 (just south of Marion Forks) is the main route into the Quartzille

Watershed. The entire 50-mile length of Quartzville Access Road is managed as a National Back Country Byway in partnership with Linn County, BLM and U.S. Forest Service. Starting from the Sweet Home side, the first 12.5 miles of Quartzville Road is a paved, two-lane county road. The second 12.5 miles of Quartzville Road is administered by the BLM and is a paved road with two-way traffic. The last 25 miles are managed by the FS as Road 11. Road 11 is a paved, single lane road, with stripped pullouts. Most of the secondary roads leading from Quartzville Access Road are narrow, single-lane gravel roads that may or may not be suitable for passenger car traffic. There are also several lesser maintained roads and spur roads that offer more challenging driving experiences.

Developed recreation sites in the Quartzville Watershed are limited to areas along Green Peter Reservoir or Quartzville Creek. Most of the recreational activities that occur on federal and private lands, outside of the Green Peter Reservoir and Quartzville Creek Recreation Corridor, are associated with dispersed upland uses such as hunting, target shooting, rock hounding, and off-highway vehicle use. Visitation is estimated at low to moderate, however, no field-based, quantitative use information is currently available.

Recreational issues in the Quartzville Watershed are associated with high levels of undeveloped recreational use along Green Peter Resevoir and Quartzville Creek, during the summer months. Along Green Peter reservoir the large size of many groups and crowding issues associated with camping along the reservoir contribute to problems with higher levels of undesirable activities such as litter, underage drinking, irresponsible campfire use, drug use, and manufacturing, and domestic violence and fighting. Long-term occupancy is also an ongoing management issue along the reservoir. The lack of publicly owned sites that are suitable for facility development only further limits management options currently available for reducing or resolving these management concerns. Many of these same problems exist along Quartzville Creek, however, to a lesser extent.

Chapter 3 Issues and Key Questions

The watershed analysis process begins by identifying significant resource issues which focus on a basic analysis of ecological conditions, processes, and interactions at work in the watershed. These issues are addressed by asking basic and fundamental key questions. Key questions focus the analysis on cause-and-effect relationships and on conditions as they relate to the ecological processes occurring in the watershed. The key questions have been grouped into three resource categories:

- **Terrestrial**
- **Aquatic**
- **Human Uses**

This first step in the process should answer the question *What is the condition of the watershed and how did it get this way?* The key questions for each resource category focus on a basic analysis of ecological conditions, processes and interactions at work in the watershed. An attempt to answer key questions is accomplished by gathering the current resource data available or by identifying data gaps. Current and reference conditions/trends and causal relationships are examined to the extent practicable for each of the resource categories. Answering the key questions provides the basis for recommendations which address the issues identified.

Not all issues initially identified were carried through the analysis process. Some issues were deferred due to lack of information. Other issues were not addressed because they are not covered by federal law or jurisdiction.

Considerable overlap and interaction occur among the various ecosystem components within the three resource categories. For instance soil erosion affects both upland productivity and water quality. Riparian ecosystems are an interface between aquatic and terrestrial resource categories that affect both. There are upland terrestrial and aquatic wildlife and plant species. The grouping into resource categories was used purely as an organizational aid for easing analysis and promoting easier reading.

A scoping questionnaire seeking public input for both the Crabtree and Quartzville Watershed analysis was sent out to landowners, residents, and interested parties during the spring of 2000. In addition, notification regarding ongoing watershed analyses was published in the Salem District Project Update, with contact email addresses and phone numbers. Respondents indicated that recreation opportunities, water resources, and forest health are important issues. The comments reflected the need for balanced multiple use resource management, including sound forestry practices and preserving older forests. This information was considered during the watershed analysis process and the formulation of the issues and key questions that follow.

Terrestrial Resources

Issue: What management opportunities exist for protecting, maintaining, and/or improving terrestrial resources in the Quartzville Watershed?

Discussion: Terrestrial resources include vegetation, plant communities, forest health, wildlife habitat and Special Status/Special Attention plant and animal species. Land management activities have altered the watershed, resulting in changes in distribution and patterns of occurrence of habitat and species. Terrestrial resources are also affected by natural processes such as natural succession and disturbance processes. How can federal land management objectives associated with managing terrestrial resources best be met in this watershed?

Key Questions:

* What is the current condition of the terrestrial resources in the watershed?

* What are the dominant natural processes and how do they affect terrestrial resources?

* How have private and public land use practices influenced terrestrial resources and how will they in the future?

Aquatic Resources

Issue: What management opportunities exist for protecting, maintaining, or improving aquatic resources in the Quartzville Watershed?

Discussion: Aquatic resources include water quality and quantity, flood control, private and municipal water rights, fish species and instream habitat. Aquatic resources are affected by both physical conditions and natural processes such as hydrology, riparian condition, soils, erosion, and slope stability. Land management activities have altered the watershed resulting in declining fish runs, water quality and aquatic habitat degradation. Of specific concern is Quartzville Creek, which is listed by the Oregon Department of Environmental Quality as water quality limited for summer stream temperature in the 303(d) report. Demands for aquatic resources are increasing and so are conflicts with other resource uses. How can federal land management objectives associated with managing aquatic resources best be met in this watershed?

Key Questions:

* What is the current condition of aquatic resources in this watershed?

* What are the dominant physical conditions and natural processes affecting aquatic resources?

* How have private and public land use practices influenced aquatic resources and how will they in the future?

Social

Issue: What developments or other management opportunities exist to meet the demand for recreational and natural resource commodities in this watershed, while still providing resource protection consistent with federal land management objectives?

Discussion: Social resources consider human uses including forest products, transportation, minerals, and recreation. The demands on watersheds to provide for a variety of human uses and products is increasing. This analysis will focus on the role that federal lands currently play in the watershed and what future opportunities may be possible.

Key Questions:

* What are the major or human uses and where do they occur?

* What are the main concerns related to human uses?

* What are the current and future trends related to human uses?

* What future opportunities exist for meeting the needs of those directly or indirectly using the watershed or products from the watershed?

Chapter 4 Historical Conditions

Introduction

Ecosystems are not static, but vary over time and space. This dynamic nature of ecosystems exemplifies the need to consider ranges of conditions over time, rather than single points in time.

The following narrative explains how ecological conditions have changed over time due to natural disturbances and human influences. This information is used to explain existing conditions and predict potential trends.

Geologic History

The Quartzville Watershed is located within the western Cascades physiographic region, whose history began some 42 million years ago during the Eocene era (53.5 to 37.5 million years ago). The curved oceanic Farallan plane began underthrusting the North American continental plate. Early volcanism resulted from this and flowed from a volcanic chain found immediately east of the Pacific continental margin. These small, low volcanoes spaces along a northwest/southeast belt deposited thick accumulations of andesitic tuffs and lava flows that form the base of the western Cascade Mountains. This broad belt indicates that the subducting Farallan plane was undercutting the continental plate at a shallow angle and at a rapid rate (three inches/year). During this period and the subsequent Oligeocene period (37.5 to 22.5 million years ago), the coastline angled in this northwest/southeast direction through the Willamette Valley to just west of the volcanic vents of the western Cascades. Volcanic ash was flushed out of the vents into marine basins along the coast. Upper continental shelf sands were the final marine sediments to be deposited along the retreating shoreline. During this Oligeocene period, many eruptions of andesitic lavas and siliceous tuffs were interspersed with oceanic sediments in the eastern margins of the Willamette Valley.

During the mid-Miocene period (22.5 to 5 million years ago), more tilting and folding from subduction were followed by volcanic lava flows along with the development of the western Cascades volcanic arc. The growth of this range was modest as the volcanic accumulations sank almost as fast as they piled up. Consequently, as in other areas of Oregon, violent eruptions from volcanic cones 13 to 9 million years ago left accumulations unmatched today. However, by 7 million years ago, the belt had narrowed to a band as wide as the present High Cascades Range. Cascade volcanism is the result of tectonic forces deep in the earth's crust. On the North American plate, the western Cascades were rotated clockwise into their present position. As the rotation began and the angle of the Farallan descending slab became flatter, volcanic activity occurred from west to east. This is illustrated by the fact that the oldest rocks in the Cascades are 42 million years old and the youngest are 10 million years old on the west edge of the High Cascades Range. Over time, more than six times as much material has erupted in the west Cascades as in the east. Convergences are slowing from three to one-half inch per year with

more slanting angles and less subducting. This slowing down began in the Miocene period and continues to this day. Additional uplift, mild folding, and faulting began 4.5 million years ago during the Pliocene period.

Specifically, for USDA Forest Service lands in the headwaters of the Quartzville Watershed, the area is composed of older Tertiary lava flows and other extrusive rocks. More specifically, undivided Miocene and Oligocene tuffaceous sedimentary rocks, basalt flows, tuff and breccias form the foundation of the Quartzville Basin. They consist of a heterogeneous assemblage of continental, largely volcanogenic deposits of basalt and basaltic andesite, including flows and breccias, complexly interstratified with epiclastic and volcanoclastic deposits of basaltic to rhyodacitic composition. They also include extensive rhyodacitic to andesitic ash-flow and air-fall tuffs, abundant lapilli tuff and tuff breccia, andesitic to dacitic mudflow (lahar) deposits, massive to bedded fine-to coarse-grained tuffaceous sedimentary rocks, and volcanic conglomerates. Radiometric potassium/argon dates on parts of this formation are mostly 32 to 17 million years ago. Most of these strata were previously assigned to the Little Butte Sequence (Walker and Duncan, 1989).

Flows and flow breccias of olivine andesite, basaltic andesite, and some basalt generally cap the main ridges in the eastern portion of the Quartzville Drainage, primarily along the ridge line from Minniece Point to Pinnacle Peak, then south and west to Swamp Peak. This unit is unconformable on the older deposits. Erupted mostly from widespread, northwest trending dikes and dike swarms and related plugs and lava cones, their potassium/argon age dates range from about 17 to 10 million years ago or middle to late Miocene. These rocks have previously been designated as the Sardine Formation by some authors (Walker and Duncan, 1989).

The surface expression of these rock formations has been extensively modified by erosion since late Miocene time, especially from Pleistocene through Holocene, with both glacial activity and slope instability. At the higher elevations, particularly from Little Meadows on to Pinnacle Peak, and around to Swamp Peak, the headwaters of both Quartzville and Canal Creeks display the remnants of one or more Pleistocene glaciations. Cirque basins, hanging valleys, and assorted morainal deposits all reside on the landscape, but most have been extensively altered by stream erosion and slope instability.

The materials of the Little Butte Series usually weather to form deep colluvial and residual soils that give rise to unstable soils with both rotational and translational failures. However, stabilized slump/landflow features, such as sag ponds, bench and scarp topography, and disrupted drainages are not common on USDA Forest Service lands, and are generally found only east Bruler and Butte Creeks. In most areas of the drainage, steep highly-dissected ridges and valley terrain predominates, and only a very few actively unstable remnants of these larger landflows can still be found scattered within the stabilized terrain.

Today, the Quartzville Watershed is mainly composed of basalt, andecite, and pyroclastic deposits in the headwater reaches of the watershed, and nonmarine terrace and alluvial deposits in the lower-elevation western reaches.

Geomorphic Descriptions

The entire analysis area can be roughly subdivided into three relatively distinct sections by two generally north/south tending lines. The more easterly division roughly follows Beabe Creek and Little Meadows Creek. East of this line, glacially formed slopes are more dominant with gentle and tolling terrain and deeper soils. West of this line, steep rocky canyons with shallow stable, colluvial soils predominate. These steep dissected V-shaped canyons and sharp well-defined ridges extend west until the western dividing line roughly follows Packers Gulch Creek to the main Quartzville Creek stem and then along Boulder Creek to the Middle Santiam River divide. West of this line, rounded ridges and benches again begin to predominate in a much older section of the West Cascades with deeper, more well developed soils.

Terrestrial

Disturbance Regimes and Ecological Effects

There are many disturbance factors that operate within the Quartzville Watershed. These factors include wind, fire, floods, insects, disease and humans. Today, humans are the agents of greatest disturbance in the landscape. In the past when human population levels were low, fire was the primary disturbance factor.

Fire Ecology

Fire is the primary natural disturbance factor over the landscape that causes the greatest ecological effects over space and time. Understanding basic fire ecology terminology is helpful in understanding fire effects on the ecosystem from a historical perspective. A fire regime is a generalized description of the role fire plays in an ecosystem. It is the combination of fire frequency, predictability, intensity, seasonality, and extent characteristics of fire in an ecosystem. There are many descriptions, but the one used here is based on fire frequency and fire intensity (Agee 1981, Heinselman 1981). Fire frequency is the return interval of fire over a given area. Fire intensity/severity is the ecological impact of a fire, such as mortality of plant or animal species, changes in species composition, and other ecosystem characteristics.

Western Oregon Cascades Province

Much of the information on disturbance processes for the Western Oregon Cascades Province comes from the Mid-Willamette Late-Successional Reserve Assessment (LSRA, 1998). In that assessment, there are two major plant association groupings in the Cascades portion of the Quartzville Watershed; the warm/moist western hemlock/Pacific silver fir, and dry western

hemlock/Pacific silver fir plant associations. There is a specific fire regime for each of the two plant associations. The fire regimes are based on the physical factors of: elevation, aspect, topography, climate and weather patterns. These factors have significant effects on fire behavior, which affects fire regime, and therefore fire history (Teensma 1987, Morrison and Swanson 1990, Garza 1995, Weisberg 1997).

The fire regime associated with the **warm/moist western hemlock/Pacific silver fir plant association** is characterized by average low frequency (>200 years) stand replacing fires; moderate frequency (80-200 years) partial burns. The dominant early seral species regenerating after a stand replacement disturbance in this regime is Douglas-fir. Western hemlock and western red cedar may be components in developing stands in the western hemlock type. Pacific silver fir and noble fir may be components of developing stands in the Pacific silver fir type. One or two intermediate disturbances may occur over the life of the stand. These disturbances can kill the fire intolerant western hemlock and Pacific silver fir while only slightly affecting the tolerant Douglas-fir. Post-fir seedbeds will vary, with western hemlock and Pacific silver fir able to regenerate under more shady conditions than Douglas-fir. These intermediate disturbances serve to increase the within as well as between, stand heterogeneity. Most stands in this regime reach classic old-growth conditions of multiple layers, large snags and downed wood. The fire pattern for this fire regime is one of stand replacement fires that occur over large areas (greater than 1000 acres) of the landscape infrequently, creating large, early seral patches. Partial burns and under burns occur in a more variable pattern, creating gaps and heterogeneity across the landscape.

The fire regime associated with the **dry western hemlock/Pacific silver fir plant association** is characterized by average moderate frequency (80-200 years) stand replacing fires; average moderate frequency (80-200 years) partial burns. The dominant early seral species regenerating after a stand replacing disturbance is Douglas-fir. Western hemlock and western red cedar may be components of developing stands. Some stands in this regime reach classic old-growth conditions of multiple layers, large snags and downed wood. Some stands may not develop multilayered canopies before experiencing another stand replacing event. One or two events may occur over the life of the stand. These disturbances can kill the fire intolerant western hemlock and western red cedar, while only slightly affecting the fire tolerant Douglas-fir, leaving remnants of various densities. Post fire seedbeds will vary, with western hemlock able to regenerate under more shady situations than Douglas-fir. These intermediate disturbances serve to increase the within as well as between, stand heterogeneity. Pacific silver fir, noble fir and Douglas-fir commonly regenerate after a stand replacing fire in the Pacific silver fir type. Intermediate disturbances have a variety of effects in this zone. Pacific silver fir, having thin bark and shallow roots, is very susceptible to mortality. Noble fir is moderately susceptible (especially when young), and Douglas-fir is quite fire tolerant. Partial stand replacing fires are quite variable,

leaving patches of live stands interspersed with areas of high mortality. Stand replacement fires

occur over large areas (greater than 1000 acres) of the landscape at moderate frequencies (80-200 years) creating large, early seral patches. Partial burns and under burns occur in a more variable pattern, creating gaps and heterogeneity across the landscape.

Historically, large blocks of older forest dominated the Cascades portion of the watershed. The watershed was unroaded until relatively recent times, and direct influences from human disturbance was minimal. Fragmentation was less and connectivity of habitats was higher, resulting in better wildlife dispersal capabilities across the landscape.

Fire left a mosaic of forest types, seral stages and a legacy of structural diversity across the landscape. The result was multilayered canopies, high numbers of standing dead trees, downed logs and coarse woody debris (CWD), and a prolonged stand establishment phase that lasted 20-100 years. It has been hypothesized that long establishment periods (brush>hardwoods>conifers) helped control root rots.

Earlier timber harvest eliminated much of the structural diversity components and has changed the forest to a less complex system. Fire has been virtually eliminated from the ecosystem through fire prevention and suppression.

With the harvest of trees, the amount of older forest, standing dead and down CWD components of wildlife habitat have decreased. As a result, within stand diversity has decreased and between stand diversity has increased. Timber harvest and road construction has increased the amount of high contrast edge and isolation of remaining patches in the watershed. Harvest patterns along property boundaries have disrupted travel corridors and decreased connectivity of habitats resulting in poorer wildlife dispersal capabilities. As a result of commercial forestry, the regeneration period has been shortened resulting in a proportionately higher amount of mid seral stages across most of the watershed (See Map #8: Seral Stages).

Fire History of FS lands

The source of fire ignitions comes from two primary sources, lightning and humans. Lightning was the primary source of wildfire ignitions in the Pacific Northwest and humans the secondary cause. Occurrence or patterns of lightning fires are determined by regional climate, land forms, elevation, aspect, and fuel type.

Lightning Fires: Numerous lightning caused fires have occurred in Quartzville in the last several decades. Lightning fires were common throughout the drainage, but they tended to concentrate around Minniece Point, Chimney Peak, Knob and Slate Rocks, and the head waters of Beabe and Canal Creeks. If not suppressed by aggressive fire fighting efforts, these fires would have likely ignited hundreds to thousands of more acres just with in the last fifty years. Fire return intervals in the natural system were likely a century or less for the last thousand years or so. This may even be even shorter if we include the aboriginal fires that were set along the ridge lines, perhaps every three or four years. It is likely that a prehistoric Quartzville was composed of large tracts of open brush and regeneration, coupled with large areas of open

underburnt timber with large fire resistant trees.

This scenario with open ridge lines and underburn, open south aspects created an ideal environment for the growth and regeneration of sugar pine. Extensive field reconnaissance has shown that large old growth sugar pine and natural sugar pine regeneration are common to the hot south aspects, especially south of Slate Rock and White Bull Mountain. Unfortunately, recent field work on both the Detroit and Sweet Home Ranger Districts has revealed that most of the sugar pine are dead or dying. The likely cause is the elimination of fire, which reduced the competition and created the open stands. Considerably more shade tolerant, fire intolerant species have proliferated throughout these stands. Stem densities have increased from a few dozen trees per acre in the understory to several hundred trees in many areas. In addition the species mix has changed from sugar pine, Douglas-fir, and western white pine, to western hemlock.

On the other hand, especially in the areas of Bruler, Butte, and Freezeout Creeks on the more gentle glaciated sideslopes and benches, fires were less frequent, of lower intensity, and smaller in size. More traditional old growth habitat with its multi layered stands and abundance of snags and coarse woody debris were prevalent. These areas had much longer return intervals for catastrophic fires. Much of the early timber harvest was concentrated within these old growth stands.

Human Fires: The divides of the Quartzville Watershed were main travel ways for American Indians for many thousands of years. From ethnographic information, fires were set on the main ridge lines between Quartzville and the North and Middle Santiam drainages. Most of the ridgelines and south aspects contain one hundred to two hundred year old fire regenerated second growth. This is especially common south of Slate Rock and south of White Bull Mountain. These fires were set for several reasons including brush removal for huckleberry production, and big game forage to improve hunting. These fires likely extended down slope on the dry south aspects and underburnt thousands of additional acres. This created an open stand condition with numerous large fire tolerant old growth, primarily Douglas fir and sugar pine. These stands became less susceptible to large stand replacement fires because fuel loading was reduced to low levels and ladder fuels were almost nonexistent.

Fires have been suppressed over the last century by the FS. Quartzville was home to numerous look outs during the early and mid parts of the last century. Lookouts were located on Chimney Peak, Swamp Peak, Knob Rock, Minniece Point, and Slate Rock, as well as several others just outside the drainage. These lookouts and an extensive trail system were utilized to locate, attack and suppress lightning starts and other fires.

Timber harvest and associated slash disposal through the 1960s to the 1980s resulted in a patchwork landscape that at the small scale tended to replicate intense fire regimes. Aggressive salvage programs and utilization requirements removed much of the woody debris and snags. Fall burns often removed most duff and litter. These stands were aggressively replanted with around 500 trees per acre and later thinned to 300 trees per acre. The productive soils of

Quartzville produced well stocked stands which thrived and are currently ready for commercial thinning. County receipts dollars will hopefully be used to catch up on the back log of precommercial thinning acres for the next six to eight years.

Wind Events

Wind also has the capacity to disturb large areas of the landscape and on a historical basis has done so approximately every 25 years (Teensma 1987). The last extensive large wind event in Oregon was the Columbus Day Storm of 1962, which blew down 11 billion board feet of timber in Oregon and Washington, 98 percent of which was west of the Cascade Crest. Other major wind events occurred in December 1996, March 1963, February 1958, April 1957, November 1953, January 1921 and January 1880. Wind is also associated with patch size disturbances over the landscape as are insects and disease. These three disturbance factors add small complex changes over large spatial and temporal scales and have direct and indirect influences on fire ecology.

Blowdown contributes to fragmentation in this watershed, especially in the Packers Gulch, Canal Creek and Upper Quartzville Sub-watershed Basins. There was a major wind event on January 10th of 1990 that had severe impacts to the older stands in the watershed. There was approximately 80 million board feet (MMBF) of timber that was blown down, only about 40 MMBF was subsequently salvaged due to management concerns and the economics of harvesting the more dispersed areas. Insects damage to the surrounding stands of the down wood that was not harvested likely amounted to about 20 MMBF of dead trees. The fuel loadings in the watershed increased dramatically due to this wind event.

Insects and Pathogens

Insects and pathogens are important components of western Oregon's forested ecosystems. Insects function in forest dynamics as defoliators, decomposers, pollinators, and prey or hosts to other species such as birds, amphibians, and other insects. The diversity and community composition of insects and pathogens influences processes such as nutrient cycling, plant population dynamics, and predator-prey interactions. From the silvicultural perspective, insects and pathogens can affect tree growth rates, stand structure, fire hazard, recruitment and decomposition of CWD. Insects and pathogens can profoundly affect and on occasion actual become disturbance processes in the forest environment.

Insects

Much of our current understanding about insects comes from studies conducted on the H.J. Andrews Experimental Forest (HJA), located on the Blue River Ranger District of the Willamette National Forest. Over 3,400 insects have been documented from the HJA, and this may represent only half of the total species actually present (Parsons et al. 1991). Of these 3,400 species, 523 moth species

(order Lepidoptera) have been recognized. Lepidoptera are vital components of food webs by serving as the primary food resource for bats and passerine birds.

Studies on the HJA also show that insect diversity and functional diversity are much higher in canopies of old-growth trees compared with those of young trees (Schowalter 1989, 1995). In addition to being more diverse, mature and old-growth stands are less susceptible to insect outbreaks, and therefore typically suffer less defoliation than young stands (Schowalter 1989). Forests management activities such as selective logging, fire suppression, and seedling planting have proven vulnerable to mountain pine beetle (*Dendroctonus ponderosae*), western spruce budworm (*Choristoneura occidentalis*), and Douglas-fir tussock moth (*Orgyia pseudotsugata*).

Although several thousand insect species inhabit our forests, it is only a few species, primarily specific bark beetles (Coleoptera) and defoliating caterpillars (Lepidoptera), that significantly affect growth and survival of conifers and thus receive the most attention.

Douglas-fir beetle (Dendroctonus pseudotsugae): Douglas-fir beetle *(Dendroctonus pseudotsuga*e) is present in all of the LSR stands. Its populations are maintained at low levels in root disease pockets or on scattered dead or down trees. Endemic populations (i.e., low, relatively static numbers which cause relatively insignificant amounts of defoliation or tree killing) can build up to epidemic levels (i.e., high numbers that cause readily noticed or significant amounts of defoliation or tree killing) following windstorms when a significant number of trees fall down. Data from 50 years of aerial surveys, conducted to detect insect-caused mortality, indicate notable increases in Douglas-fir beetle caused mortality every eight to twelve years, usually two years after stormy winters. Impacts range from scattered mortality (one tree killed per four acres) over large areas to concentrations of 5 to 20 trees killed per acre in areas 1 to 50 acres in size .

Mountain pine beetle* (Dendroctonus ponderosa*e): An outbreak of mountain pine beetle *(Dendroctonus ponderosa*e) in western white pine occurred in the LSRs during the late 1960's. Thousands of acres were affected as most of the white pine was reaching old age and was being outcompeted by other species. Therefore, western white pine populations have dropped significantly below historic levels in most stands.

Balsam wooly aphid* (Adelges picea*e): An exotic insect, the balsam wooly aphid *(Adelges picea*e), was introduced into the Pacific Northwest in the 1920's on true firs in the Willamette Valley and gradually spread to the Cascades. During the 1960's, aphids caused extensive areas of mortality in Pacific silver fir, especially in the high elevations of Jefferson, Waldo West, Hills Creek, and possibly Horse Creek LSRs. While this insect has had little influence recently, it had a profound influence on the structure of high elevation LSR stands.

Pathogens

Similar to insects, there are relatively few fungi species that are considered to be a problem in the forest environment. Of the more than 100,000 species of fungi, only a small fraction (< 200 species) can cause serious damage. Below is a summary of those fungi species that are of concern:

Laminated root rot* (Phellinus weirii*): Laminated root rot *(Phellinus weir*ii), a native disease that affects many conifer species, is the most widespread disease of Douglas-fir in the western Cascades. Various surveys show that laminated root rot is patchily distributed and occurs in 3-5% of the Douglas-fir forest. Trees killed by the disease provide snags and logs, which benefit many wildlife species. However, current management emphasizes planting or retaining resistant or immune species such as western white pine and western redceder.

White pine blister rust* (Cronortium ribicol*a): White pine blister rust *(Cronortium ribicol*a) can infect nearly all the 5-needle pines including western white pine, sugar pine, and white bark pine in the LSRs. Older, large diameter western white pine, sugar pine, and ponderosa pine populations have dropped below historic levels in the few LSRs where they are found. Disease resistant western white pines have been planted in harvested units within the LSRs.

Armillaria root rot and others: Armillaria root rot *(Armillaria* spp., basidiomycete fungi), Annosus root disease *(Heterobasidion annosu*m), dwarf mistletoe *(Arceuthobium* spp.: parasitic angiosperms in the family Viscaceae), and other fungal diseases are present within the analysis area and are expected to cause minor infections on their host species within the LSRs.

Wildlife Habitat

The Quartzville Watershed is located in the Western Oregon Cascades Physiographic Province. Historically, disturbance in the Quartzville Watershed has been dominated by fires and windstorms that left varying quantities of standing dead and down wood, which are important components of wildlife habitat. Fires left a mosaic of forest types and seral stages across the landscape. Large blocks of older forest dominated the Cascades Range where the Quartzville Watershed is located. The watershed was unroaded until relatively recent times, and direct influences from human disturbance was minimal. Fragmentation was less and connectivity of habitats was higher, resulting in better wildlife dispersal capabilities across the landscape.

Fires set by Native Americans have resulted in large blocks of open grown, fire resistant trees with a grass/forb understory. These stands had few snags or down wood. There likely were pockets (wet areas, stream vegetation) where fire did not regularly encroach and where shrubs and understory trees were prevalent. Edge habitat created between the burned and unburned areas were likely extensive throughout the area. These open forest stand conditions and associated edges were likely stable across the landscape.

Habitat conditions within the burned areas were likely very beneficial for grazing animals like elk but much less so for animals requiring snags or down wood for some portion of their life needs. Edge habitat between the cover and open areas provided essential habitat for a number of species.

Wildfires in stands not normally burned by Native Americans resulted in habitat with various tree sizes, amounts of snags and down wood, and understory vegetation. Stand replacement fires created high levels of snags and down wood. The first few years following a severe disturbance

were very beneficial for early seral species, particularly where numerous snags and down wood were present.

Timber harvest activities during the last 40 years have resulted in higher intensity, more frequent human caused disturbance regimes. With the harvest of trees, the amount of older forest, standing dead and down coarse woody debris (CWD) components of wildlife habitat have decreased. Timber harvest and road construction has increased the amount of high contrast edge and isolation of patches of older forest in the watershed. Harvest patterns along property boundaries have decreased connectivity of habitats resulting in poorer wildlife dispersal capabilities, especially for the less mobile species. As a result of commercial forestry, the regeneration period has been shortened resulting in a proportionately higher amount of mid seral stages across portions of the watershed.

This departure from historic disturbance regimes have shifted the abundance and distribution of wildlife species in the Quartzville Watershed. Species that find their optimum habitat in older forest, and standing dead/down CWD are likely to be less favored than in historic times. These species include the clouded salamander, Oregon slender salamander, pileated woodpecker, and the spotted owl. Species whose primary habitat is edge and open areas in the forest environment have tended to be favored. These species include black-tailed deer, mountain quail, great horned owl, red-tailed hawk and golden eagle.

Some species which were present during historic times have been greatly reduced or extirpated due to direct human impacts. These species include the fisher, wolverine, and the gray wolf. Competition with non-native species such as bullfrogs, starlings and house sparrows is minimal due to the Quartzville Watershed's location further into the Cascades away from rural environments in the Willamette Valley where these introduced species are abundant.

Aquatic

Hydrology / Water Quality

Stream channel morphology reflects a channel system's ability to transport or store inputs of water, sediment, and wood. Differences in channel slope, flow, depth, sediment supply, and large woody debris affect a channel's sensitivity to changes in inputs (Washington Forest Practices Board, 1993).

Limited stream gauging data exists for the Quartzville Watershed. However, significant flood events are known to have occurred in the South Santiam sub-basin as long as records have been kept. The most recent major floods recorded in the watershed were in December 1964, and February 1996. Floods are often a result of warm storms, heavy rain and snow pack at lower elevations, resulting in the generation of large volumes of runoff in a short period of time. The amount of snow pack, and the time required for runoff to reach a stream are affected by the number and size of openings in the natural forest canopy, and the miles of road in the vicinity of stream channels. Openings in the forest canopy allow for a heavier snow pack to accumulate, when compared with a closed forest canopy.

Roads also affect stream flows and yields, but in a different way than harvesting. While harvesting affects evapotranspiration, roads influence hillslope flow paths by converting subsurface flow to surface flow, and allowing it to enter the stream much more quickly. The combination of harvesting and roads in small watersheds have been shown to increase peak flows, produce higher storm volumes, and produce earlier rises in stream flow response to storms (Jones et. al. 1996).

Historically, disturbance in the watershed prior to European influence is thought to be due mostly to fire. The fire regime in the watershed was characterized by natural moderate frequency partial burns and low frequency stand replacement fires. These disturbances would have affected stream channels, flows, and water quality, and provided woody debris and gravels to streams. The natural disturbance cycle was long enough to allow recovery of the stream system in between fire events. This type of disturbance is different from the disturbance cycle seen in the watershed currently. Timber harvesting has occurred on public and private lands, forming a patchwork of stands of varying ages. Roads provide continual disturbance, change the hydrologic response to storms, and the input of sediment to streams. The historic low to moderate frequency of disturbance in the forested reaches of the watershed have been replaced by chronic, constant disturbances, and has affected the character and morphology of streams.

Soils

Slope Stability

The relationship between pyroclastic rock and slope stability was studied by the FS on the H.J. Andrews Experimental Forest by Dyrness (1967). In this study, 94 percent of mass soil movement events occurred on the 37 percent of the area made up of pyroclastic material, and 6 percent of the area made up of green tuff and breccias.

Comparative rates of soil movement from various land uses have been inventoried over a 25-year period in the experimental forest in the Cascade Range. Mass erosion rates were calculated to be 0.87 cubic meters per hectare per year for undisturbed forests, 2.45 cubic meters per hectare per year for clearcuts , and 26.19 cubic meters per hectare per year associated with roads. In a summary of several studies, McNutt and McGreer (1985) calculated natural slumping rates of 0.0224 per square mile per year; or one slump in 45 years per square mile in areas of undulating topography with slope gradients of less than 60 percent. Natural failure rates of areas of steep to extremely steep slopes (70 to 100%) occur in old-growth Douglas-fir stands.

Fisheries

Historically, winter steelhead trout (*Oncorhynchus mykiss*) and spring chinook salmon (*O. tschawytscha*) were the only anadromous salmonids that could migrate over Willamette Falls, up the Santiam River system and into Quartzville Creek. Both species used Quartzville Creek for spawning and rearing. Spring chinook would enter the Santiam sub-basin in May and hold in large, deep mainstem pools until they spawned in the early fall. Winter steelhead would enter the sub-basin from March through May and spawn immediately upon reaching their spawning grounds. Adults that survived the spawning process would return downstream to the ocean.

Pacific lamprey (*Lampetra tridentata*) also were capable of ascending the falls and entering the upper Willamette River tributaries, but little is known about their historic distribution or abundance.

The Santiam sub-basin provided the majority of the winter steelhead production and about one-third of the spring chinook salmon production in the Willamette Basin (Wevers, et al. 1992). Up to two-thirds of the Santiam sub-basin steelhead production occurred in the upper portions of the North and South Santiam rivers. The remaining production occurred in the lower foothill tributaries.

Little information is available regarding historic abundance of steelhead and chinook in Quartzville Creek, however, they are believed to have been plentiful. Historically, upstream migration of both species in mainstem Quartzville Creek was blocked by a barrier waterfall at approximate River Mile 15.3, approximately 1.8 miles upstream of the mouth of Canal Creek. Upstream migration of chinook may have been blocked by a steep cascade near the mouth of Yellowbottom Creek. Many Quartzville Creek tributaries were probably utilized by steelhead, and the larger ones by chinook, when accessible.

Much of the most productive habitat in the Santiam sub-basin has been blocked by dams on the North, South and Middle Santiam rivers. Detroit Dam and the downstream Big Cliff Dam, constructed in 1953 on the North Santiam, and Foster and Green Peter dams, constructed in 1968 on the South and Middle Santiam rivers, have blocked anadromous fish passage to historic upstream spawning and rearing areas. As a result of the Foster and Green Peter dams, anadromous fish are no longer present in Quartzville Creek.

Hatchery production of spring chinook was increased as mitigation for the dams in the Santiam Basin. Large numbers of Willamette stock spring chinook fry, fingerlings and smolts were released in the Quartzville Creek watershed from 1968-1975, and from 1979-1986 and large numbers of winter steelhead (N. Santiam and S. Santiam stock) fry, fingerlings and smolts were released in the watershed from 1980-1987. Additionally, 386,000 sockeye salmon (*O. nerka*) were released in Green Peter reservoir in 1967-68, and 600 Skamania stock summer steelhead smolts were released in Green Peter Reservoir in 1986 (Wevers, et al. 1992).

Foster and Green Peter Dams were built with fish ladders and stocking of anadromous fish upstream of the dams was conducted in attempts to reestablish anadromous runs of steelhead and chinook. The fish ladders were fairly successful in passing adult fish upstream, but problems were encountered in passing smolts downstream. In the late 1980's it was decided that reestablishment of anadromous fish populations upstream of Green Peter Dam was not feasible until smolt collection facilities could be built at Green Peter Dam or at the mouths of Quartzville Creek and the Middle Santiam River where they enter Green Peter Reservoir. In 1995 the U.S. Army Corps of Engineers conducted a study to determine the feasibility of constructing and operating smolt collection facilities. The project was determined to be feasible but expensive, and is currently shelved due to lack of funding.

Stocking of kokanee (landlocked sockeye salmon) was conducted in Green Peter Reservoir until 1980, and was resumed in 2001. Adult kokanee are known to ascend the lower reaches of Quartzville Creek and the Middle Santiam River to spawn.

Resident rainbow trout (*O. mykiss*) have been stocked in Quartzville Creek since the 1920's, although the numbers of fish are unknown. Although stocking of non-native resident fish in most of the flowing waters in Oregon was discontinued in 1998 in order to comply with Oregon Department of Fish and Wildlife's (ODFW) Wild Fish Management Policy, catchable rainbow are still stocked in Quartzville Creek due to the absence of wild anadromous populations with which the rainbow trout would compete.
Bull trout were also historic residents of the Quartzville Watershed. The last bull trout was sighted in the Middle Santiam Watershed in 1954.

Habitat

Anadromous and resident fish existed in streams that had an abundance of large persistent wood. Log jams were likely common, particularly in the low gradient (<2%) sections. Woody debris provided instream cover and helped dissipate flood flows. Channels had a diversity of substrate types for spawning and invertebrate production, as floods routed landslide debris throughout the system. Stream channels were more complex, with water flowing around boulders and large pieces of wood. Side channel and off-channel habitats were not common due to the steep, narrow configuration of the canyons. Riparian areas throughout the watershed were likely dominated by older coniferous forests, with some alder and maple along the stream corridor.

Stream temperatures were likely cool in the summer, supporting stable populations of spring chinook that would enter the Santiam sub-basin in May and hold in large mainstem pools until they spawned in the fall, utilizing deep, cold water pools for holding during summer months. Periodic fires, often followed by landslides, had a negative effect on salmonids due to increased sedimentation and increases in water temperature as a result of vegetation removal. However, due to the biotic diversity brought about by fire in the landscape, there were likely places where some fish could escape the impacts of these events.

Log driving is known to have occurred on Quartzville Creek (Farnell 1979). Although the years in which log drives took place are unknown, they probably were common in the late 1890's and early 1900s. Log drives and associated splash dams had serious adverse effects on instream habitat conditions for fish.

Sixteen miles of mainstem Quartzville Creek were surveyed in 1937-38 by U.S. Fish and Wildlife Service personnel. Personnel of the Oregon Fish Commission surveyed the mainstem from the mouth, which was then at the confluence with the Middle Santiam River, 22 miles upstream to the mouth of Little Meadow Creek, as well as 12 miles of tributaries in 1959 (McIntosh et al. 1994; Willis et al. 1960). Most of the information contained in the survey reports is in narrative form, and is focused on investigation of potential impoundment and hatchery sites, the potential for increasing the range of anadromous fish, and identifying fish passage barriers and water diversions.

Descriptions of the instream substrate in both of the historic surveys are similar to the substrate descriptions included in the reports from surveys conducted by BLM in 1993 and by ODFW in 1999, indicating that stream substrate composition has changed little since 1937. In contrast, the count of resting pools (presumably deep pools suitable for adult spring chinook summer habitat) included in the 1937-38 survey report indicates a pool frequency of 43 pools/mile in the reach from Yellowstone Creek to Canal Creek. The BLM survey in 1993 resulted in a count of 8 pools/mile, and a survey conducted by ODFW in 1999 resulted in a count of 9 pools/mile in the same reach. Although some of the difference in pool frequency may be attributable to flow conditions at the time of survey, survey methods and surveyor bias, it is an indication that streambed agradation in pool areas has occurred, probably as a result of the closure of Green Peter Dam.

Human Uses

Prehistoric Human Activities

Currently there are no recorded prehistoric archeological sites on the portion of Quartzville Creek (Gilsen, 1990; U.S.D.I., n.d.) managed by the BLM. However, with the exception of the slopes east of the creek in Sec. 25, T. 11S., R. 3E., and a small part of Sec 29., T. 11S., R.4E., no systematic cultural resource inventory has been conducted within the river corridor. In addition, a number of factors may prevent easy site identification. These include dense vegetation, watercourse changes, terrace build-up and erosion, flooding with resultant washout and silt deposition, and historic human activities including placer mining, construction, and artifact collection.

It is very likely that aboriginal archeological sites are present in the corridor and will be found in future inventories. Sites have been found above and below the designated river segment and in the uplands of the immediate watershed. These sites consist of lithic scatters and isolated artifacts a probable indication of camps, travel routes, and resource procurement and processing sites, primarily related to hunting and fishing activities and tool-making and tool-maintenance.

American Indian people have occupied the Santiam River drainages for thousands of years. Excavated sites near Sweet Home and Oakridge have been dated to 6000 B.C. (Minor, et.al., 1980). In general, Cascade upland sites appear to have been used by people who focused their settlement and subsistence pattern on the lowlands of the Willamette Valley, but utilized the uplands in the mid to late summer for numerous short term hunting and berry picking expeditions (Baxter, 1986). The uplands also provided sources of jaspar and chert for tools (Winkler, 1990).

In the ethnographic period, the American Indian people occupying and/or using this area were the Santiam division of the Kalapuya people. The Santiam peoples' major village sites were identified in the Willamette Valley near Salem and Albany (Swanton, 1952). Late summer and early fall hunting in upland environments is recorded for Kalapuyan people (Zenk, 1976), though the majority of their subsistence activities focused on the Willamette Valley, its immediate foothills and the lower reaches of its major tributaries. Early historic accounts describe a very high Native American population density in the Willamette Valley, but this population suffered severe losses during the epidemics of the early nineteenth century (Minor, et.al., 1980). The

remaining members of the Santiam Kalapuya were removed to the Grand Ronde Reservation after signing a treaty in 1855.

Molala Indians also lived on the western slopes of the Cascades, apparently year round. The Chimbuiha band occupied the headwaters of the Santiam and the Mukanti band occupied the western slopes of the Cascades (Swanton, 1952). Little is known about the Molala culture, but they are believe to have wintered in multi-family camps located along streams in lower elevations usually on the westside of the Cascades, exploiting the higher country for game, fish, berries and roots. (Rigsby, n.d.) Relations between the Kalapuya and Molala were cordial and intermarriage did occur (Minor, et. al. 1980). The pure Molala lifeway abruptly ended in 1855 when the survivors of the 1848 Molala war (Baxter, 1986) were moved to the Grand Ronde Reservation.

American Indians from the Warm Springs Reservation came over the mountains by way of Mt. Jefferson and crossed the Middle Fork of the Santiam along a route called Buck Trail until at least 1914. "The Indians would go up the Quartzville branch and catch and dry fish, pick huckleberries and then return to Sweet Home and work in the hop yards in the fall" (Surdam and Anderson, 1939). Whether these people were Kalapuya, Molala, or other groups, perhaps based primarily on the east side of the Cascades, is not clear, but it is apparent that some Indians using and/or inhabiting the western Cascade slopes were placed on the Warm Springs Reservation, as well as the Grand Ronde Reservation.

Historic Human Activities

The first discovery of placer gold in the Quartzville area was reported in about 1848 in the sands of Dry Gulch, a tributary to Quartzville Creek (Stumpf, 1979). The first claim in the Quartzville Mining District is reported to have been filed by Jeremiah Driggs in 1863. In 1864, two major lode claims, the White Bull and the Red Bull, were made (Callaghan & Buddington, 1938). That same year, the town of Quartzville was laid out and a stamp-mill was set up (McArthur, 1965). By the end of 1865, 500 mining claims had been staked and Quartzville had a population of 1,000. Ultimately, the profits from the mines were small and by 1866, the area's mining activities were already in decline. The town of Quartzville was abandoned by 1871.

A second boom began in the 1880s and lasted into the early 1900s. Mining operations by large investors and companies peaked in the 1890s while individuals worked claims up past the turn of the century. After 1910, mining activity in this area slowed, as the most accessible deposits were exhausted. Interest again increased during the 1930s Depression, but continued on a small scale only and ceased as a serious economic activity during World War II. Between 1863 and 1951, production for the Quartzville Mining District was totaled at $181,255, with 8,557 ounces of gold and 2,920 ounces of silver removed (Brooks and Ramp, 1968). Currently the majority of mining activity within the river corridor is recreational.

Nearly all the BLM managed lands along Quartzville Creek are originally those unhomesteaded lands granted by Congress to the Oregon and California Railroad Company (O&C company) between 1866 and 1869 for the purpose of raising money to pay for construction of a railroad which would start in Portland and go through the Willamette Valley , south to California. The

O&C Company was required to sell these lands to settlers, but in many cases, as with this area, the land was heavily timbered and had steeply dissected slopes with forest type soils, and was therefore unsuitable for farming. In 1916, due to numerous violations of the terms set by Congress for the land grant, the unsold O&C lands were revested to the General Land Office and ultimately, its successor, the Bureau of Land Management. The first timber sales on these lands occurred in the early 1950's.

Chapter 5 Current Conditions

Introduction

The Quartzville Watershed spans from Green Peter Dam and the Middle Santiam River on the west end, to the vicinity of Scar Mountain on the extreme east end of the watershed. The watershed is 95,468 acres, or 149 square miles, and is located entirely within Western Oregon Cascades Physiographic province. Elevations range from about 1,000 feet at Green Peter Dam, to 4,974 feet at Galena Mountain, the highest peak, located on the south end of the watershed (See Map#16: Digital Elevation Model). The watershed is bordered by Gordan Peak, Swamp Peak, Knob Rock, and Chimney Peak on the southeast side of the watershed; to Galena Mountain, along Galena Ridge to Rocky Top, across Green Peter Reservoir to High Deck on the south. On the west, the watershed is bordered by Green Peter Dam, Green Peter Peak, Bald Peter, Yellowstone Mountain, and Crabtree Mountain. On the North, the watershed is bordered by Harry Mountain Ridge, Slate Rock and Pinnacle Peak.

The Quartzville Watershed was stratified into seven sub watershed basins (SWBs) which are delineated on Map #5: Subwatershed Basins. SWBs include Canal Creek, Lone Star, Moose Creek, Packers Gulch, South Green Peter, Upper Quartzville, and Whitcomb Creek. Federal acres in the watershed are managed primarily by the Bureau of Land Management and the Forest Service, with federal lands surrounding Green Peter Reservoir being managed by the Army Corps of Engineers. The area of each SWB and percentages of the total watershed are displayed in Table 5-1, below.

Table 5-1: Sub-Watershed Basins by Ownership Acres and Percent.

Sub-Watershed Basin (SWB)	Federal Acres (% of SWB)	Non-Federal Acres (% of SWB)	Total Acres (% of WA)
Canal Creek	13,168 (88%)	1,847 (12%)	**15,015 (16%)**
Lone Star	11,396 (82%)	2,427 (18%)	**13,823 (14%)**
Moose Creek	9,751 (60%)	6,461 (40%)	**16,212 (17%)**
Packers Gulch	14,408 (82%)	3,238 (18%)	**17,646 (19%)**
South Green Peter	1,464 (29%)	3,514 (71%)	**4,978 (5%)**
Upper Quartzville	12,792 (100%)	0 (0%)	**12,792 (13%)**
Whitcomb Creek	6,046 (40%)	8,956 (60%)	**15,002 (16%)**
TOTALS	**69,025(72%)**	**26,442(28%)**	**95,468 (100%)**

Terrestrial

Vegetation Patterns

Information on vegetative conditions was derived from a variety of sources. Bureau of Land Management (BLM) Forest Operations Inventory (FOI) records were used to depict vegetative conditions on BLM lands. Vegetative condition on U.S. Forest Service (FS) land was obtained from the FS Vegetation Database. Estimates of vegetative cover and stand conditions on federal lands are expressed as existing in the summer of 2000. Vegetative condition on private lands was determined from aerial photograph interpretation using the Western Oregon Digital Imagery Project (WODIP). Estimates of vegetative cover and stand conditions on non-federal lands are expressed as existing in the summer of 1997. This information was developed for the evaluation of seral stage distribution and habitat conditions across the watershed. Harvest and other management activities conducted since then were not evaluated in this analysis.

Approximately 90 percent of the Quartzville Watershed are forest types consisting mostly of Douglas-fir, western hemlock and Pacific silver fir. About five percent consists of non-forest types that include roads, rock quarries, reservoir and other manmade developments in the watershed. Meadows, rock, cliff/talus, and other natural openings in the forest environment are also included as non-forest types. Map #6: Vegetation Cover Type shows the locations of cover types in the watershed. In addition, hardwood and mixed hardwood/conifer types consisting mostly of big leaf maple, red alder, fir and hemlock comprise about five percent of the watershed, primarily at lower elevations and in riparian zones of larger order streams.

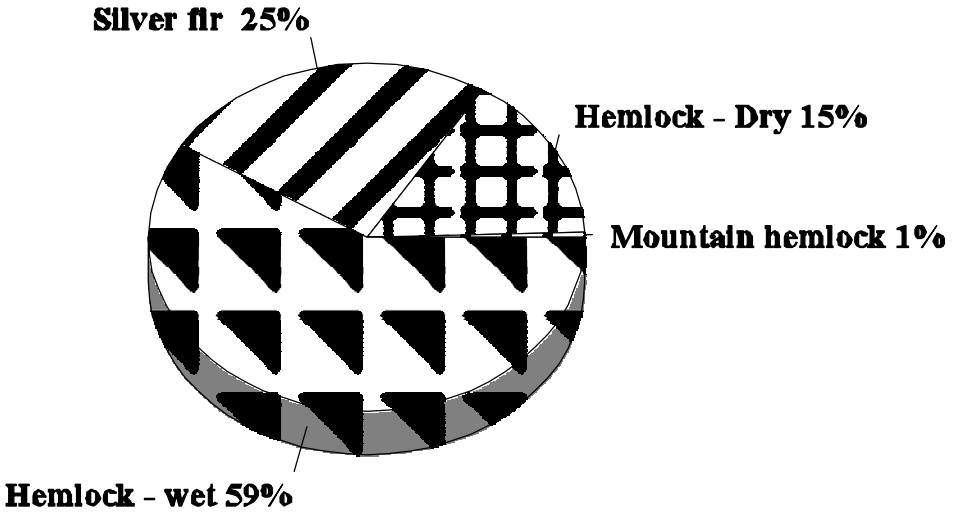


Figure 5-1: Plant Association Series.

The forested portion of the watershed can be stratified into three major plant association groups: western hemlock, mountain hemlock, and Pacific silver fir series. Plant associations describe the potential dominant plant community (a combination of tree and shrub and/or herb layers) that would inhabit a site over time without any disturbance (Hemstrom and Logan 1986). A plant association defines a biological environment in terms of the species' composition, productivity,

and response to management. Knowledge of the presence and distribution of indicator understory species further refines the biological environment, allowing us to more accurately assess site potential.

Plant associations with similar attributes have been aggregated into groups. These plant associations groups have been arranged into "sub-series" based on the broad environmental conditions in which they are found. This is a key stratification in identifying the range of structural and compositional characteristics that can be expected under natural conditions on a given site. Table 5-2 characterizes the relationship between series, sub-series environments, and plant associations found in this watershed.

Table 5-2: Plant Association Series, Sub-Series, & Indicator Species.

Series	Sub-Series Environments	Understory Indicator Species in Plant Associations
Western Hemlock	Wet	dwarf Oregon grape/oxalis; Oregon oxalis; swordfern
Western Hemlock	Dry	dwarf Oregon grape; dwarf Oregon grape-salal; rhododendron-dwarf Oregon grape; rhododendron-salal; rhododendron/twinflower; vanilla leaf; dwarf Oregon grape/vanilla leaf; twinflower; rhododendron-Alaska huckleberry/dogwood bunchberry; rhododendron/beargrass
Pacific Silver Fir		vine maple/coolwort foamflower; Oregon oxalis; coolwort foamflower; rhododendron-Alaska huckleberry/dogwood bunchberry; Alaska huckleberry/dogwood bunchberry; big huckleberry/ Oregon grape; rhododendron-dwarf Oregon grape; big huckleberry/beargrass; rhododendron/beargrass
Mountain Hemlock		grouse huckleberry; rhododendron; big huckleberry/beargrass; luzula

The western hemlock series is the most dominant series present in the watershed, occupying 74 percent of the forested portion of the watershed. This series occurs from low to mid elevations and up the major riparian areas. The western hemlock series can be further differentiated with 79 percent of the series being in the warm, moist sub-series and the other 21 percent in the drier, well-drained sub-series. The remaining 27 percent of the forested portion of the watershed, is mostly in the silver fir series at the highest elevations. A small amount of the mountain hemlock series (1 percent) is found on the highest ridges in the upper reaches of the watershed (See Figure 5-1: Plant Association Series).

Seral Stages

Seral stage is an important component in describing the overall structure of the vegetation and patterns across the watershed. On federal lands, age class distribution has been categorized into age class bands corresponding to vegetative seral stage development. On non-federal lands, the WOODIP data yielded size classes which were correlated to seral stages (See Table 5-3, Seral Stage Definitions, Map #7: Vegetation Age, Map #8: Seral Stage Map, and Figures 5-2, 5-3 & 5-4, Seral Stage Amounts by Ownership).

Table 5-3: Seral Stage Definitions.

Seral Stage	Age Class (years)		Size Class	Size Class (Private lands)
	(BLM)	(FS)		
Open/Grass/Forb	0 to 10	0 to 9	0	0
Open sapling/brush	10 to 40	9 to 39	1	less than 10 inches DBH
Closed Sapling	40 to 80	39 to 80	2	10 to 19 inches DBH
Mature	80 to 200	80 to 200	3	20 to 29 inches DBH
Old Growth	greater than 200	greater than 200	4	greater than 30 inches DBH

Seral Stage	Acres
Old Growth	31,903
Mature	12,934
Closed Sapling	9,473
Open Sapling/Brush	27,118
Early-Grass/Forb	9,306
Nonforest	4,733

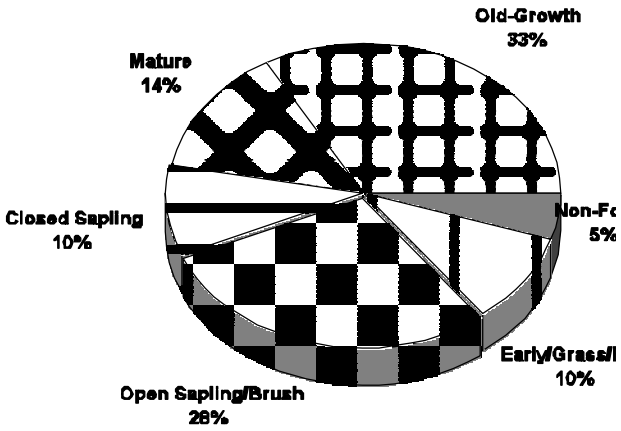


Figure 5-2: Seral Stages for All Lands.

Mature and older forest (late seral) comprise about 47 percent of the Quartzville Watershed. Acres of late seral forest in the Quartzville Watershed was further broken down by ownership and SWB. The Lone Star, Upper Quartzville, Canal Creek, and Packers Gulch SWBs are the most viable SWBs in terms of the amount of late seral forest habitat, all with over 50 percent in late seral conditions. The amount of late seral in Moose Creek and Whitcomb SWBs is limiting with 34 percent and 24 percent, respectively. The South Green Peter SWB is the most limiting, with 18 percent in late seral conditions.

Seral Stage	Acres
Old Growth	31,770
Mature	9,918
Closed Sapling	1,779
Open Sapling/Brush	19,428
Early-Grass/Forb	1,924
Nonforest	4,206

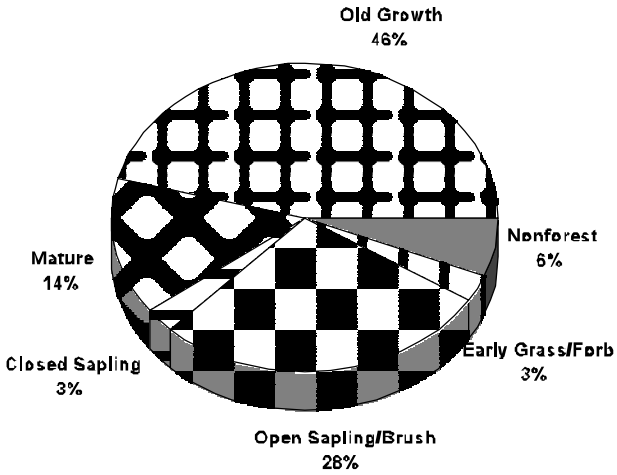


Figure 5-4: Seral Stage for Federal Ownership.

Ninety-three percent of the late seral forest in Quartzville Watershed is on federal lands. Seral stage amounts and distribution were further analyzed on federal lands and categorized by Land Use Allocation (LUA) (See Table 5-4: Seral Stage Acreage on Federal Lands by Land Use Allocation). Late seral forests comprise 60 percent of the federal ownership in the watershed. Over 37,000 acres of the late seral forest is in Late Successional Reserve (LSR), the land allocation that makes up 62 percent of all lands in the watershed. Sixty-three percent of the LSR

Seral Stage	Acres
Old Growth	133
Mature	3,016
Closed Sapling	7,694
Open Sapling/Brush	7,691
Early-Grass/Forb	7,382
Nonforest	527

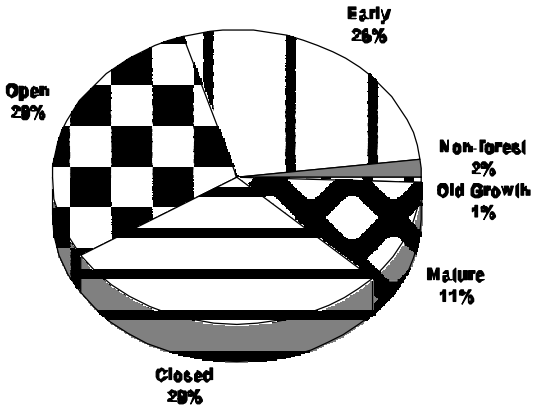


Figure 5-3: Seral Stage for Non-Federal Ownership.

is in older forest conditions compared with 75 percent in Connectivity (CONN) and 43 percent in General Forest Management Area (GFMA). Approximately 46 percent of the federal ownership in the watershed is in old-growth forests more than 200 years of age.

Table 5-4: Seral Stage Acreage on Federal Lands * by Land Use Allocation.

Seral Stage	BLM GFMA	%	BLM CONN	%	BLM_LSR	%	FS_LSR	%
Early/grass/forb	102	4%	18	0%	390	2%	1,285	4%
Open Sapling/brush	513	19%	665	17%	8,395	35%	9,640	28%
Closed Sapling	826	31%	43	1%	243	1%	175	<1%
Mature	374	14%	2,041	53%	1,935	8%	5,363	15%
Old-Growth	788	29%	828	22%	12,319	51%	17,831	51%
Non-forest	86	3%	232	6%	937	4%	335	1%
Totals	2,689		3,827		24,219		34,629	

* Does not include Army Corps of Engineers lands (3,613 acres), which are comprised of a high percentage of non-forest habitat (73%) that includes Green Peter Reservoir in the Whitcomb, South Green Peter and Moose Creek SWBs.

Late Seral Habitat Quality

Late seral forest within each SWBs was calculated and further analyzed for edge effects and fragmentation. Harvest patterns and natural disturbance in the past have created a mosaic of seral stages across the watershed. Where a late seral patch is surrounded by younger age classes,

the edges of the patch exhibit environmental conditions that are different from the interior of the patch. As the amount of open area and edge increases, habitat quality declines for species associated with late seral forests and improves for species that are associated with edge and open areas. The amount of interior late seral forest in relation to the amount of total late seral forest gives some indication of the quality of existing late seral forest habitat and the influence of edge effects.

Edge on existing late seral forest was modeled to determine the amount of interior late seral forest and the influence of the edge effects. As a result of this analysis, it was found that about 50 percent of the late seral forests in the watershed are interior forests. The majority of interior late seral forests, about 14,000 acres, are found in the Lone Star, Upper Quartzville, and Canal Creek SWBs. These SWBs are located in the upper half of the Quartzville Watershed on BLM and Forest Service lands in LSR. Packers Gulch, Moose Creek, Whitcomb, and South Green Peter SWBs, located in the lower half of the watershed, are less viable with about 7,000 acres of interior late seral forests. Road locations were mapped to estimate the effect of roads on existing interior late seral forest. This analysis indicates that the late seral forest in the Quartzville Watershed is further fragmented due to edge effects created by existing roads, especially in the Packers Gulch, Canal Creek and Upper Quartzville SWBs. Fragmentation due to roads is considerably less in the Lone Star SWB, where road densities are relatively low. In addition, blowdown contributes to fragmentation in this watershed, especially in the Packers Gulch, Canal Creek and Upper Quartzville SWBs.

In conclusion, the quality of late seral forest habitat in the Packers Gulch, Moose Creek, Whitcomb, and South Green Peter SWBs is impaired by fragmentation caused by past harvest activity. The quality of late seral forest habitat in the Lone Star, Upper Quartzville, and Canal Creek SWBs is good. However, habitat quality is further fragmented by roads and blowdown, especially in the Packers Gulch, Canal Creek and Upper Quartzville SWBs.

Landscape Structure

The structure and pattern of vegetation or habitats within an ecosystem such as a watershed, can be characterized in terms of patches, corridors, and a background matrix. The patterning of patches, matrix, and corridors across the landscape strongly influences the ecological characteristics, processes, and energy flows (Forman and Gordon 1986).

The term ‘matrix’ in landscape ecology is defined as the most connected portion of the landscape, the vegetation type that exerts the most control over landscape function (Forman and Gordon 1986, Diaz and Apostol 1992). Patches are definable vegetative types that differ in their habitat characteristics from their surroundings. Patches vary in size, shape, type, heterogeneity, and the vegetative types that surround them. For the watershed as a whole, late seral forests comprise 47 percent of the landscape, with younger stands (less than 40 years of age) occupying 38 percent. This structure is not consistent across the watershed, but varies by SWB. The Lone Star SWB has the most late seral with 70 percent. These older forest stands are matrix, being intersected by roads and patches of younger stands (27 percent) averaging about 30 acres in size. Within this SWB, private land forms a secondary matrix of younger seral stages with small

patches of older forest types. Upper Quartzville, Canal Creek and Packer's Gulch SWBs also have matrices of older forest stands (60, 55 and 53 percent, respectively) but the patches tend to be smaller, averaging 55 acres. The younger stands in these SWBs (38, 42, and 38 percent, respectively) form a secondary matrix. Most of the closed sapling stands (40 to 80 years) are found in the three lower SWBs, Moose Creek, Whitcomb, and South Green Peter on non-federal lands. These three lower SWBs have landscapes composed of all age groups, which tend to be in larger patches.

In the Moose Creek SWB, the closed forest and the older forest types form two distinct matrices that are dissected with patches of younger forest types. The Whitcomb SWB has younger forest, closed forests and older forests matrices which are dissected with patches of other types. The South Green Peter has a dominant closed forest type and younger forest type matrices with late seral patches. Ninety-three percent of the late seral forests in the watershed are on federal land, mostly in the upper SWBs, while 87 percent of the closed forest stands are on private lands.

The drainages and their associated riparian/streamside vegetation provide corridors for wildlife movement. They flow from the higher elevations through the watershed then through the Santiam River Corridor to the Willamette Valley Physiographic Province to the west. The higher elevation ridge top areas connecting the peaks on the boundaries of the watershed also serve as flow corridors. The flow of the more mobile species of wildlife is from higher elevation to lower elevation in the fall/winter and to higher elevation in the spring. This corresponds to a poorly defined flow across the watershed, presumably along drainages and ridgetops. Vegetation in natural corridors has been altered over time due to fire, past harvest patterns, and roads. Vegetation conditions in natural corridors are more favorable in the upper end (Upper Quartzville, Lone Star, Canal Creek and Packers Gulch SWBs) of the watershed where there has been less harvest. The lower portion (Whitcomb, South Green Peter and Moose Creek SWBs) have been altered more over time by past harvest patterns and roads.

The Mid Willamette LSR Assessment discussed connectivity in a larger scale than this watershed analysis. Connectivity can be described as the ability of a landscape to provide for species movement between refugia. Between LSR connectivity analysis showed that the Quartzville Watershed is an integral and important link in the predominant north-south LSR/wilderness network which comprises the backbone of the Cascades Mountain Range. The Cascade crest is approximately 16 miles to the east of the Quartzville Watershed.

To the west of Quartzville Watershed is Crabtree Watershed, which is an important link between Quartzville and Thomas Creek Watershed, which is located to the north and west. However, connectivity of federal lands between the Quartzville and Thomas Creek is disrupted by the scattered ownership pattern. The Willamette Valley Physiographic Province is located 14 miles to the west of Quartzville Watershed.

To the North of Quartzville Watershed is Thomas Creek, Box Canyon and the North Santiam River Canyon, including Detroit Reservoir. To the south of Quartzville Watershed is the South Santiam River Corridor which flows to the west through the communities of Sweet Home and Lebanon.

Special Habitats

Special habitats contribute to the overall biodiversity across the landscape and are important for plants and wildlife. They are usually non-forest types such as meadows, wetlands, rock outcrops, cliffs, and talus slopes. Quartzville Watershed is not as rich in special habitats as adjacent watersheds. Many of the special habitat features are found on the peaks and ridgetops, and are shared with adjacent watersheds.

Small natural forest openings such as wet meadows, dry meadows, ponds, dry grass hillsides with shallow soils, Sitka alder/brush patches, cliffs, crevices and talus slopes are present and scattered throughout the watershed. The most prevalent special habitats in the Quartzville Watershed include rock/outcrops/cliffs (2500+ acres) and talus slopes (300+ acres). These types of special habitats are most commonly associated with the major peaks and ridges of the watershed. Most prominent are Rocky Top and Galena Ridge on the south side of the watershed.

There are also significant amounts of rock/cliff/talus in the vicinity of Chimney Peak and Knob Rock on the southeast, Slate Rock on the north, and Crabtree and Yellowstone Mountains on the west side of the watershed.

Dry meadows with shallow soils (800+ acres), are found primarily on south to southwest aspects. Dry meadow areas shared with adjacent watersheds are found in the vicinity of Galena Ridge, Knob Rock and Gordan Peak on the south-southeast, and Crabtree Mountain on the west side of the watershed. There are also dry meadow/rock openings located in the Moose Creek SWB, on the south-southwest aspects above Moose Creek.

Wet meadows and ponds (25+ acres) are not as prevalent due to the steepness of the landscape. They are often associated with headwaters of major tributaries such as Boulder Creek and Little Meadows Creek. Wetlands in the vicinity of Green Peter Reservoir are rare due to its predominate steep shores and lack of flats and backwater areas. The most extensive backwater/wetland areas are located where Whitcomb and Moose Creeks flow into the reservoir. Other flats, backwater and wetland areas exist along the shores of Green Peter Reservoir, but are located outside the boundaries of the Quartzville Watershed.

Standing Dead and Coarse Woody Debris (CWD)

Standing dead and down CWD provide essential structure and functional habitat conditions for plant and animals in each seral stage. CWD is an important pool of energy, carbon, and nutrients in ecosystems and is important for site productivity. Data from inventory plots and stand exams were used to estimate the amount and condition of standing dead and down CWD across the watershed.

Standing Dead: The inventory and stand exam data for the watershed show that snags are not present in 78 percent of the young stands less than 40 years old. However, in closed sapling stands, 78 percent have an average of 13 snags per acre. Mature stands average almost 29 snags per acre. Old growth stands average 11 snags per acre and only 1 percent of the plots had no snags. Some of these older forest stands were most likely salvage logged at various times to capture mortality volume.

Coarse Woody Debris (CWD): Estimates of the amount and condition of down CWD was compared to the Northwest Forest Plan (NWFP) standard of 240 lineal feet per acre of hard material over 20 inches in diameter. The amount and condition of down CWD appears to be fairly good in the short term, with 55 percent of the plots meeting the NWFP standard. Most of the open sapling stands have down CWD left from previous logging in the more advanced stages of decay, much of which is smaller diameter material. In the long term, there will be a lack of large down CWD as these stands mature, due to the current lack of standing dead material available for recruitment. The closed sapling and late seral stands have snag components that will contribute down CWD in the long term.

Another method of measuring down wood is to measure percent of the ground covered by down wood. The standard of 240 feet translates to approximately 0.8 percent. For the late seral stands

in the watershed, the percent cover is between two and four percent. The recommendation of the Mid-Willamette LSR Assessment (LSRA) translates to 10-15 percent ground cover of all diameters and species in the LSR. Most of the stands in the LSR fall below this recommendation.

Overall, there is not enough large, harder material as either snags or down CWD in younger stands that will persist in the long term. Late seral stands in the LSR will no longer be mortality salvaged and closed forest stands will not be thinned without leaving a CWD component that meets the guidelines established in the LSRA. The LSRA guidelines will also be applied to treatments within Riparian Reserves. This material will be important for nutrient capital and future habitat for cavity and CWD dwelling wildlife species.

Roads and Transportation

The existence of roads have obvious physical effects on the ecosystem. The land area taken up in roads does not contribute to forested habitats. Run off from current roads can cause changes in water quality that affect aquatic and semi-aquatic vegetation and wildlife. The existence of roads causes edge effects and micro-climate changes that effect plant communities and wildlife. In addition, open roads and road maintenance activities cause disturbance effects resulting from increased traffic and human intrusion. Roads also facilitate the spread of noxious weeds and exotic species.

Total miles of road and road densities across the Quartzville Watershed were calculated by SWB and ownership (See Table5-5: Road Densities by SWB and Ownership in the Quartzville Watershed). There are approximately 586 total miles of road on all ownerships within the watershed. Currently, the average total road density across all ownerships is estimated at about 4 miles per section. The highest road densities occur in the Packers Gulch and Whitcomb Creek SWBs. The lowest road densities occur in the Lone Star SWB.

Of the 586 total road miles in the watershed, 362 miles are on federal lands (62 percent) (See Map #10: Transportation). Average total road density on federal lands is estimated at about 3.35 miles per section. Road densities on federal lands are highest in the Canal Creek and Packers Gulch SWBs on BLM lands. Road densities on federal lands are lowest on FS lands in the Lone Star SWB and on BLM lands in South Green Peter SWB. These include two areas of federal ownership that are essentially roadless, about 3,000 acres of FS ownership just north of the Middle Santiam Wilderness Area in Lone Star SWB; and 2,100 acres of BLM ownership on Green Peter Peninsula in the South Green Peter and Moose Creek SWBs. This Peninsula is surrounded by the Green Peter Reservoir, and access is limited to boats.

According to calculations done by FS staff, road densities on FS are lower than those shown in Table 5-5. FS calculations show a total of 147 miles of road, with average road densities of 2.69 miles per square mile on FS lands. The analysis shows a total of 157 miles of road with average road densities of 2.90 miles per square mile. As a result, total number of miles of road across the watershed and miles of road on FS lands would be slightly lower.

Table 5-5: Road Densities (miles per section or square mile) by Sub-Watershed Basins and Ownership.

SWB	Federal BLM	Federal FS	Non-Federal	Totals
Canal Creek	4.71	2.75	7.12	**3.64**
Lone Star	(5.71) [1]	2.13	4.28	**2.53**
Moose Creek	3.35	0	5.23	**4.04**
Packers Gulch	4.64	(0.79) [1]	6.31	**4.93**
S Green Peter	0.77	0	4.64	**3.39**
Upper Quartzville	0	3.71	0	**3.71**
Whitcomb Creek	3.17	0	5.50	**4.54**
Totals	**4.00**	**2.90** [2]	**5.42**	**3.93**

[1] (Ownership less than 1percent of the SWB)

[2] 2.69 miles per square mile as calculated by the FS

Special Status/Special Attention Species

Plants

There is one known population of BLM special status plant species and numerous known survey and manage species sites in the Quartzville Watershed. The watershed has been surveyed frequently over the years for projects from timber sales to recreation plans as well as the designation as a wild and scenic river, but rare and uncommon plants have not been found. Based on a literature review of the habitat requirements of the Special Status Species (SSS) known to occur in the province, a list of potential species has been identified for the Quartzville Watershed and its special habitats (Appendix D). This list includes Federal Endangered, Federal Threatened, Federal Proposed Threatened, and Bureau Sensitive species. Included in Appendix D is a list of Survey and Manage Species known or suspected to occur in the Cascades Resource Area and specifically in this watershed. It is based on Table 1-1 of the *Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines.*

Huperzia occidentalis, fir clubmoss, is an assessment species. Fir clubmoss grows on a variety of substrates from rocks to rotten logs in humid areas on the west slopes of the northern Cascades in Oregon, northern Idaho, and northwestern Montana. There is one documented site of *Huperzia occidentalis* in the Quartzville Watershed within the LSR.

One population of a Forest Service Region 6 Sensitive species is located in the watershed. Romanzoffia thompsonii, Thompson's mistmaiden, grows on open south-facing slopes in mossy seeps that dry up by summer. The site is in the Upper Quartzville subwatershed and is surrounded by plantations.

Exotic and Introduced Species of Concern

Noxious weeds and exotic species are a threat to native plant communities and wetlands. They can displace forage for wildlife, cause changes in wildlife habitats, create fire hazards, reduce recreational enjoyment, and cause changes in ecological processes, i.e. water infiltration or rain interception. Noxious weeds usually do not become established in native plant communities in western Oregon until there is a disturbance. Many weed species have become established after a disturbance and have become persistent.

Noxious weeds spread primarily along roads by attaching to vehicles, through the spreading of infested gravel, and through other ground-disturbing activities such as the yarding of timber.

The BLM lists invasive plant species in three priority classifications: priority I (potential new invaders), priority II (eradication of new invaders), and priority III (established infestations), listed in Appendix D. There is Priority 1 noxious weed species infestation of False brome (*Brachypodium sylaticum*) on FS lands in the Quartzville Watershed. The population is scattered along a one-mile segment of FS Road 1133. The population is being treated with herbicides. Any new sites that are found in this classification will be removed as quickly as possible to prevent their spread. In the Quartzville Watershed, there are a few known meadow knapweed and spotted knapweed sites. Both species are Priority II noxious weed species. These sites are monitored annually for control. Those populations found on FS lands are treated with herbicides. There are several known occurrences of the Priority III noxious weeds such as Canadian thistle, St. Johnswort, tansy ragwort, and Scotch broom in the Quartzville Watershed. Established infestations are widespread throughout the landscape. Additional Priority III species populations are expected to be found in the analysis area. The Oregon Department of Agriculture releases biological control agents to contain infestations throughout the state for Priority III species and to prevent further spread. Biological control agents will reduce, but not eradicate, noxious weed populations. Increased miles of roads and disturbed ground will increase the suitable habitats for noxious weeds. Noxious weed inventories are to be done every five years.

Besides noxious weeds, several exotic species exist in the watershed. Although these species are not classified as noxious, they compete with the native vegetation and often have negative ecological impacts. In areas where the soil has been disturbed, such as road cuts, gravel pits, and clearcuts, exotic species such as Oxeye daisy are common. Nonnative species are found in almost every type of habitat throughout western Oregon.

Animals

As part of the analysis, the occurrence of wildlife species in the Quartzville Watershed was analyzed. A list of vertebrate wildlife species was compiled using FS and BLM Wildlife databases, the Oregon Natural Heritage Program (ONHP) Database, and various wildlife field guides and texts along with knowledge of the habitats present gained through air photo interpretation, GIS information, and field reconnaissance. The resulting list is included in Appendix E.1. The resulting list of wildlife species was then cross referenced with ***Rare, Threatened and Endangered Species of Oregon*** (ONHP, February, 2001), the Regional Forester's Sensitive Animal list for the Willamette National Forest and Salem District's sensitive species list to determine federal, state, FS and BLM status of each species with status. The Special Status Species (SSS) which are known or highly likely to occur in the Quartzville Watershed and their habitat preferences are included in Appendix E.3. This list includes two federally threatened, eight FS Sensitive species, eight Bureau Sensitive species, four Bureau Assessment species, and 18 Bureau Tracking species. In addition, there is one survey and Manage mollusk species, four survey and Manage/Protection Buffer bat species and the red tree vole that are documented or highly likely to occur in the Quartzville Watershed. Species which are documented to occur in the watershed are denoted with a (D) in Appendix E.3.

Little is known about the occurrence of special status invertebrate species in the Quartzville Watershed. A list of suspected or possible special status invertebrate species that could occur in the watershed is included in Appendix E.2. The list includes four FS Sensitive Species that could occur in the watershed.

There is one Survey and Manage mollusk species that is documented to occur in the Quartzville Watershed. The Oregon megomphix ***(Megomphix hemphilli)***, a Survey and Manage Bureau Sensitive species, is found in moist conifer/hardwood forests with big-leaf maple in association with duff and leaf litter at low to mid elevations. Surveys that have been conducted for this species indicate that the Oregon Megomphix is common along the interface between the Willamette Valley and the Western Oregon Cascades. The Oregon Megomphix has been found at low elevations in the Moose Creek SWB.

The harlequin duck, a FS and Bureau Sensitive Species, is found on swift flowing mountain rivers and larger streams where it breeds and in rocky coastal areas during the winter. It is a common breeding species on Quartzville Creek and some of its major tributaries, where is occurs in good numbers on private, BLM and FS lands. It is also known from the North Santiam to the north and the McKenzie drainage to the south.

The goshawk, a Bureau Sensitive Species, has been observed in the Quartzville Watershed, but breeding status is unknown. The goshawk prefers late seral forests generally at higher elevations. Goshawks have been observed during the nesting season in Whitcomb SWB, Green Peter Peninsula, Canal Creek area, and in the vicinity of Little Meadows Creek in the Upper Quartzville SWB.

The golden eagle is known to occur in the Quartzville Watershed, but breeding status is unknown. They are known to occur along Galena Ridge during the nesting season. Golden eagles may occur elsewhere in the watershed, especially in the Upper Quartzville and Lone Star

SWBs. The closest known nest site to the Quartzville Watershed is north of Harry Mountain in the Thomas Creek Watershed.

The peregrine falcon, a former endangered species, is currently considered to be a FS and Bureau Sensitive species. There is one peregrine falcon eyrie in the vicinity of Rocky Top in the South Green Peter SWB. In addition, the peregrine falcon is highly likely to occur as a migrant and winter visitor and could occur elsewhere in the watershed as a nesting species (Pagel, pers. comm.). Suitable cliff habitat for nesting is present in the Quartzville Watershed, especially in the Upper Quartzville, Lone Star and South Green Peter SWBs. Although Green Peter Reservoir is a large water body, it provides only limited prey in the form of waterfowl, due to its depth and lack of peripheral wetlands. Sufficient prey is available in the form of avian species such as the band-tailed pigeon and passerine birds.

The western bluebird is a species native to the Willamette Valley and the foothills of the Cascades. They need cavities and standing dead/cull material in open areas for nesting. There is a scarcity of this type of material in the Quartzville Watershed. Competition with non-native starlings and house sparrows is minimal due to the watershed's location further into the Cascades away from rural environments in the Willamette Valley where these introduced species are abundant.

The common nighthawk is known to occur from the Willamette Valley floor to higher elevation clearcuts. Breeding populations in the Willamette Valley are of concern, however, this species has been known to breed in the Cascades at rather high elevations in early seral and open areas. Common nighthawks are known to be present during the breeding season in the Quartzville Watershed.

The red tree vole, a Survey and Manage Species, is likely to occur in the Quartzville Watershed. This arboreal vole is found in mid to late seral forests with closed canopies. The red tree vole is considered to be a late seral associate and there is suitable habitat present in all SWBs, primarily below 3,500 feet elevation. Red tree vole habitat in the Quartzville Watershed was analyzed according to seral stage, stand conditions and elevation. The Quartzville Watershed is 72 percent federal ownership, of which 65 percent is suitable habitat for the red tree vole. Red tree vole habitat occurs in all SWBs, but surveys for this species are lacking in the Quartzville Watershed.

The long-eared myotis, long-legged myotis, silver haired bat and Townsend's big-eared bat are Survey and Manage/buffer species that are suspected to occur in the watershed. They are species which have been identified as in need of additional protection in the Northwest Forest Plan. They are associated with cliff/crevice and cave habitats and some are known to utilize standing dead/cull components in forest stands. In addition, the Townsend's big-eared bat is known to use buildings and abandoned mines. They forage in a variety of habitats, especially riparian areas.

The Fisher is known to occur in the Quartzville Watershed. There are two sightings in the Quartzville Watershed, both in the Canal Creek SWB. Fishers prefer mature and old-growth forests and riparian areas containing large quantities of dead and down wood.

Threatened and Endangered Species

There are no endangered species known or suspected to occur in the Quartzville Watershed. There are two federally threatened species which have been documented to occur in the watershed. The bald eagle has been documented as a nesting species and year round resident in the vicinity of Green Peter Reservoir. The northern spotted owl has been documented to occur throughout the watershed.

The Canadian lynx was listed as a threatened species on March 24, 2000 by the U.S. Fish and Wildlife Service in thirteen states including Oregon. Habitat for lynx in the Salem District BLM and the Willamette National Forest was analyzed based on criteria set forth by the Lynx Scientific Team. According to the Lynx Conservation Assessment and Strategy (LCAS), Lynx and its habitat are not considered to be currently present in the Salem District BLM. The Willamette National Forest has made the determination that the Lynx and its habitat are not present within the National Forest boundaries, which includes the Quartzville Watershed. As a result of analysis, there are no areas within the Salem District BLM or the Willamette National Forest that meet the minimum criteria for habitat characteristics and spatial requirements in order to develop a Lynx Habitat Unit (LHU) according to the LCAS.

Bald Eagle

There are two known bald eagle nest sites in the vicinity of Green Peter Reservoir. Both nest sites are located on BLM lands on Green Peter Peninsula. Associated with these bald eagle sites is a Bald Eagle Management Area (BEMA) of approximately 935 acres in size. Bald eagle habitat in the BEMA was analyzed and the results are shown in Table 5-6: Bald Eagle Habitat in the Green Peter Bald Eagle Management Area by LUA. The BEMA is located in both LSR and CONN LUAs. Approximately 29 percent of the BEMA is in LSR and 71 percent is in CONN. About 31 percent of the BEMA is suitable bald eagle nesting habitat, of which 33 percent is in LSR, including one of the two nest sites. The other nest site and 67 percent of the suitable nesting habitat is in CONN. About 64 percent of the BEMA is in sub-suitable mature habitat, of which 27 percent is in Green Peter Peninsula LSR and 73 percent is in CONN. The majority of the sub-suitable mature habitat is in the 80 year old age class. In addition, there is approximately 80 acres of LSR outside of the BEMA.

In addition to federal lands in the BEMA, there is about 50 acres of isolated non-federal lands on Green Peter Peninsula surrounded by the BEMA and Green Peter Reservoir. These lands are in younger age classes and there is currently no suitable nesting habitat.

Table 5-6: Bald Eagle Habitat Classes in the Green Peter Bald Eagle Management Area by Land Use Allocation.

Bald Eagle Habitat Class	BLM_LSR	CONN	TOTAL

	Acres	%	Acres	%	Acres	%
Suitable Nesting	94	33%	192	67%	**286**	**100%**
Sub-Suitable Mature	164	27%	439	73%	**603**	**100%**
Non-Suitable Capable	9	24%	29	76%	**38**	**100%**
Non-Suitable Non-Capable	5	62%	3	38%	**8**	**100%**
Totals	**272**	**29%**	**663**	**71%**	**935**	**100%**

Productivity of the two nesting pairs has been somewhat poor in recent years. Usually, only one of the two pairs is found to be successful in any given year. Ospreys are abundant and a widespread nesting species around the entire perimeter of Green Peter Reservoir. Competition with Ospreys may be a contributing factor to the poor reproductive success.

Bald eagles have large home ranges and are known to move long distances. An annual mid winter bald eagle count is conducted which covers an area from Foster Reservoir just east of Sweet Home to the Green Peter Reservoir area. Results of this survey indicate that the bald eagles in this area are year round residents. It is thought that the birds present during the winter are the pairs that bred here and their progeny (Sandburg, pers. comm.). The area from Green Peter Reservoir downstream to Foster dam is considered to be a minor wintering area for bald eagles. The majority of bald eagles that winter in the area are found in the Willamette Valley to the southwest of the Quartzville Watershed (Isaacs, pers. comm.). There is suitable bald eagle nesting, perching and wintering habitat on BLM lands in the vicinity of the reservoir in South Green Peter, Whitcomb and Moose Creek SWBs. Bald eagles are only rarely observed up Quartzville Creek, more than a quarter mile away from the high water of the reservoir.

Northern Spotted Owl

The overall habitat conditions for northern spotted owls was analyzed across the entire watershed. Age classes and forest types were classified as suitable for nesting, foraging, dispersal or non-suitable habitat for the spotted owl. Non-suitable habitat was further classified as either capable or non-capable of becoming suitable habitat over time. The results are displayed in Table5-7: Spotted Owl Habitat by Ownership and on Map #9: Spotted Owl Habitat Map.

Table 5-7: Spotted Owl Habitat by Ownership.

Spotted Owl Habitat Class	Federal		Non-Federal		TOTAL	
	Acres	%	Acres	%	Acres	%
Nesting	34,619	50%	140	1%	34,759	36%
Foraging	7,059	10%	3,004	11%	10,068	11%
Dispersal	1,786	3%	7,694	29%	9,480	10%
Capable	21,311	31%	15,073	57%	36,384	38%
Non-capable	4,250	6%	527	2%	4,777	5%
TOTALS	**69,025**	**100%**	**26,442**	**100%**	**95,468**	**100%**

Currently, approximately 47 percent of the Quartzville Watershed is considered to be suitable habitat for nesting and/or foraging (suitable), 57 percent is functional as dispersal and 43 percent is non-habitat (See Figure 5-7: Spotted Owl Habitat by Ownership). Of the non-habitat, 88 percent is capable of becoming suitable habitat over time.

Approximately 60 percent of federal lands in the watershed is considered to be suitable habitat, 63 percent is functional as dispersal and 37 percent is non-suitable habitat. Of the non-suitable habitat present on federal lands, 83 percent is capable of becoming suitable habitat over time.

Habitat conditions for spotted owls was further analyzed by SWB and viability estimates for nesting and dispersal were made based on the amount of suitable and dispersal habitat and past surveys in each SWB. As a result of this analysis, all of the SWBs were found to be viable for nesting spotted owls with the exception of Whitcomb, Moose Creek and South Green Peter SWBs. Whitcomb and Moose Creek SWBs were found to be limiting and the South Green Peter SWB is possibly non-viable for nesting spotted owls. The Lone Star and Upper Quartzville SWBs were found to be highly viable for nesting spotted owls. The Quartzville Watershed, as a whole, was also found to be viable for dispersal of spotted owls. Dispersal is most limiting in the South Green Peter, and Whitcomb SWBs, in the vicinity of Green Peter Reservoir.

Spotted owl habitat on federal lands in the Quartzville Watershed was further analyzed and categorized by LUA (See Table 5-8: Spotted Owl Habitat on Federal Lands by Land Use Allocation). The amount of suitable habitat is 43 percent in GFMA, 75 percent in CONN, and 64 percent in LSR.

Table 5-8: Spotted Owl Habitat on Federal Lands* by Land Use Allocation.

Spotted Owl Habitat Class	GFMA (%)	CONN(%)	LSR (%)		
			BLM	FS	Total LSR
Nesting	788 (29%)	1,217 (32%)	13,527 (56%)	19,083 (55%)	32610 (56 %)
Foraging	374 (14%)	1,652 (43%)	727 (3%)	4,101 (12%)	4828 (8%)
Dispersal	826 (31%)	43 (1%)	243 (1%)	183 (1%)	426 (1 %)
Capable	595 (22%)	683 (18%)	8,772 (36%)	10,926 (31%)	19698 (33 %)
Non-Capable	106 (4%)	232 (6%)	950 (4%)	336 (1%)	1286 (2 %)
Totals	**2,689**	**3,827**	**24,219**	**34,629**	**58,848**

* Does not include Army Corps of Engineers lands (3,613 acres), which are comprised of a high percentage of non-capable habitat (73%) that includes Green Peter Reservoir in the Whitcomb, South Green Peter and Moose SWBs.

The Quartzville LSR (RO213) and Middle Santiam Wilderness complex is about 92,400 acres in size and spans four major watersheds from Crabtree to the west, through Quartzville, into the North Santiam to the north towards Detroit Reservoir and south and east into the Middle Santiam Watershed. This very large reserve is an integral and important link in the predominant north-south LSR/wilderness network where the majority of dispersal between known spotted owl sites in the Cascades Range takes place. The Mount Jefferson LSR (RO214) and wilderness complex is located to the northeast, straddling the Cascade crest, which is approximately 16 miles to the east of the Quartzville Watershed.
Contained within the Quartzville Watershed is the majority of the Quartzville LSR/wilderness complex (61 percent). Within the Quartzville LSR there are several thousand acres of non-federal lands in early seral stages, completely surrounded by LSR and Critical Habitat. Most of this non-federal land is capable of becoming suitable habitat in the future.

Approximately five percent of the Quartzville LSR/wilderness complex is located in the Crabtree Watershed immediately to the west. The Crabtree Watershed is an important link between Quartzville and Thomas Creek Watershed and LSR (RO246) to the north and west. However, connectivity of federal lands between the Quartzville LSR and Thomas Creek LSR is disrupted by the scattered ownership pattern. The Willamette Valley Physiographic Province is located 14 miles to the west of Quartzville Watershed.

To the north of Quartzville Watershed is Thomas Creek, Box Canyon and the North Santiam River Canyon, including Detroit Reservoir. To the north of Thomas Creek is the North Santiam River Corridor, and the cities of Lyons, Mill City, and Gates. The North Santiam River Corridor limits spotted owl dispersal to the north of the watershed. To the north about 10 miles across the North Santiam River Corridor is the Little North Santiam Watershed.

Contained within the Quartzville Watershed is the Whitcomb LSR (RO212). This LSR is 3,450

acres in size and is located about 2 to 3 miles to the southwest of the Quartzville LSR. Connectivity between the Quartzville and Whitcomb LSRs is somewhat disrupted by the ownership pattern, but there is a contiguous connection of BLM lands in the Moose Creek SWB across Matrix lands. Some of these Matrix lands are in Critical Habitat. In addition, there is a small LSR, 352 acres in size on the tip of the Green Peter Peninsula in the vicinity of the Bald Eagle Management Area.

To the southwest of Quartzville Watershed is Hamilton Creek, a low elevation watershed comprised mostly of private lands and Willamette Valley foothills. To the south of Hamilton Creek are the communities of Lebanon and Sweet Home and the South Santiam River Corridor, which acts as a barrier to spotted owl movement to the southwest.

Spotted owl dispersal out of the Quartzville Watershed is limited by the scattered federal ownership and the North Santiam River Corridor to the north and west, the South Santiam River Corridor to the southwest and the Willamette Valley to the west. The Quartzville Watershed is significant for spotted owl dispersal because it contains the bulk of the Quartzville LSR, which is an integral and important link in the predominant north-south LSR/wilderness network where the majority of dispersal between known spotted owl sites in the Cascades Range takes place. Dispersal is especially significant on the east end of the watershed in the Upper Quartzville, Lone Star and Canal Creek SWBs.

Most of the federal lands in the Quartzville Watershed are designated as Critical Habitat for the spotted owl in Critical Habitat Unit OR-14, which includes some of the federal lands in the North Fork Crabtree SWB of the Crabtree Watershed as well. There are 62,435 acres of Critical Habitat in the Quartzville Watershed, spread across all SWBs. Approximately 91.5 percent (57,124 acres) is in LSR and 8.5 percent (5,311 acres) is in the Matrix LUAs. Approximately 48 percent of the Critical Habitat in the Matrix is in GFMA and 52 percent is in CONN. In addition, there are 1,932 acres designated as LSR under the NWFP that are not designated as Critical Habitat (See Table 5-9, Spotted Owl Critical Habitat by Sub-Watershed Basin and Map #9: Spotted Owl Critical Habitat Map).

Critical Habitat was further analyzed for suitability and dispersal capabilities both inside LSR and on adjacent Matrix lands outside of LSR. Most of the Critical Habitat in the Matrix is in the Moose Creek and Whitcomb SWBs between the Whitcomb LSR and the larger Quartzville LSR to the east. The percentage of suitable habitat in LSR Critical Habitat was not found to be significantly different than in adjacent Matrix Critical Habitat. However, the condition of the suitable habitat in LSR versus the Matrix was found to be considerably better. Critical Habitat in LSR was found to be viable for both nesting and dispersal of spotted owls. However, Critical Habitat in the Matrix was found to be limiting for nesting, but viable for dispersal of spotted owls (See Table 5-10: Spotted Owl Critical Habitat on LSR and Adjacent Matrix Lands).

Table 5-9: Spotted Owl Critical Habitat by Sub-Watershed Basin.

Sub-Watershed Basin (SWB)	Critical Habitat Acres in LSR (%)	Critical Habitat Acres in Matrix (%)	Total Critical Habitat Acres (%)	LSR not in Critical Habitat
Canal Creek	12,243(97.5%)	318(2.5%)	**12,561 (20%)**	**604**
Lone Star	11,396 (100%)	0 (0%)	**11,396 (18%)**	**0**
Moose Creek	4,708 (56%)	3,747 (44%)	**8,455 (14%)**	**0**
Packers Gulch	14,078 (98%)	292 (2%)	**14,370 (23%)**	**0**
S Green Peter	5 (2%)	279 (98%)	**284 (<1%)**	**0**
Upper Quartzville	11,500 (100%)	0 (0%)	**11,500 (18%)**	**1,292**
Whitcomb Creek	3,194 (83%)	675 (17%)	**3,869 (6%)**	**36**
TOTALS	**57,124(91.5%)**	**5,311(8.5%)**	**62,435(100%)**	**1,932**

Table 5-10: Spotted Owl Critical Habitat in LSR and Adjacent Matrix Lands.

Spotted Owl Habitat Class	Critical Habitat in LSR		Critical Habitat in Matrix		Critical Habitat totals	
	Acres	%	Acres	%	Acres	%
Nesting	31,676	55%	1,602	30%	33,278	53%
Foraging	4,903	9%	1,653	31%	6,556	11%
Dispersal	410	1%	840	16%	1,250	2%
Capable	18,896	33%	931	18%	19,827	32%
Non-capable	1,239	2%	285	5%	1,524	2%
TOTALS	57,124	100%	5,311	100%	62,435	100%

Once the overall habitat conditions were analyzed across the watershed, each individual known spotted owl site (KOS) was analyzed. The KOS is established by buffering the site center with the provincial home range radius for the spotted owl. The provincial home range radius for the Western Oregon Cascades province is 1.2 miles. Once the KOSs were established, the habitat within each was classified as either suitable, dispersal, or non-suitable habitat for the spotted owl. The results were used to estimate viability of each site. A KOS that has an intact 70 to 100 acre core area, and the equivalent of over 40 percent suitable habitat within its provincial home range radius is considered to be viable.

There are 35 spotted owl site centers located in the watershed. Due to their overlapping home ranges, these thirty-five KOSs were grouped together into complexes, and the habitat was further analyzed to determine the number of viable KOSs within each habitat complex.

There are five habitat complexes within the Quartzville Watershed. The Crabtree Complex spans from the North Fork Crabtree SWB in Crabtree Watershed through the western Quartzville in Packers Gulch SWB and the north end of Moose Creek SWB. This complex contains ten KOSs, three of which are in Crabtree and seven are in Quartzville. Five of the seven KOSs contained within Quartzville were found to be viable and two were found to be limiting. All seven are located in BLM LSR in Critical Habitat for the spotted owl.

The Whitcomb Complex spans from the south end of Moose Creek SWB into Whitcomb SWB to the west. This complex contains six KOSs, one of which is viable and five are limiting. Three of the six are located in LSR and three are located in BLM Matrix and have an unmapped LSR (core area) associated with them. All six are located in Critical Habitat for the spotted owl.

The Canal Creek Complex spans from the east end of Packers Gulch SWB through the Canal Creek SWB. This complex contains eight KOSs, seven of which were found to be viable and one is limiting. All eight are located in BLM and FS LSR in Critical Habitat.

The Mid Quartzville Complex is contained mostly in the Lone Star SWB. This complex contains five KOSs, four of which were found to be viable and one is possibly non-viable. Four of the five KOSs are located in FS LSR in Critical Habitat and one is located on adjacent non-federal lands.

The Upper Quartzville Complex spans from the Upper Quartzville SWB to the east out of the Quartzville Watershed to adjacent watersheds to the east, south and north. This complex contains seventeen KOSs, eight of which are in the Quartzville Watershed. Six of the eight KOSs within Quartzville were found to be viable and two were found to be limiting. All eight are located in FS LSR, seven of which are in Critical Habitat for the spotted owl.

There is one KOS in the South Green Peter SWB that is possibly non-viable. In addition, there are fourteen spotted owl site centers located just outside of the watershed, most of which occur on the east end of the watershed surrounding the Upper Quartzville SWB. Here, Quartzville Watershed contributes suitable habitat and dispersal capabilities to and from adjacent watersheds.

Barred owls compete directly with spotted owls for territory and to a lesser extent prey. They are more aggressive than spotted owls and broader in their habitat requirements. Barred owls have been known to occur for over ten years in the Moose Creek and Whitcomb SWBs where they have bred in the vicinity of Green Peter Reservoir. Recently, barred owls have been observed as far east as the Packers Gulch SWB. They appear to be increasing, spreading up the Quartzville Creek corridor from the south and Thomas Creek to the north. There are no known sightings in the upper end of the watershed in Lone Star, Canal Creek or Upper Quartzville SWBs.

Current acres of federal suitable, dispersal, capable habitat, and number/condition of KOSs in the Quartzville Watershed was calculated and the results are shown in Table 5-11.

Table 5-11: Current Status of the Spotted Owl and Its Habitat.

	Total in WA	Total in LSR (%)	Total not in LSR (%)
Acreage within Boundary	**95,468**	**58,848 (62%)**	**36,620 (38%)**
Acreage of Federal	**69,025**	**58,848 (85%)**	**10,177 (15%)**
Federal Suitable Spotted Owl Habitat	**41,677**	**37,438 (90%)**	**4,239(10%)**
Federal Dispersal Plus Spotted Owl Habitat	**43,463**	**37,864 (87%)**	**5,599 (13%)**
Federal Capable Plus Spotted Owl Habitat	**64,783**	**57,562 (89%)**	**7,221 (11%)**
Federal Critical Habitat	**62,435**	**57,124 (92%)**	**5,311(8%)**

(% suitable habitat)	Total in WA	Total Protected	Total Unprotected
Spotted owl sites (>40%)	**23**	**23**	**0**
Spotted owl sites (20-40%)	**10**	**7**	**3**
Spotted owl sites (<20%)	**2**	**0**	**2**
Total Spotted Owl Sites	**35**	**30**	**5**

Fires and Fuels

In the Quartzville Watershed, lighting starts are more frequent and common in the higher elevations on lands managed by the FS. Fire ignitions near Green Peter Reservoir or Quartzville Creek are more likely to occur as a result of human use.

Natural events and social values have in more recent years contributed to an increasing fuel load throughout the watershed. On January 10, 1990, one of the largest catastrophic wind storms to hit

this watershed occurred. With that storm, over 100,000,000 board feet of timber was wind thrown to the ground. About 40,000,000 board feet were harvested between 1991 and 1994. The remaining down timber still resides on the landscape. The insects that fed and continue to feed on the down wood often move into live trees, and have killed and estimated additional 20,000,000 board feet of timber. As a result of lands set aside to protect the northern spotted owl and the introduction of the Northwest Forest Plan in 1992, most timber harvest ceased in Quartzville. Salvage and slash disposal has been forgone due to management restrictions.

At the same time, with reductions in funding and increased restrictions, commercial thinning and precommercial thinning opportunities have been delayed. In more recent years, snow down, blow down and increased mortality have added extensive amounts of fuel to the landscape. Consequently, fuel loadings at this time in much of the watershed are outside or at the high end of the natural range of variability. It is estimated that down decomposing organic matter ranges from 35 to 70 tons per acre on much of the landscape. These fuels include both litter, down logs and ladder fuels. This means that the potential for a high intensity, stand replacement fire is high. When the fire behavior elements, such as lack of rain, high temperature, low humidity, and windy conditions align, they will produce to a high hazard situation in conjunction with the high fuel loading. Potential fire intensities would be extreme and above that which any more natural fire occurrence would commonly produce. The potential for significant adverse soil damage is likely.

The much of the following discussion applies to FS lands and is tiered to the *Willamette National Forest Fire Management Plan, December 19, 2001*. The Quartzville Watershed is within the Calapooia Fire Management Unit. Units are based on fourth order watershed delineations.

In General, Fuels in the Quartzville watershed are described by two of The National Fire Danger Rating System (NFDRS) fuel model keys G and H. Fuel model G describes dense conifer stands where there is a heavy accumulation of litter and downed material. Such stands are typically very mature and may also be suffering insect, disease, and wind or ice damage ---natural events that create a very heavy buildup of dead material on the forest floor. The duff and litter are deep and much of the woody material is more than three inches in diameter. The undergrowth is variable, but shrubs are usually restricted to openings. Types meant to be represented by fuel model G are hemlock, sitka spruce, coast Douglas-fir, and windthrow or bug-killed stands of pine and spruce. Douglas-fir, Hemlock, Spruce and a few waning pockets of Ponderosa Pine describe this area. Windblown and bug killed trees are also present in the watershed. Fires in this fuel situation could present at the upper limit of control by direct attack. Wind or drier conditions could lead to an escaped fire. Fuel Model H describes short needled conifers (White Pines, Spruces, Larches, and True firs). In this case, True Firs and Spruces. Stands are healthy with sparse undergrowth and a thin layer of ground fuels. Fires are typically slow spreading and are dangerous only in scattered areas where the downed woody material is concentrated and extensive ladder fuels are present.

Although fuel conditions present potential for stand replacing fire, analysis of historical fires describes the Fire Regime of the watershed as Average Low Frequency for Stand Replacing Fires (>200 years) and Average Moderate frequency (80-200 years) for Partial Burns. Analysis of

fuel and historical weather conditions say that Fire Behavior Risk is moderate for the area. Fire Occurrence Risk (ignition sources, i.e. humans, lightning, railroad) is of Moderate Fire Occurrence. Small areas of High Fire Occurrence Risk dot the map (populations, lightning prone area, high recreational use areas).

Aquatic

Hydrology and Water Quality

The Quartzville Watershed is contained within the larger South Santiam sub-basin covering 1,061 square miles, which in turn flows into the 11,100 square mile Willamette River Basin; the largest river basin in Oregon. A large percentage of the state's population and major cities are located in the Willamette River Basin including Portland, Salem, and Eugene. The United States Geologic Survey (USGS) has divided the Willamette River Basin into hydrologic units and assigned each a hydrologic unit code. The Quartzville watershed analysis is synonymous with the Quartzville Creek 5th field hydrologic unit (1709000604). The 5th field boundary extends, along Quartzville Creek, from Green Peter Dam upstream to the headwaters. Quartzville Creek Watershed has been sub-divided into seven Sub-watershed basins (SWBs), also known as 6th field watersheds (See Map #5: Sub-Watershed Basins). SWB names and acreages are listed in Table 5-1: Sub-Watershed Basins of the Quartzville Watershed by Ownership Acres and Percent.

Hydrology is affected by the geology found within the area. Shallow soils are overlain on various parent materials comprising a very diverse landscape and water storage capacity is dependent upon the overburden and the parent material. Glacial deposits tend to store a higher amount of water than the volcanics that are found within the area. These changes in geology also affect the morphology of the area. Areas of wide valley bottoms tend to be areas of deposition and narrower areas tend to transport sediment through them. The areas of deposition found within the Quartzville drainage act as a solar heat sink, which collect solar radiation and transfer the heat to the water flowing over, through, and under these deposits.

Total miles of streams were calculated and stream densities across the Quartzville Watershed were mapped by SWB (See Maps #11: Stream Order and #12: Stream Flow). There are approximately 1215 miles of stream in the watershed analysis area. Stream densities by SWBs are shown in
Table 5-12. The SWB stream densities vary from 10.1 miles per square mile in Canal Creek to 6.1 miles per square mile in South Green Peter. Analysis areas further upstream in the watershed exhibit higher stream densities than analysis areas nearest Green Peter Dam. Figure 5-5 displays the differences between SWBs. The higher elevation Canal Creek and Upper Quartzville SWBs have the highest stream densities. Packers Gulch and Lone Star SWBs are about average, and the lower elevation Whitcomb Creek, Moose Creek and South Green Peter SWBs are below average. Stream densities and road densities interact. The higher the stream density, the greater the potential for management impacts to streams. Sub-watersheds with higher stream densities often have greater topographic relief, which can affect erosion processes.

Table 5-12: Quartzville Creek Stream Densities by Sub-Watershed Basin.

Sub-Watershed (6th Field)	Stream Densities (mi./sq.mi.)
Canal Creek	10.1
Lone Star	7.9
Moose Creek	6.9
Packers Gulch	8.4
South Green Peter	6.1
Upper Quartzville	8.8
Whitcomb Creek	7.6
Watershed Average	8.1

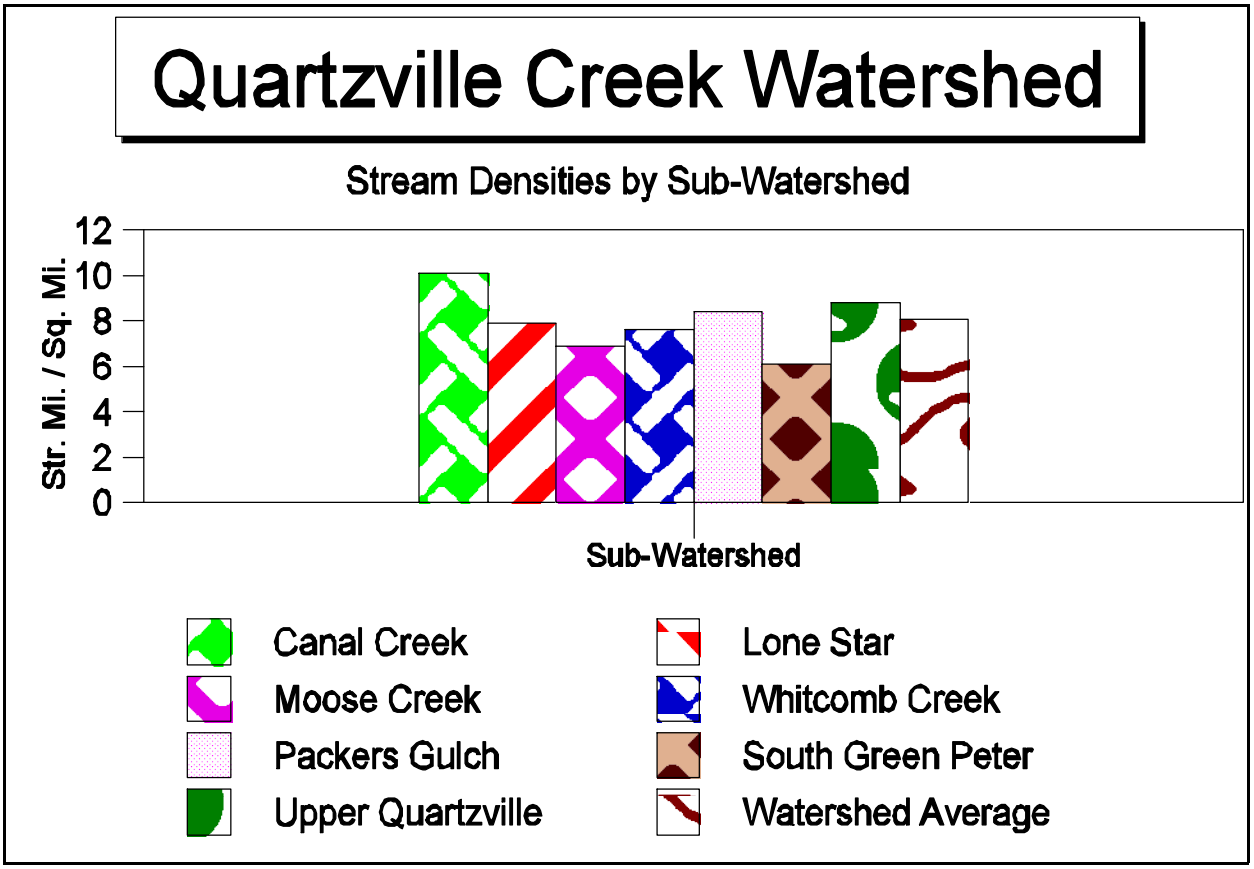


Figure 5-5: Stream Density by Sub-Watershed

Stream flow

The watershed analysis area exhibits high winter flows and low summer flows typical of the Cascade Range drainages, with approximately 71 percent of the flow occurring November through March. Approximately 66 percent of annual precipitation is also received during this period (See Figure 5-6: Discharge and Precipitation).

Green Peter Dam and its associated reservoir are located in the southwest corner of the watershed analysis area.

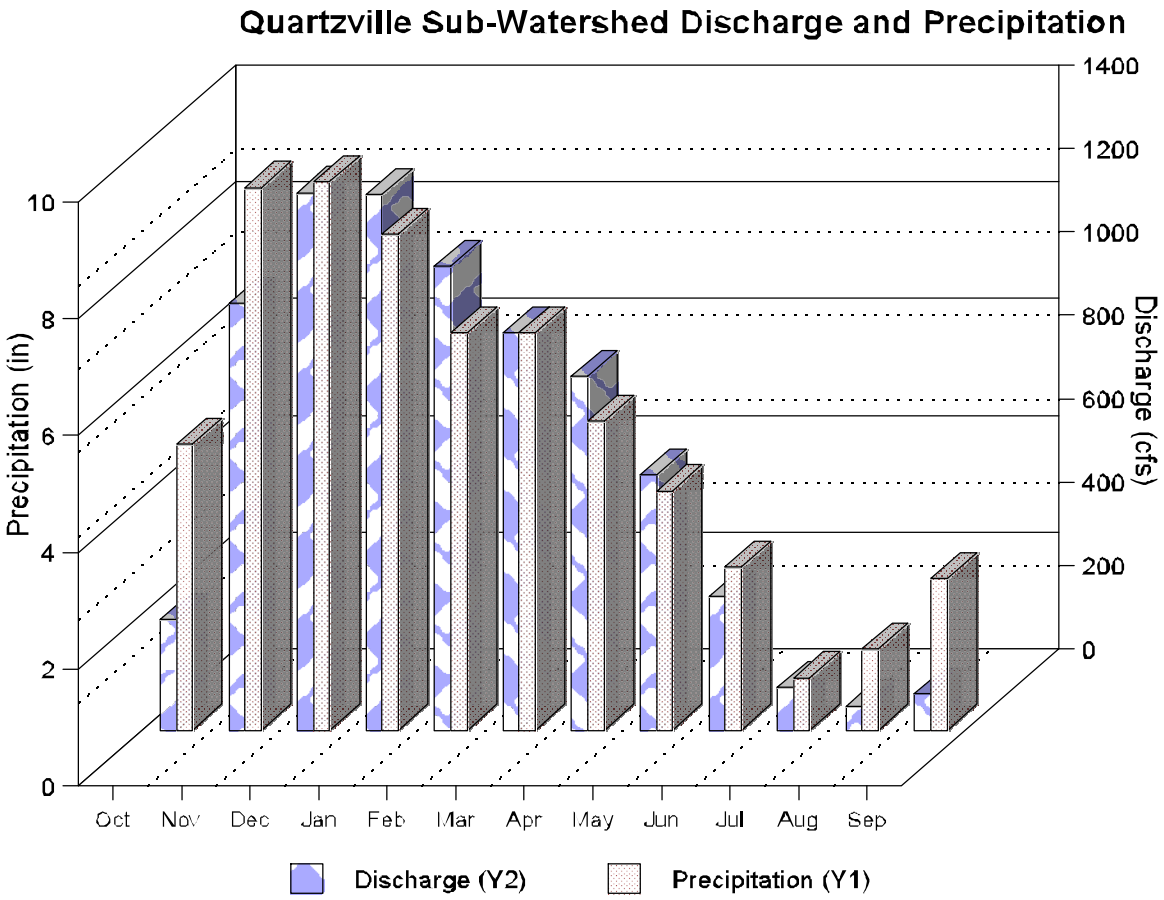


Figure 5-6: Discharge and Precipitation.

Annual stream hydrographs from the U.S. Geological Service stream gaging station number 14185900, Quartzville Creek near Cascadia, Oregon were used to analyze stream discharge in the watershed. In a year of average precipitation, the groundwater recharge due to storms occurs between early October and the end of April, and stream flow is regulated predominantly by precipitation. From May through September, groundwater discharge occurs and is the main component of stream flow available for runoff.

Water Rights and Minimum Instream Flows

All waters within Oregon are publicly owned and controlled by the state, in accordance with state laws. With few exceptions, a permit from Oregon Water Resources Department (WRD) must be obtained to claim rights to surface waters. This includes the instream uses and diversions of water. State laws recognize prior appropriation as the basis for water right allocation, and during periods of water shortage, the permittee with the oldest water right has priority over junior claims. In addition, a water right can be attached to the land where the permit was established, and transferred to subsequent owners. Table 5-13 contains a summary of permitted water withdrawals or diversions for the Quartzville Watershed Analysis from the Oregon State Water

Rights Information System (WRIS).

Table 5-13: Water Rights Summary.

	Domestic	Irrigation	Industrial (Mining)	Municipal	Fish/Wildl.	Misc.	Total
CFS	0.4	0.02	2.8	0	0.3	0	3.52
AFT	0	2	2	194,600	2	0	194,606

CFS: Cubic Feet Per Second
AFT: Acre Feet

Totals are for permitted withdrawals or current maximum allowed usage, and do not necessarily reflect actual use. ODFW instream water rights are not included in this summary.
From: Oregon Water Resources Department, Water Rights Information System.

Water rights themselves are not a guarantee that sufficient flows will be available within the protected sections, since consumptive water rights pre-dating the instream rights and extreme low flow periods may prevent the desired flows from being achieved during some periods. Table 5-14 shows the low flow water availability during the summer and fall low flows at the Quartzville Creek gaging station (from the U. S. Geological Survey Open-file Report 90-118). An 80 percent exceedence flow value was used for the analysis, which means in a given month the average discharge will be higher than the exceedence value eight years out of ten, and lower than the exceedence value two years out of ten. From these values, it appears likely that resident fish populations will be maintained with these low flow levels, although stream temperatures are likely limiting during this time period (refer to stream temperatures section).

Table 5-14: Low Flow Water Availability in Quartzville Creek at 80 Percent Exceedence.

	CFS discharge which was equaled or exceeded 80% of time				
	Jun	Jul	Aug	Sept	Oct
Quartzville Creek at River Mile 5	124	56	34	31	42

Non-Consumptive Water Use

Although hydroelectric power generation is not quantified in the water rights for the Quartzville Watershed, this is one of its primary water uses. Water from the Quartzville Creek Watershed contributes to the hydroelectric operations of Green Peter and Foster Dams (the latter is located below the watershed analysis area).

Water Quality

Protection and enhancement of water quality in the Willamette River Basin was identified by Oregon Department of Environmental Quality (ODEQ) as one of the most critical long range environmental issues facing the state (Tetra Tech 1993). Pollutants are generally divided into two sources. Point sources which come from an identifiable source, such as a factory or sewage

treatment plant, and non-point source pollutants such as soil erosion or pollutants in precipitation runoff, which are not as easily traceable. Point sources of water pollution are closely monitored by the ODEQ, and contribute significantly less pollution to Oregon rivers than in the past. Non-point sources, such as road and agricultural runoff are harder to regulate because of the difficulty in determining accurately the amounts as sources of pollutants entering the stream. Most of the non-point pollution in the Willamette River Basin occurs in the winter and spring when heavy rains wash pollutants into rivers (Tetra Tech 1993). Due to the lack of industry within the Quartzville Watershed, non-point sources are the main sources of pollution.

The ODEQ has divided Oregon into 19 river basins and developed water quality criteria for each. Streams that do not meet these criteria may be listed as water quality limited. The criteria encompass physical and chemical characteristics including: pH, water temperature, dissolved oxygen, fecal coliforms, turbidity, and other parameters (See Table 5-15: Selected Water Quality Criteria For Quartzville Watershed).

Table 5-15: Selected Water Quality Criteria For Quartzville Watershed.

pH	6.5 to 8.5
Water temperature	Fish rearing: 64 degrees F. or less
Dissolved oxygen	> 90% saturation
Fecal coliform	< 200 per 100ml.
Turbidity	< 10 % increase

In the ODEQ publication, *1988 Oregon Assessment of Non-point Sources of Water Pollution* (ODEQ 1988), also known as the *319 Report*, surface waters are listed where problems were thought to occur using existing data or by observation. The publication lists Quartzville Creek and Gold Creek (a Quartzville Creek tributary) water quality as being moderately impacted, supported by data in the upper reaches. The problems identified were nutrients and insufficient stream structure. The probable causes were listed as vegetation removal, and riparian vegetation and bank disturbance. Affected values were identified as fisheries, aquatic life, water recreation, aesthetics, and downstream municipal water supply. The 319 report was an initial assessment of water quality in Oregon, and was used as a bench mark for future studies.

The *Oregon Department of Environmental Quality's 303(d) List Of Water Quality Limited Waterbodies*, also known as the *303(d) report*, is a compilation of water bodies where existing required pollution controls are not stringent enough to achieve the state's water quality standards. States were required to develop this list under the 1972 Federal Clean Water Act. Unlike the

319 report, sufficient data to show a specific problem exists is required to place a stream on the list. Quartzville Creek is listed on the 303(d) list as water quality limited for summer stream temperature, from the Quartzville Creek gaging station (14185900), at stream mile 5, upstream to its headwaters. Summer temperatures have been found to be above the 64 degree Fahrenheit threshold for fish rearing for notable periods of time (See stream temperatures section).

Several water quality studies have been conducted in the Willamette River Basin in the past decade. Some provide information for the Santiam sub-basin which contains the Quartzville Watershed, however data specific to Quartzville is limited. Tetra Tech (1993) estimated non-point pollution annual loads of nitrogen, phosphorous, and total suspended solids for watersheds in the Willamette River Basin. Table 5-16 compares the Santiam sub-basin with the average for the entire Willamette River Basin. Results suggest the non-point pollution levels are 5 to 20 percent higher in the Santiam sub-basin than the Willamette Basin average; however sources have not been identified.

Table 5-16: Phosphorous, Nitrogen, and Suspended Solids.

Area	Total Phosphorous (kg/ha)	Total Nitrogen (kg/ha)	Total Suspended Solids (kg/ha)
Santiam Sub-Basin	0.78	5.47	770
Willamette Basin	0.74	4.57	680

Actual levels coming from Quartzville Watershed are undocumented. It is suspected that most of the phosphorous and nitrogen levels at the Sub-basin and Basin levels are coming from agricultural lands.

A summary of information on aquatic biota in the Willamette Basin was published by the USGS in 1997. The report cited the results of a pesticide and trace metal study in fish found in Willamette Basin watersheds. Squaw Fish collected in the Santiam Watershed at river mile 0.5 were found to contain small amounts of chlorinated pesticides, PCBs, and trace metals. River mile 0.5 is over 25 miles downstream of the Quartzville Watershed.

Stream Temperatures

The BLM has collected summer and fall water temperatures since 1996 at sites on mainstem Quartzville Creek, and several tributaries using temperature data loggers. Oregon Administrative Rules (OAR340-41) give numeric temperature criteria where measurable increases in stream temperatures
due to human activities are not allowed. The temperature threshold for salmonid fish rearing in Quartzville Creek is 17.8 degrees C (64 degrees F).

In the Quartzville Watershed, the main channel has been listed as water quality limited due to temperature from the gaging station at river mile 5 upstream to its headwaters. Temperature monitoring sites on the mainstem are located at river mile 5 (the gaging station near Panther Creek), river mile 6.5 at Yellowstone Creek, river mile 7 at Boulder Creek Bridge, river mile 8 Packers Gulch Creek, river mile 9 at a private bridge, river mile 10 at Yellowbottom Creek, and river mile 12 at the Forest Service Boundary. River miles are measured in an upstream direction, beginning with 0 at the mouth. Data have also been collected at the mouth of Yellowstone, Yellowbottom, Boulder, Canal, Flush, Fourbit, Panther and Packers Gulch Creeks, tributaries of Quartzville Creek. Data from 2000 were summarized by calculating seven day maximum averages, which are an average of the maximum recorded temperatures for a given date, the three days prior and the three days after the date. The seven day maximum average was used rather than straight daily maximums, because aquatic organisms are more susceptible to disease and other environmental stress when water temperatures are elevated over a period of time. Seven day maximum averages also remove some of the fluctuation that can appear in graphs of daily maximums.

Figure 5-7 presents the Quartzville Creek temperature data on four different 2000 dates, plotted by river mile. This graph shows that there is a general increase in stream temperature from river mile 12 downstream to river mile 6.5. However, this stream temperature increase is not very large, due primarily, to several sources of cooling water (i.e., Yellowstone Creek, Yellowbottom Creek, Boulder Creek, Flush Creek, and Fourbit Creek), which are moderating the stream temperature of Quartzville Creek.

The Quartzville Watershed 7-day averages are plotted in Figure 5-8. The figure indicates temperatures in Quartzville Creek at river mile 12 were below the basin standard of 17.8 degrees C (64 degrees F)., but data was not collected for the month of July through the first part of August. Previous years' monitoring from this location have shown this time period to have been above the basin standard temperature. All other Quartzville stations were above the standard for extended periods of time. Because the data represent a seven day running average, it is apparent that water temperatures are high for extended periods of time in the summer. At temperatures near or above the 17 degrees Celsius threshold, salmonid species are forced to seek refuge in cooler water in places such as deep pools, or cooler tributaries. Yellowstone, Yellowbottom, Boulder, Flush and Fourbit Creeks were below the standard the entire period of record, and Packers Gulch Creek most of the time. Canal Creek and Panther Creek were above the basin standard temperature for approximately half of the time period monitored (mid June through mid September). All of the creeks were, generally, cooler than mainstem Quartzville Creek over the entire period of sampling. Focusing on data at river miles 12 and 6.5, water temperatures remain fairly constant throughout the summer months, although a slight temperature increase is noted in a downstream direction.

Some resource damage has been observed as a result of the removal of soil and vegetation from river banks. During the Summer of 2000 the BLM in partnership with ODEQ and FS conducted an intensive water temperature monitoring program in the South Santiam Sub-basin. In Quartzville Creek there were four mainstem sites and six tributary sites. The monitoring included

deployment of continuous water temperature data loggers and on-site collection of channel and riparian condition along with streamflow. The onsite data collection occurred during the warmest period for water temperature, during the beginning of August.

During this on-site data collection of channel characteristics it became visually evident that the clarity of water as one moved upstream from Yellowbottom Creek to Canal Creek became increasingly degraded. The water in the deeper pools no longer allowed visual inspection of the bottom from the river bank. The decrease in clarity appeared to be due to an algal bloom that could be associated with suspension of sediment in the presence of elevated water temperatures (72 degrees F). There are reaches within this portion of the river which are shallow, exposed to the sun, and consist entirely of bedrock. These reaches act as thermal sinks and are part of the natural heating to the river system. On the two occasions when this was observed there were placer dredging operations underway with visual turbidity evident from the pump outfall. The suspended sediment evidenced by the turbidity can contribute to a flush of nutrient to the system, when in the presence of elevated temperature and sunlight can lead to a bloom of algae. The presence of algae itself may not impact beneficial uses such as macro-invertebrates and trout however over the low flow period could contribute to a measurable depression of dissolved oxygen. This can have a real effect in terms of stress to cold water organisms in that reach. High levels of clarity and no visual bloom was noted above the placer mining area in this river segment.

The impact of the February 1996 flood was fairly dramatic in the Quartzville Creek Watershed, especially in Quartzville Creek itself. High flows caused large sediment loads to be deposited on the flood plain and removed riparian vegetation, which resulted in direct solar input to this stream.

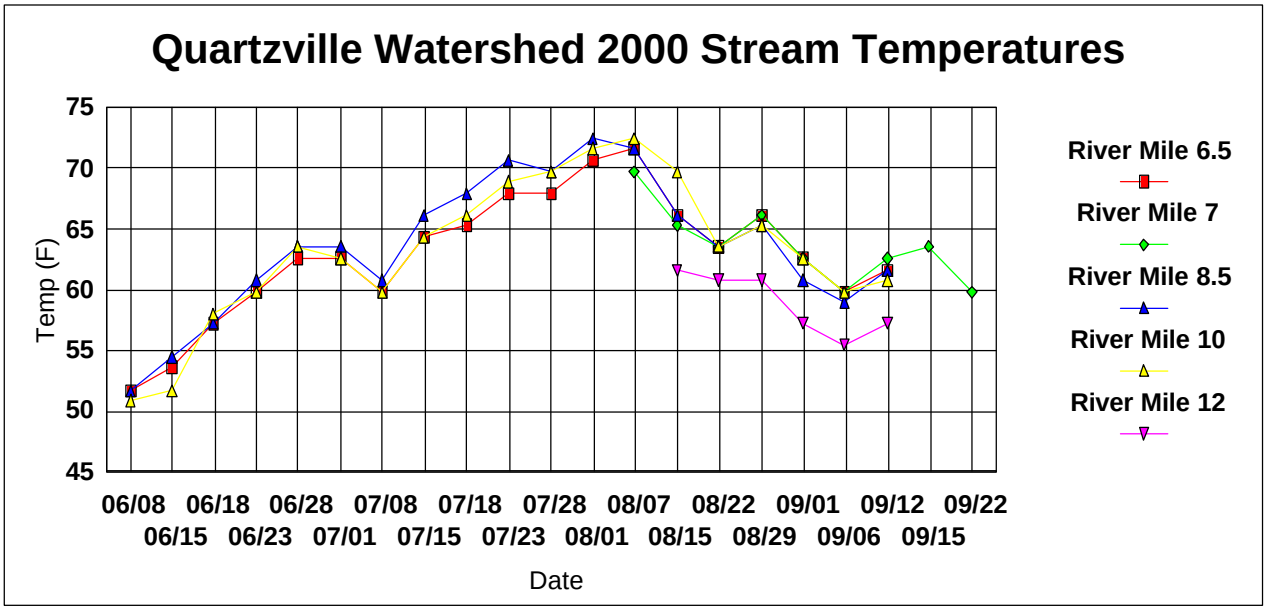


Figure 5-7: Seven Day Maximum Temperatures.

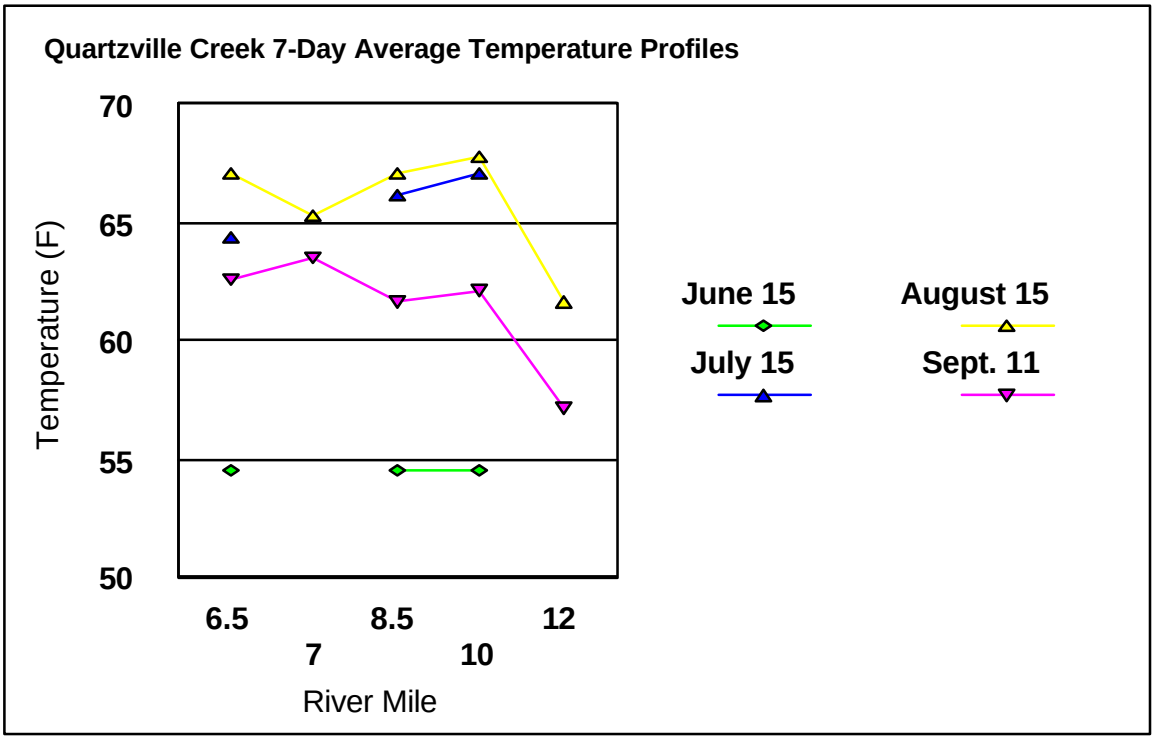


Figure 5-8: Seven Day Maximum Average Temperature Profiles.

The USD A Fores

t Service monitored their portion of the Quartzville Watershed for stream temperatures during the summer of 2001. The results of the monitoring show that portions exceed State standards. Quartzville main stem from McQuade Creek downstream exceeds 64 degree standards set by the state. This is due to the valley widening at the McQuade Creek confluence and a solar sink of alluvium contained within the valley drastically affecting water temperatures downstream. All other tributaries sampled were above the State standards.

Road Summary

Total miles of road and road densities across the Quartzville Watershed were calculated by SWB and ownership (See Map #10: Transportation, and Table 5-5: Road Densities by SWB and Ownership in the Quartzville Watershed). There are approximately 586 miles of road on all ownerships within the watershed, and the average total road density is estimated at about four miles per square mile. The highest road densities are over 4.5 miles per square mile and occur in the Whitcomb Creek and Packers Gulch SWBs. Moose Creek, Canal Creek and Upper Quartzville SWBs have moderately high road densities of between 3.5 and 4.5 miles per square mile, while Lone Star and South Green Peter have road densities less than 3.5 miles per square mile.

Of the 586 total road miles in the watershed, 362 miles are on federal lands (62 %). Road densities on federal lands are estimated to be about 3.35 miles per square mile, which is moderate. Road densities on federal lands is highest in the Packers Gulch SWB (over 4.5 miles per square mile).

Road surfaces and cut banks are basically impermeable to rainfall and snowmelt runoff. Roads can also intercept subsurface flow in cutbanks and concentrate surface runoff. During storms and snowmelt periods, roads act as intermittent stream channel extensions. They increase drainage density by concentrating runoff and routing it to streams more quickly than by natural processes. Increases in road densities in the vicinity of streams result in more water being delivered to natural channels in a short period of time. This can cause peak discharges to occur sooner than expected, and increase their size (Jones and Grant 1996)*. The potential channel network expansion due to roads was calculated by totaling the length of road within 100 feet of a stream channel and adding the value to the total stream miles in the SWB. Table 5-17 lists miles of stream, miles of roads within 100 feet of an existing stream, and the estimated channel network expansion due to roads. Packers Gulch SWB has greater than 15 percent channel expansion, which is considered moderately high.

*The findings in the Jones and Grant paper are controversial and subsequent research has shown different conclusions. On USDA Forest Service lands, the Jones and Grant findings are not considered valid.

Table 5-17: Estimated Channel Network Expansion.

SWB	Stream Miles	Road Miles Within 100 Feet of Streams	Estimated Channel Network Expansion (Percent)
Canal Creek	237.7	25.9	10.9
Lone Star	170.1	14.8	8.7
Moose Creek	174.4	22.2	12.7
Packers Gulch	232.6	36.9	15.9
South Green Peter	47.8	4.1	8.6
Upper Quartzville	175.0	18.3	10.5
Whitcomb Creek	177.5	20.2	11.4

While surface erosion on exposed hillslopes usually decreases within a few years of disturbance as the slope revegetates, road surfaces can continue to erode as long as the road is in use. Cutslopes and fillslopes revegetate after road construction; however the running surfaces produce fine-grained sediments over the life of the road. Roads can disrupt sub-surface flow, re-route surface flow, and in effect, act like stream channel extensions during storms, contributing runoff and sediment to streams. The amount of sediment and runoff reaching streams depends on the location, quantity and type of traffic, geology, and construction of the road.

Cumulative Effects

In past watershed analyses, cumulative effects were estimated using data on forest stand birth dates. Interpretation of stand birth dates from aerial photographs for non-BLM lands is labor intensive and expensive. Due to funding and time constraints, *Western Oregon Digital Imagery Project* (WODIP) data was used to classify tree overstory ages rather than specific stand birth dates. WODIP data is produced by interpreting satellite imagery, and places areas of like vegetation into categories based on the species, diameters, and amount of crown closure. Vegetation maps derived from WODIP data are estimated to be 80 percent accurate for the type of stand. However, because the data must be grouped into broad age bands, the age estimates are not as accurate as birth date information collected from aerial photographs.

The WODIP images were grouped into age bands based on estimates of forest type, crown closure, and tree stem diameter. A comparison of actual stand ages where existing data was available with WODIP data for the same areas revealed errors in the cumulative effect calculation of up to 30 percent. In several cases the WODIP results showed the SWBs to be in better condition than when analyzed using actual ages, however the error could be in either a positive or negative direction. Due to the level of error inherent on the calculations, project specific cumulative effects analysis will need to be conducted in the future as projects are proposed.

A general condition ranking was accomplished using WODIP data to compare SWBs to each other and the Quartzville Watershed. The intent was to estimate which SWBs appear to have the largest amount of forested acres in young age classes, and which have the least. The goal was to provide a rough estimate where watershed restoration activities might be most useful within the Quartzville Watershed.

Timber management and harvest on private industrial forest land has historically been and currently is a major land use in this watershed. Timber management and harvest activities has also occurred on federal public lands in the watershed, however, is expected to be lower in the future. In order to rank the SWBs into relative condition based on forest management activities, only forest management acres were used in each SWB. Table 5-18 lists the total acres in each SWB, forest management acres and percentages.

Table 5-18: Acres Managed as Forest.

Quartzville SWB	Total Acres	Forest Management Acres	Forest Management Acres (Percent)
Canal Creek	15,015	14,903	99
Lone Star	13,823	13,581	98
Moose Creek	16,212	14,926	92
Packers Gulch	17,646	17,001	96
S. Green Peter	4,978	3,992	80
Upper Quartzville	12,792	12,686	99
Whitcomb Creek	15,002	13,647	91
Total for Quartzville Watershed	95,468	90,736	95

Forest management acres within each SWB were evaluated, and the percent of forest in a young age class and mature age class estimated. The age of overstory trees within the young age class is less than 40 years. The mature overstory age class contains stands approximately 80 year old and older. Table 5-19 lists the SWBs in acres and percent in both the young age and older age classes.

Table 5-19: Acres/Percent Forest Lands in Young and Mature Age Classes.

Quartzville SWB	Forest Management Acres	Forest in Young Age Class (Acres/Percent)	Forest in Mature Age Class (Acres/Percent)
Canal Creek	14,903	6,274 (42%)	8,188 (55%)
Lone Star	13,581	3,797 (28%)	9,646 (71%)
Moose Creek	14,926	6,361 (43%)	5,440 (36%)
Packers Gulch	17,001	6,733 (40%)	9,328 (55%)
S. Green Peter	3,992	1,698 (43%)	893 (22%)
Upper Quartzville	12,686	4,911 (39%)	7,738 (61%)
Whitcomb Creek	13,647	6,653 (49%)	3,602 (26%)
Total for Quartzville Watershed	90,736	36,427 (40%)	44,835 (49%)

The SWBs with the greatest percent of forested land in the young age class was Whitcomb Creek. Lands in this SWB are owned and managed by private industrial parties with large land holdings, and BLM land managed as LSR. In contrast, Lone Star and Upper Quartzville SWBs currently have the lowest percentage of forest lands in the younger age class. These watersheds are managed to a greater degree by private industrial companies, BLM, and FS. The SWB with the greatest amount of older forest is Lone Star with 71 percent. Most of the older forest stands in this SWB are located on BLM and FS lands in the upper reaches and are managed as LSR.

Future harvest plans by private land owners are not known, and can change quickly. The level of harvest by industrial companies depends on several factors, including national or local economic conditions. However, many companies in western Oregon use a 40-year rotation age for determining when to harvest managed forest lands. Assuming that much of the private land 40 years or older will be harvested in the next decade, an estimate of the level of potential future harvest was made for the Quartzville SWBs. Table 5-20 lists the acres of private land and the percent in a greater than 40 year age class.

Table 5-20: Private Lands in the Greater Than 40 Year Age Class.

SWB	Private Forest Acres	Acres/Percent in Greater than 40 Year Age Class
Canal Creek	1,846	571 (31%)
Lone Star	2,427	583 (24%)
Moose Creek	6,461	2,603 (40%)
Packers Gulch	3,238	1,579 (49%)
S. Green Peter	3,514	1,804 (51%)
Upper Quartzville	0	0 (0%)
Whitcomb Creek	8,887	3,689 (42%)
Watershed Total	26,373	10,829 (41%)

South Green Peter and Packers Gulch have the highest percentages of private land at an age where harvest is likely. Since the timing of actual harvest cannot be predicted, an in-depth cumulative effects analysis will have to be completed for SWBs when BLM projects are proposed.

Transient Snow Zone

Transient snow zones (TSZ) are areas where snow normally accumulates and melts several times a winter, often melting rapidly (See Map #15: Snow Zone/Slope Stability). Openings in the forest canopy in these areas increase the amount of snow accumulating on the ground, and provides more runoff when a rain on snow event occurs. The cumulative effect of increases in runoff can be large, causing flooding, stream channel and bank damage. Since over half of the Quartzville Creek Watershed is located within a transition snow zone (51 percent), major rain on snow events are fairly common in this watershed area.

Stream channel dimensions and characteristics adjust to accommodate bankfull flows, which correspond to the two-year event in lower gradient steams and apparently to the five-year event in steeper mountain streams (Leopold et.al 1964, Washington Forest Practices Board 1993). Change in the magnitude of frequent flood flows can affect channel scour and fish habitat.

Existing data did not provide enough information to analyze the effects of management on transient snow. Future projects will require additional data collection and analysis on a site specific basis.

Soils

On BLM lands, soil properties, classifications, series descriptions, and soil maps of the Quartzville Watershed are contained within the *Soil Survey of Linn County Area Oregon*.

On USDA Forest Service lands, landforms range from highly glaciated upland benches and flats at the headwaters of Freezeout, Little Meadows, and Quartzville Creeks to steep rocky canyons and crags of Beade, Gold, and Gregg Creeks, to the large scale benches and flats and associated glacial deposits north of Swamp and Gordon Peaks, to the flat stable river terraces along the Lower Elk and Canal Creeks. The various landtypes that describe the terrain and associated soils are discussed in the *Willamette National Forest Soils Resource Inventory*. 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. Mapping standards and definitions are based on the 1973 version (Legard and Meyer, 1973).

Slope Hazard and Stability

Slope hazard ratings for erosion were estimated using slope steepness. Slopes under 60 percent were rated as a low hazard, 60 to 75 percent slopes were rated as moderate, 76 to 90 percent slopes were rated high and slopes over 90 percent were rated as severe (See Map #15: Precipitation Zones/Slope Stability Hazard).

Slope stability by SWB was estimated using geographic information systems maps and database information. Slope stability ratings were based on slope hazard ratings and age of the overstory vegetation. Table 5-21 lists the assumptions used to calculate slope stability. Values were tallied and presented here to identify the SWBs with the highest percentage of unstable ground. These unstable areas may be prone to mass movement under certain environmental conditions.

Table 5-21: Slope Stability Assumptions

Slope Hazard Slope Range (%)	Overstory Age (years)	Stability
Low (0 to 59)	Any	Stable
Moderate (60 to 75)	Less Than or Equal to 10	Potentially Unstable
	Greater Than 10	Stable
High (76 to 90)	Less Than or Equal to 20	Unstable
	Greater Than 20	Potentially Unstable
Severe (90 and Above)	Any	Unstable

Overstory ages for non-federal lands were not available, so an age of less than 10 was used in these areas. Results are listed in Table 5-22 by SWB and ownership.

Table 5-22: Slope Stability by Sub-Watershed and Ownership (acres)

SWB	Ownership	Stable	Potentially Unstable	Unstable
Canal Creek	BLM	2,451	194	31
	Other	10,741	1,243	355
	Total	**13,192**	**1,437**	**386**
Lone Star	BLM	104	3	0
	Other	11,458	1,619	639
	Total	**11,562**	**1,622**	**639**
Moose Creek	BLM	8,159	475	208
	Other	7,007	301	62
	Total	**15,166**	**776**	**270**
Packers Gulch	BLM	13,538	583	231
	Other	2,136	781	378
	Total	**15,674**	**1,364**	**609**
South Green Peter	BLM	490	1	0
	Other	4,151	281	55
	Total	**4,641**	**282**	**55**
Upper Quartzville	BLM	0	0	0
	Other	12,555	199	38
	Total	**12,555**	**199**	**38**
Whitcomb Creek	BLM	4,133	151	29
	Other	8,899	1,529	260
	Total	**13,032**	**1,680**	**289**

Canal Creek, Lone Star and Packers Gulch appear to have the greatest acreage by far in an unstable condition. The SWBs with the most extensive BLM ownership classified as unstable are Moose Creek and Packers Gulch (208 and 231 acres, respectively).

FS lands that have actively unstable and potentially highly unstable slope stability or unsuited

terrain, have been eliminated from management considerations. The one area of larger scale, active slope instability associated with slump/earthflows has yet to be directly harvested. Indirect effects from drainage and evapotranspiration changes are not readily apparent at this point. Timber harvest has accelerated failure rates in some highly debris chute prone locations, but again much of these landtypes have been eschewed in the last two decades. For the most part, translational failure features in the older plantations have now healed over and stabilized. The primary, management-related factor affecting slope instability was road sidecast failure from the older road systems, built in the 1960's and 1970's. Newer roads, after about 1980, were much better designed to fit the terrain and end haul excess excavation. Since the early 1990's, road decommissioning and storm proofing have reduced earlier failure rates. Currently, failure rates are estimated to have returned to near pre-harvest levels.

Compaction

Soil compaction, fortunately, is not duplicated well in nature, except on grander scales, such as glacial and sediment loading. Consequently, man's activities can play a significant, cumulative, and detrimental role in this arena. The major source of most compaction (and also much disturbance) is ground-based skidding equipment used during periods of higher soil moisture. Fortunately, unrestricted tractor yarding and unrestricted tractor piling have not been considered options on those landtypes where sideslopes are gentle enough to support tractor usage for almost two decades. Considering that most sideslopes within the Quartzville Watershed are too steep for ground-based equipment, that much of the harvest in the last decade was accomplished with cable yarding systems, and that many of the older tractor logged units are now beginning to actively loosen the soil through a variety of natural mechanisms, the effects from tractor usage are not cumulatively critical.

Fisheries

No anadromous fish are present in the Quartzville Creek watershed due to passage problems at Foster and Green Peter Dams. Resident fish are found in approximately 233 miles of streams within the watershed (See Map #13: Fish Presence). However, for the purpose of this watershed analysis, where fish distribution data are lacking, it is assumed that 3rd order and larger streams are fish-bearing and that 1st and 2nd order streams are not. Resident fish present in the watershed include native populations of cutthroat (*O. clarki*) and rainbow trout, mountain whitefish (*Prosopium williamsoni*), northern pikeminnow (*Ptychocheilus oregonensis*), large scale sucker (*Catostomus spp*.), sculpin (*Cottid spp.*) and dace (*Rhinicthys spp.*). Introduced fish species found in Green Peter Reservoir include kokanee, largemouth bass (*Micropterus salmoides*) and smallmouth bass (*M. dolomieui*). Kokanee are adfluvial (reside in lakes and ascend tributary streams to spawn) and are known to spawn in

Quartzville Creek. Largemouth or smallmouth bass may at times enter the lower reaches of Quartzville Creek from Green Peter Reservoir.

Habitat

The Oregon Department of Fish and Wildlife (ODFW) has conducted habitat inventories on several streams in the basin in conjunction with BLM and the Oregon Forest Industries Council. Surveyed streams are shown in Table 5-23. Most surveys began at the mouth of each stream, and typically ended at road crossings with barrier culverts, property ownership lines, or headwater areas where the stream went dry. The mainstem Quartzville Creek survey began at the upstream end of Green Peter Reservoir, and the Whitcomb Creek, Moose Creek and Trout Creek surveys began at the streams' confluences with Green Peter Reservoir. Reach changes in mainstem Quartzville Creek were determined by tributary junctions. In the tributary streams reach changes were generally determined by changes in valley or channel form, major changes in vegetation type, changes in land use or ownership, or tributary junctions.

Table 5-23: Streams With Completed Aquatic Habitat Inventories (downstream of the Willamette National Forest Boundary)**.**

Stream	Year Surveyed	No. of Reaches	Miles Surveyed
Quartzville Cr.	1999	8	9.76
Whitcomb Cr.	1997	3	2.70
E. Fk. Whitcomb Cr.	1997	2	2.78
Moose Cr.	1995	2	4.29
Trout Cr.	1995	4	2.96
Trout Cr. (post flood resurvey)	1996	1	0.74
Yellowstone Cr.	1996	3	3.52
Boulder Cr.	1996	1	2.87
Packers Gulch Cr.	1997	5	3.13
Thomas Fk. Packers Gulch	1997	2	1.75
E. Fk. Packers Gulch	1997	4	1.42
S. Fk. Packers Gulch	1997	1	1.92
W. Fk. Packers Gulch	1997	2	1.93
Total:		38	39.77

ODFW has established benchmarks of desirable and undesirable values for the various habitat parameters included in the surveys, shown in Table 5-24.

Table 5-24: ODFW Aquatic Inventory and Analysis Benchmarks

	Undesirable	Desirable
Pools		
Pool Area (percent total stream area)	<10	>35
Pool Frequency (channel widths between pools)	>20	5-8
Riffles		
Gravel (percent area)	<15	>35
Secondary Channel % of Total Area*	<2	>6
Percent Eroding Streambank*	>10	<5
Large Woody Debris		
Pieces (per mile)	<160	>320
Volume (m^3 per mile)	<320	>480
"Key" Pieces (>60cm dia. & >10cm long per mile)	<16	>48

* Not included in ODFW Inventory and Analysis Habitat Benchmarks.

Table 5-25, following the narrative habitat descriptions below, is a summary of instream habitat conditions in surveyed reaches throughout the watershed.

Pool Habitat

Pools are a critical habitat element for many fish species, salmonids in particular. Deep pools provide cover from predators for juvenile and adult fish, rearing areas for juveniles, refuge from the velocities of high flows, and often provide cooler water during times of elevated water temperatures. Pools in higher order, constrained channels tend to be large and deep and are anchored geomorphically. Such pools may be relatively insensitive to effects of management activities, as their formation and maintenance are more determined by flow and geology. Effects of management activities and high flow events are likely to be greatest in low gradient, unconfined reaches of tributaries where bedload deposition and aggradation can occur.

All of the mainstem reaches have “desirable” pool frequencies and “desirable” or “fair” percentages of pool area. Most of the tributary reaches rated “fair” for pool frequency and percent pool area except for the upper reaches of Trout Creek, Yellowstone Creek and the Thomas Fork and East Fork of Packers Gulch which had “undesirable” amounts of pool habitat.

Spawning Gravel Quantity

Instream gravels are highly mobile during high flow events. Where stable instream structure is lacking, gravels may be completely flushed out of the channel to floodplains and downstream areas. High flows can cause bank erosion and landslides that can be either detrimental or beneficial for spawning areas. Erosion and slides can negatively impact spawning gravels by depositing fine sediments in gravels but may also be beneficial by introducing new gravels into channels that are gravel limited.

Few reaches in the watershed showed “desirable” gravel quantity (percent gravel substrate, estimated in riffles). Most rated “fair,” but reaches 1 and 8 of the mainstem and reach 1 of Trout

Creek had “undesirable” percentages of gravel in riffles. This assessment was not possible in several tributary reaches due to absence of riffle habitat.

Off-Channel Habitat

Off-channel habitats include secondary channels and backwater areas. Both can be critical rearing areas for salmonid fry and also provide refuge for fish from the velocity of high flow events. Secondary channels are most likely to develop in unconstrained and moderately constrained, low gradient reaches. Streams that have been channelized and/or subjected to large woody debris (LWD) removal and streams constrained by roads within the riparian zone often have less off-channel habitat than their gradient and level of confinement would allow in a natural state.

Few reaches showed “desirable” levels of off-channel habitat. The mainstem of Quartzville Creek is constrained by Quartzville Access Road which probably limits the development of secondary channels. Tributary reaches that are probably constrained by roads within the riparian areas are reach 1 of Yellowstone Creek, Boulder Creek, and reaches 2-4 of Packers Gulch. In the other tributaries, most of the reaches that have “undesirable” percentages of off-channel habitat are higher gradient reaches in which secondary channel habitat is less likely to develop.

The upper reaches of Quartzville Creek, which are mostly on National Forest lands, typically do not have large amounts of off channel habitat due to the natural fluvial geomorphology of the channel. Most of the historic off channel habitat occurred in the lower reaches of the watershed where lower gradients and broader flood prone widths allowed for more diverse channel characteristics. Most of this type of channel now lie under the pool formed by Green Peter dam.

Streambank Stability (% Eroding Streambank)

Erosion of streambanks is a natural process and is necessary to ensure a continuous supply of wood, gravel and cobble to stream channels. However, human activities such as agriculture, timber harvest and road construction often cause weakening of landforms that eventually lead to landslides and accelerated erosion of streambanks.

ODFW survey methods record the percentages of streambank within each reach that show signs of active erosion. All of the mainstem reaches had “desirable” (low) or “fair” amounts of eroding streambank, as did all of the surveyed reaches within the Packers Gulch drainage with the exception of the Thomas Fork. Both reaches of the Thomas Fork showed very high levels of erosion. The lower reach of Trout Creek, the only reach that was resurveyed following the flood of February 1996, showed a dramatic post-flood increase in the percentage of actively eroding banks.

In-Channel Large Woody Debris (LWD)

LWD in streams helps to dissipate stream energy, retain gravels, nutrients, and organic debris, aid in pool formation and maintenance, increase stream sinuosity, create diverse habitat for fish

and other aquatic organisms, and slow the nutrient cycling process. Besides providing instream and overhead cover for aquatic organisms, LWD also provides a nutrient base and/or preferred substrate for many taxa of aquatic invertebrates. High flow events transport much of the LWD downstream, particularly in mainstem channels. Mainstem channels typically contain lower levels of LWD than tributary channels. Due to the greater channel width and higher stream energy of mainstem rivers, generally only the larger pieces are retained. LWD in tributary streams may be flushed downstream by high flows or debris torrents or it may remain if flows are not high enough to float the larger pieces. Landslides that occur during storms are a primary source of new instream LWD.

This watershed probably has not meet the in-channel wood loading standards due to the historic fire regime, particularly in the upper portions of the watershed. Stand replacing fires with fairly short frequencies reduced the of large wood recruitment potential of many drainages, especially those on south facing slopes.

ODFW survey methods record the number of pieces of LWD (>15cm in diameter and >3m in length) per 100 meters of stream, as well as the volume of wood in cubic meters and the number of "key pieces" of LWD (>60cm in diameter and >10m in length) per 100 meters of stream. In Table 5-25: Summary of Instream Habitat Conditions, LWD counts have been converted to number of pieces and volume per mile of stream. All of the mainstem reaches had "undesirable" levels of LWD, as did Boulder Creek and most of the reaches of Packers Gulch and the Thomas and South Forks of Packers Gulch. All of the reaches of the East and West Forks of Packers Gulch had "fair" or "desirable" levels of LWD, as did most of the reaches of Whitcomb, Moose, Trout and Yellowstone Creeks.

Table 5-25: Summary of Instream Habitat Conditions. Based on ODFW Habitat Benchmarks. Unshaded values indicate desirable conditions while dark gray shading indicates values associated with undesirable conditions. Light gray shading indicates values that are in-between.

Reach	Length (miles)	Gradient (%)	Avg. Active Channel Width (ft.)	Pool Frequency (chan.widths per pool)	% Pools (by area)	% Gravel in Riffles	2º chan. %	% Eroding stream-bank	Woody Debris per Mile

									Pieces[1]	Volume (m^3)	Key Pcs.[2]
Quartzville 1	0.47	2.1	98	3.6	25	13	9.7	4	102	119	2
Quartzville 2	1.49	1.2	85	6.1	37	18	1.8	7	82	64	3
Quartzville 3	1.29	0.5	96	6.2	37	15	1.4	3	86	64	2
Quartzville 4	0.60	1.7	76	4.9	53	17	1.3	0	80	60	2
Quartzville 5	2.03	1.1	95	6.3	34	24	2.3	2	64	74	5
Quartzville 6	1.32	0.6	94	3.7	49	22	5.9	2	42	29	1
Quartzville 7	1.66	1.1	115	3.7	27	15	2.6	6	78	135	5
Quartzville 8	0.90	1.3	90	4.6	43	13	1.2	5	41	39	2
Whitcomb 1	0.35	3.0	52	9.6	19	15	10.3	7.6	171	257	17
Whitcomb 2	0.36	5.2	39	10.1	16	N/A	2.2	16.9	156	344	22
Whitcomb 3	2.00	11.3	28	16.3	11	20	3.7	23.6	211	568	28
EF Whitc. 1	0.80	3.7	24	10.0	20	33	2.1	8.4	243	616	36
EF Whitc. 2	1.98	9.7	19	18.3	12	N/A	0.7	44.3	367	643	24
Moose Cr. 1	1.91	3.4	38	6.5	44	30	4.8	9.0	370	700	24
Moose Cr. 2	2.39	11.3	30	10.7	11	27	2.8	6.2	428	866	24
Trout Cr. 1	0.69	9.9	21	13.1	10	5	1.8	6.2	249	764	35
Trout Cr. 2	1.13	20.8	12	256.2	1	15	2.4	2.2	426	1,734	84
Trout Cr. 3	0.79	7.2	10	212.8	<1	18	1.6	36.2	294	863	34
Trout Cr. 4	0.36	30.4	7	288.2	23	N/A	0	2.7	356	997	31
Trout Cr. (96)	0.74	11.5	19	12.4	12	29	1.4	52.3	362	638	24
Yellowst. Cr 1	1.52	6.3	28	9.0	20	36	0.6	26.8	209	318	15
Yellowst. Cr 2	1.57	14.5	21	26.5	8	N/A	0.7	12.5	270	632	47
Yellowst. Cr 3	0.43	11.7	6	163.3	6	N/A	0	0	281	958	95
Boulder Cr.	2.87	10.7	22	14.2	11	N/A	0.7	23.2	143	276	12
Reach	Length (miles)	Gradient (%)	Avg. Active Channel Width (ft.)	Pool Frequency (chan.widths per pool)	% Pools (by area)	% Gravel in Riffles	2º chan. %	% Eroding stream-bank	Woody Debris per Mile		

									Pieces[1]	Volume (m^3)	Key Pcs.[2]
Pack. Gulch 1	0.26	3.7	38	6.6	20	N/A	7.7	5.2	208	265	8
Pack. Gulch 2	1.59	3.4	30	6.3	28	15	0.5	7.6	202	242	2
Pack. Gulch 3	0.17	4.8	33	7.1	21	N/A	3.6	2.5	94	82	6
Pack. Gulch 4	0.38	6.3	23	17.7	9	15	1.8	0	74	53	0
Pack. Gulch 5	0.74	11.9	14	11.9	14	15	0.6	0.1	431	780	4
Tho. Fk. PG 1	1.56	12.6	20	13.1	10	N/A	1.7	67.7	191	249	5
Tho. Fk. PG 2	0.19	23.5	13	26.8	7	N/A	1.0	93.6	47	142	0
E.F. P.G. 1	0.32	8.2	16	14.9	6	N/A	0.8	0.4	266	575	25
E.F. P.G. 2	0.27	4.1	14	25.7	2	70	0.5	0	496	1,830	115
E.F. P.G. 3	0.60	9.2	17	7.6	17	55	0.7	0.4	608	1,817	107
E.F. P.G. 4	0.23	12.7	12	51.5	2	N/A	0.2	0	435	1,452	87
S.F. P.G.	1.92	11.8	23	10.4	13	N/A	0.5	9.3	127	327	13
W.F. P.G. 1	0.93	8.0	26	5.2	25	35	6.5	0	220	475	24
W.F. P.G. 2	1.01	13.4	21	14.5	10	N/A	1.8	5.3	250	1,054	50

[1] Includes all pieces of woody debris with a minimum diameter of 15cm and a minimum length of 3m.
[2] Includes all pieces of woody debris with a minimum diameter of 60cm and a minimum length of 10m.

LWD Recruitment Potential

Recruitment of LWD into a particular stream reach occurs when instream wood is moved from an upstream reach or when stream adjacent trees fall into the channel. The ultimate source of instream LWD is the adjacent riparian forest, generally within 100 feet of stream channels. The potential for suitable LWD input is partially dependent on the size and health of trees in the riparian zone. Trees in young stands (less than 40 years of age) may be too small to affect stream processes. Trees in the 40- to 80-year age classes may have adequate size but these stands are vigorous, and little mortality is likely to occur for several decades. Coniferous trees are generally more beneficial to streams than deciduous trees due to much lower decay rates in the aquatic environment.

In the Quartzville Creek watershed, about 29 percent of the riparian areas (within 30 meters of stream channels) have high potential for LWD recruitment to streams (dominant age-class >130 years) and about 8 percent have moderate potential (conifer dominated or mixed forest, 80-130 years). The remaining 63 percent have low potential (conifers <80, hardwoods and non-forest). The Lone Star, Upper Quartzville and Packers Gulch sub-watersheds (SWBs) have the highest potential for LWD recruitment (Table 5-26), while the South Green Peter, Whitcomb Creek and Moose Creek SWBs have the lowest. Riparian acreage with low potential is mainly a result of past timber harvest tracts that are currently stocked with young conifers. All of the Upper Quartzville and most of the Lone Star and Canal Creek SWBs lie within the Willamette National Forest.

Most of the federal lands are designated LSR and will be managed to optimize large, mature forest stand conditions. LWD recruitment potential across the watershed is therefore expected to improve as the old harvest stands age. Thinning in managed stands in both LSR and riparian reserve need to occur to improve these stand characteristics for future instream wood recruitment.

Table 5-26: LWD Recruitment Potential Within 30m of Stream Channels by SWB.

SWB	Low		Moderate		High		Total Riparian Acres
	Acres	Percent	Acres	Percent	Acres	Percent	
Canal Cr.	2,676	50	698	13	2,024	37	5,394
Lone Star	3,323	28	486	12	2336	60	3,896
Moose Cr.	3,443	71	439	9	962	20	4,845
Packers Gulch	2,878	53	200	4	2,300	43	5,378
South Green Peter	1,654	89	63	3	150	8	1,867
Upper Quartzville	1,415	35	392	10	2,207	55	4,014
Whitcomb Cr.	4,307	81	130	0	809	16	5,023

Human Uses

Human use is the predominant disturbance factor in the Quartzville Watershed today. It is therefore important to have some understanding of the types and extent of human uses in the watershed. This section will more fully describe human uses in the watershed, the current social environment, and concerns associated with those uses. The influence of disturbance resulting from human uses on biological resources in the watershed, are more fully addressed in the

terrestrial and aquatic sections of this chapter.

General Socio-Economic Environment

Before discussing specific human uses in the Quartzville Watershed, it is important to provide a general socio-economic context surrounding and including the watershed. Linn County was selected as the scale of analysis because it includes all of the lands in the Quartzville Watershed and most of the communities within the zone of influence to those lands.

The Quartzville Watershed is in northern portion of Linn County. The major source of the socio-economic information provided is from the 1998, 2000, and 2002 Regional 4 Economic Profile, prepared by the Oregon Employment Department. Region 4 includes Linn, Benton, and Lincoln Counties.

County Population and Demographics

With Linn County's proximity to the I-5 travel corridor and the relatively high quality of life it offers, migration into the county is expected to continue as the major driving force of expected increases in the county's population. The population of Linn County was 91,227 in 1990 and is expected to increase by 27 percent by the year 2010 to116,053. Most of the increases are likely occur near the larger cities directly adjacent to the I-5 corridor like Albany. More limited growth would be expected smaller communities (Lebanon and Sweet Home) and other more rural areas in the county. Given that the Quartzville Watershed has no land currently zoned for residential development, very little of any of the proposed population growth would occur within the watershed. However, increases in populations near the Quartzville Watershed, would increase the demand for the resources and recreational opportunities the watershed provides.

The closest incorporated communities to the Quartzville Watershed are Sweet Home, Lebanon, and Albany. 2000 U.S. Census data estimated that Sweet Home population grew 17 percent from 6,850 residents in 1990 to 8,016 residents in 2000. Lebanon grew 18.7 percent from 10,950 residents in 1990 to 12,950 residents in 2000. Albany, the largest city in Linn County, experienced the highest population growth of the three cities, increasing 38.7 percent from 29,462 residents in 1990 to 40,852 residents in 2000.

The median population age for Linn County is likely to increase as the "baby boomers " of the 1950s and 1960s become older. Data from the U.S. Census taken in 2000, estimate Linn County's median age at 37.4, just over a year older than the state average of 36.3. It also estimates that minority populations in Linn County are just below seven percent of the county's total population. The Hispanic population makes up most of the minority population (four percent). Changes in 2000 U.S. Census survey questions about race make it very difficult to precisely determine changes from the 1990 U.S. Census Data.

Economy

Linn County's economy and employment has historically been dominated by agricultural, lumber/wood, and rare metals industries. The largest industry shift has been a decline in the lumber/wood industry. The majority of this shift is due to technological improvements and a reduction in the timber supply from federal forests. In the 1970s, lumber products production accounted for one in every four non-farm payroll jobs in Linn County. Between 1979 and 1987, the mechanization of mills and other increases in efficiency resulted in a 40 percent reduction in the number of workers required for a given level of production. By 1994 through 1999, lumber products accounted for only one in every ten jobs. It is estimated that a total of 2,100 jobs in the lumber products industry were lost in Region 4 between 1989 to 1994.

Mobile home manufacturing in Linn County has helped to mitigate the economic effect of declining lumber products. The manufacturing of mobile homes is a fast growing business in the same industry designation as logging and lumber mills. In 1995 Palm Harbor Homes opened a Millersburg plant, providing 300 jobs.

While Linn County faces some economic challenges in the short term, the long term picture is encouraging. The production of grass and legume seed and other agricultural products continues to be major industry in Linn County. With Linn County's proximity to I-5, it is a prime location for future business development. This is beginning to pay off even now, as firms and businesses look further south into the Willamette Valley for relocation and expansion. Linn County's neighboring counties are also growing, providing jobs within commuting distance for many Linn County residents.

The Quartzville Watershed's major potential for contributing to Linn County's socio-economic health is tied most closely to providing high quality recreational opportunities and meeting water supply needs on public lands. Private industrial forest lands and to a lesser extent, federal forest lands will continue to contribute to the wood products industry.

Forest Products

Bureau of Land Management (BLM) Lands

The BLM manages approximately 32 percent (32,783 acres) of the Quartzville Watershed (See Map #2: Ownership). Timber management activities on BLM lands are tied to the Land Use Allocation specified in the Salem District Resource Management Plan, May 1995 (RMP).

Under the guidance in the RMP, regeneration and thinning harvest is expected in both General Forest Management Areas (GFMA) and Connectivity (CONN) Land Use Allocations. Some habitat management activities may also occur in Riparian Reserves and Late Successional Reserves (LSR's) in an effort to meet habitat enhancement or other restoration objectives. However, given that 82 percent of the BLM lands in the Quartzville Watershed fall within an LSR or Riparian Reserve, forest products from these lands is expected to be relatively limited

(See Table 5-27: Land Use Allocation for BLM lands and Map #4: Land Use Allocations). Below is a table showing BLM lands by LUA in the Quartzville Watershed.

Land Use Allocation	Outside Riparian Reserves		Inside Riparian Reserves		Total	
	% of All BLM	Acres	% of All BLM	Acres	% of All BLM	Acres
GFMA	5%	1,662	3%	1,015	9%	2,677
CONN	5%	1,595	7%	2,252	12%	3,847
LSR	37%	11,405	42%	12,854	79%	24,259
Total	**48%**	**14,662**	**52%**	**16,121**	**100%**	**30,783**

Table 5-27: Land Use Allocations for BLM lands.

Special Forest Products: The collection of Special Forest Products (SFP's) for both personal and commercial use is allowed on most BLM lands in the Quartzville Watershed in compliance with the RMP. Currently there is no formal inventory data on the type and amount of SFP's on BLM lands the Quartzville Watershed. When possible, information about SFP's are gathered during stand exams. Permits for the collection of SFP's are issued in response to requests. Based on past permits issued, some of the SFP's collected on BLM lands in the Quartzville Watershed include mosses, mushrooms, transplants, boughs, floral greenery, and non-sawtimber wood products like firewood. The collection of boughs and firewood are the most popular commercial SFP's for the Quartzville Watershed. Standard design features for all SFP permits issued in the Quartzville Watershed are no harvest within ¼ mile of any designated recreation site or within the approved or interim corridors adjacent to Wild and Scenic Rivers. SFP harvest would be allowed within the river corridor boundaries provided the action is compatible with LSR values. The authorized officer proposing the SFP harvest contract will confer with the RA Recreation Specialist to determine if the proposed harvest would have any adverse impacts. Also, no harvest within 200 feet of the edge of the channel for streams or edge of the water or riparian vegetation for lakes, ponds and wetlands larger than one acre. For wetlands smaller than one acre, no harvest within the outer limits of riparian vegetation associated with it. The following Special Forest Products will not be sold in LSR include transplants, mosses, cascara bark, conks, mushrooms, pitch, and burls. Authorized and unauthorized collection of similar SFP's most likely occurs on private forest lands as well.

U.S. Forest Service (FS) Lands

FS manages approximately 36 percent (34,629 acres) of the Quartzville Watershed (See Map #2: Ownership). The 1990 Willamette National Forest Land and Resource Management Plan

(LRMP) classified most of the Quartzville Watershed as General Forest (MA-14a), with principal focus on managing forest products. In 1994, the Record of Decision for Managing Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl amended the existing Forest Plan. Most of the watershed is now Late Successional Reserve (LSR), with the principal focus on protecting and enhancing late-successional and old growth forest ecosystems for old-growth dependent species. This management change has had varying levels of impacts on human activities within the watershed, especially limiting timber harvest and related activities. Generally human activities in the LSR that create little or no effect on habitat can continue unaffected by the recent management plan change. Management activities now face greater scrutiny under the amended Forest Plan.

Special Forest Products: The collection of the full range of special forest products on FS lands is allowed in areas and quantities consistent with the Mid-Willamette LSR Assessment including bough and beargrass sales. FS staff indicated that unauthorized theft of special forest products in the Quartzville Watershed is relatively high. Attempts to control theft include more aggressive patrolling and increased sale of appropriate SFP's.

Industrial Timber Lands

Industrial forestry is the predominant private land use in the Quartzville Watershed. Approximately 27 percent (25,611 acres) of the lands in the watershed are managed by private industrial timber companies for the primary purpose of providing commercial timber products (See Map#2: Ownership). Most private industrial forest companies seek to meet the economic objectives of their firm, while managing their lands on a sustained yield basis. However, changes in economic factors and differences in individual company policy can significantly affect harvesting levels and practices in the short and long term. For this reason, general assumptions about the management of private industrial forest lands in the Quartzville Watershed must be made. These assumptions are based on observed past and present management practices. For the purposes of this analysis, it is assumed that unless otherwise stated, private industrial forest lands in the Quartzville Watershed will continue to be managed for commercial timber products on a sustained yield basis, with an average rotation age of 40 to 60 years. Management of private industrial forest lands is required to comply with the Oregon State Forest Practices Act. The authorized and unauthorized collection of special forest products likely occurs on private industrial forest land.

State of Oregon Lands

The Oregon Department of Forestry (ODF) manages less than one percent (14 acres) of the land in the Quartzville Watershed. For the purposes of this analysis it is assumed that state lands would be managed in a similar manner as private industrial forest lands. Management of state lands is also required to comply with the Oregon State Forest Practices Act.

Major Forest Product Concerns

With the increasing regulation and restriction of forest management activities on both private and public forest lands, private industrial forest landowners are concerned about being able to manage their lands according to the company's objectives. This is a general concern that applies to many areas, not just the Quartzville Watershed. Because of the mixed ownership pattern in the Quartzville Watershed, access rights across BLM lands is also a concern.

Other general concerns are associated with public use problems such as illegal dumping, equipment and sign damage, vandalism, fire danger, long term occupancy, and the unauthorized removal of forest products.

Residential and Agricultural Uses

Forest management activities on BLM lands located adjacent to or near private non-forest uses, especially residential dwellings, can create potential concerns for the BLM and the residential property owners. In an effort to address these concerns early in the project planning process, areas with a potential for high sensitivity were identified in the RMP as Rural Interface Areas (RIA's). These RIA's include BLM lands within a ½ mile of private lands zoned for 1 to 20 acre lots or larger lots with homes nearby. Additional RIA's were identified for BLM lands within a ½ mile of private lands with a Rural Residential County Zoning. No RIA's or significant agricultural activities were identified in the Quartzville Watershed.

Water Uses

Water uses and concerns within and downstream from the Quartzville Watershed are described in the aquatic section of this chapter.

Roads and Access

In addition to the resource issues that have been discussed in the terrestrial and aquatic sections of this chapter, roads also play an important role in the level and pattern of human use in a watershed.

Quartzville Access Road (Road 11 on FS) which connects U.S. Highway 20 (just east of Sweet Home) to State Highway 22 (just south of Marion Forks) is the main route into the Quartzville Watershed. The entire 50-mile length of Quartzville Access Road is managed as a National Back Country Byway in partnership with Linn County, BLM and FS. Starting from the Sweet Home side, the first 12.5 miles of Quartzville Road is a paved, two-lane County Road. The second 12.5 miles of Quartzville Road is administered by the BLM and is a paved, road with two-way traffic. The last 25 miles are managed by the FS as Road 11. Road 11 is a paved, single lane road, with stripped pullouts. Most of the secondary roads leading from Quartzville Access Road are narrow, single-lane gravel roads that may or may not be suitable for passenger car traffic. There are also several lesser maintained roads and spur roads that offer more challenging driving experiences.

BLM Lands

Road Easements and Right-of-way Agreements

Access to public lands in the lower portion of Quartzville Watershed is complicated by the checkerboard pattern of federal and private land ownership. This ownership pattern has resulted in the development of a complex system of road easements and right-of-way agreements between federal and private landowners. The following is a summary of the most common right-of-way and road use agreements:

Between FS and BLM

FS and BLM Right-of-Way and Road Use Agreement: Grants reciprocal use of roads and right-of-ways between the FS and BLM roads they manage.

Between BLM and Private Landowners

Exclusive Easement: Grants control of the right-of-way of a road on private land to the United States Government and allows it to authorize third party use and set rules of use.

Non-exclusive Easement: Only allows use of a road on private land by the United States, its agents, and those authorized to do business on lands administered by the United States. The underlying private landowner still controls the road, subject to the rights granted to the United States.

Reciprocal Right-of-Way: Grants the exchange of use between the United States and a private landowner. This right-of-way agreement provides for each party to use the other's roads or construct roads over the other's land.

BLM Road Maintenance Shop and Public Use of BLM Controlled Roads

BLM Road Maintenance Shop: The BLM manages a road maintenance shop located along Quartzville Creek (See Map#17: Special Management Areas). The road maintenance crew moved out of the shop in the Fall of 2001. As funding allows, the BLM plans to remove all site structures and fencing and to the extent possible restore the area to a more natural looking appearance.

Public Use of BLM Controlled Roads: BLM controlled roads on public or private lands are not public roads. They are considered administrative roads designed and maintained for managing public land resources. Historically the public has been allowed to use these roads to access public lands. However, the road system is not static. To offset new road construction or to reduce road densities, existing roads may be decommissioned. Roads may also be left intact, but blocked to reduce full sized motorized vehicle access and disturbance to wildlife, or resource damage such as garbage dumping, or erosion from excessive off-road use.

FS Lands

In addition to the FS/BLM agreement already mentioned, there are small amounts of private land

adjacent to FS-owned or controlled roads. The FS has granted a non-exclusive easements to these landowners when necessary.

Private Lands

Though not expressly authorized, use of private forest roads by the public to access public lands may occur unless the road is physically restricted. The installation of gates or blocking of roads on private land is increasing, due to problems with vandalism, garbage dumping, resource damage, fire hazard and other criminal activity.

Major Roads and Access Concerns

There are concerns about cars being driven under the influence of intoxicants and/or at speeds too fast for the existing road conditions, along the entire length of Quartzville Road/Road 11. The county segment of the Quartzville Road has been posted with speed limits, however the BLM and FS segments are not posted.

In general, some segments of the public will continue to be concerned about maintaining public use of roads accessing public lands, while others may advocate for the reduction of roads to encourage more non-motorized use. Private landowners will continue to be concerned about their access rights and the impacts of public use of their roads and lands. The BLM is concerned about providing for public access while still complying with right-of-way agreements and meeting other resource management objectives for the Quartzville Watershed and the Salem District. The FS is concerned about managing the road system for a variety of uses and demands. This includes providing for many different recreational experiences and management opportunities, while protecting resources and minimizing safety hazards and user conflicts.

Lands and Mineral Uses

Mineral uses associated with gold mining claims and recreational mining within the Quartzville Watershed are described below. Other mineral activities in the watershed are associated with rock quarries for road building. There are no other known gas leases, communication sites, land withdrawals or utility rights-of-way in the watershed.

BLM Lands

Recreational gold mining is allowed along Quartzville Creek on both private and public lands within the designated wild and scenic river corridor boundaries (See Map #17: Special Management Areas). Recreational mining is only allowed in the mainstem of Quartzville Creek and does not extend to any of its tributaries. The recreational mining area was established when BLM approved a Recreation and Public Purposes (R&PP) lease of lands along Quartzville Creek to Linn County in 1984. Although the BLM still retains authority over the leased lands, this action segregated the minerals on these lands from the federal mining laws. As a result, no mining claims can be located within the BLM portion of the corridor, keeping these lands open to

the public for recreational mining. Private landowners within the recreational mining area described above have also historically allowed access to Quartzville Creek for recreational mining activities. The Western Mining Council, a mining club, was also an important partner in setting up the recreational mining area and has continued to be active in the corridor, helping in a number of volunteer river clean-ups over the last 10 years.

Recreational panning and sluicing is allowed year round, however digging in the banks or removing vegetation is prohibited. A permit is required by the Oregon Department of Environmental Quality (ODEQ) for the operation of a dredge or highbanker. Only dredges equipped with a suction hose less than four inches in diameter are allowed in the recreational mining area. The permitted dredging period set by the Oregon Department of Fish and Wildlife for Quartzville Creek begins June 1st and ends September 15th. Compliance by miners with obtaining the required ODEQ permits appears to be relatively high, and BLM staff check permits as part their visitor contact program.

Some resource damage has been observed as a result of the removal of soil and vegetation from river banks. Other concerns about the potential for dredging to contribute to the formation of algal blooms was discussed in the aquatic section of this chapters.

FS Lands

Mining activity on the public lands in the Quartzville Watershed has a long, active, and colorful history. Currently it includes recreational day use gold panning and extensive small scale placer (suction dredge with a hose of four inches or less) operations. No large underground hardrock mining now occurs, and no large commercial operations remain. Placer claims abound on both the main stem and numerous tributaries in the central Quartzville area where the BLM and the FS lands adjoin. Several patented claims are present in Dry Gulch area on lands within the national forest boundary. Much of this terrain has been claimed and reclaimed in the last 100 years as miners have searched for the "mother lode". Currently, one dredging operation is of sufficient size and extent that an approved Plan of Operations is on file at the Sweet Home Ranger District, Willamette National Forest. In addition, over 50 Notices of - Intent claims and several Plans of Operation have been submitted to the FS. Notices of Intent generally involve small scale dredging operations with a suction hose diameter of four inches or less and little or no ground disturbance.

Hard rock mining began in earnest in the Quartzville District in 1863. Most of the actively prospected part of the district lies in the southeastern part of T. 11 S., R. 4 E., but the district extends into the northeastern comer of T. 12 S., R. 4 E. Almost all the production has come from the ridge south of Dry Gulch in Sections 22 and 23 of T. 11 S., R. 4 E. The area went through several boom and bust cycles in the late 1800s when access was provided by a road from Gates on the North Santiam River. As late as 1931, the district was only accessible by trail from the Linn County side. By 1938, a road had been constructed from Sweet Home up Quartzville Creek to access the area. Over the years this roadway was widened and much improved, and it now serves as the principal access for the Quartzville Recreational Corridor

and Back Country Byway (Callaghan and Buddington, 1938).

Most of the prospects and mines have developed largely from pockets and rich streaks near the surface. The veins of the Quartzville district are generally much less extensive with less sulphide than those of most other Oregon mining districts. Many veins are cemented by massive to vuggy to cherry quartz veinlets. Quartzville was named after these quartz formations found with the gold in the mines. Between 1863 and the 1890s, more than a thousand people may have been involved in the mining operations in Quartzville, and a small town with post office developed. As with many boon and bust operations, by early in the 1900s most of these operations and the towns that formed around them were abandoned (adapted from Callaghan and Buddington, 1938).

Today, nothing remains of the old Quartzville town site (located on private land). It has been completely reclaimed by nature, and is now a young Douglas fir forest. Currently, most mining activity is centered along the main stem of Quartzville Creek in a recreational mining corridor managed by the BLM. Upstream of this corridor on National Forest System lands and other tributaries on BLM, most streamside zones have been claimed and reclaimed over the years. Current FS recreational policy is to encourage use of the Back County Byway and the Recreational Mining Corridor, manage claimants as the need arises, and discourage exploration and trespassing on the historic mining sites. Unlike the BLM, the FS does not promote an official recreational mining program due to the need to respect the current active mining claims. In addition, the FS in deference to private property rights, does not advertise the rich mining history of the Quartzville town site with directional or interpretative signing.

Little private land occurs within FS lands in the Quartzville Watershed. The primary private land in-holdings are associated with patented claim blocks. It is not likely that they will become available for purchase or trade. Acquiring these lands would be beneficial for several reasons. If acquired, these lands provide the FS with opportunities for interpretation of mining history and protection of the remaining items of historical value. It would also help minimize the fragmentation of dispersal habitat for the spotted owl. Many of the plantations associated with the claims are now commercial thinning size and over stocked. They are beginning to fall apart; natural mortality is increasing as well as fuel loading. There is a need to treat these stands with thinnings and partial cuts instead of clear cuts, to promote the return to old growth habitat.

Major Lands and Mineral Concerns: Some resource damage has been observed as a result of the removal of soil and vegetation from river banks along the BLM portion of Quartzville Creek. The BLM continues to talk with miners about appropriate mining activities. Mining regulations for BLM lands in the recreational mining corridor are also address on signs and in a mining guidelines brochure.

Recreation Resources

The Quartzville Watershed offers a wide spectrum of developed and undeveloped recreation opportunities in forested settings of the Cascade Mountain Range. The two largest attractions in the Quartzville Watershed are associated with water-based recreation in Green Peter Reservoir and Quartzville Creek National Wild and Scenic River. The watershed's proximity

to the population centers such as Eugene, Salem and Portland make it an important recreation resource in the Willamette Valley. The watershed is also a popular recreation destination for residents of nearby communities including Sweet Home, Lebanon and Albany. The major recreation providers in the watershed include the U.S. Army Corps of Engineers, Linn County Parks Department, Bureau of Land Management, and the U.S. Forest Service.

Quartzville Creek and Green Peter Reservoir Memorandum of Understanding (MOU): The need for cooperative management of both recreation and other natural resources was recognized in 1993 when the Salem District BLM entered into a MOU with the Willamette National Forest, Linn County and the Oregon Department of Fish and Wildlife. The MOU charges each participating agency to look for opportunities for improving information exchange and partnership projects. The U.S. Army Corps of Engineers have also been an important partner in the watershed. Private landowners and public land management agencies have also been meeting recently in 2002 to discuss opportunities for better coordination and cooperation in the management of recreational use in the corridor. This includes developing to the extent possible, consistent visitor contact information, signing and recreational use guidelines along the entire length of the Green Peter Reservoir and Quartzville Creek corridor.

Recreation on Army Corps of Engineers and Linn County Parks Lands

Green Peter Reservoir

Green Peter Reservoir is the most significant recreational feature in the Quartzville Watershed in terms of visitation, receiving over 125,000 visitors a year. Green Peter Reservoir offers a variety of recreational activities including motorized and non-motorized boat use, water skiing, personal water craft use, swimming, fishing, and camping. Most of this use is undeveloped and is managed by the U.S. Army Corps of Engineers (ACOE). The Linn County Parks Department (LCPD) manages most of the developed facilities along the reservoir. The high use season for the reservoir begins Memorial Day weekend and extends through Labor Day weekend. Shortly after Labor Day weekend, the water level in Green Peter Reservoir is drawn down to provide additional water to anadromous fish in the South Santiam and Willamette Rivers. Below is a description of the developed and undeveloped recreation facilities and use along Green Peter Reservoir.

> **Whitcomb Creek Campground and Thistle Creek Boat Ramp:** Both of these sites were built by ACOE, but are currently managed by LCPD (See Map #17: Special Management Areas). Whitcomb Creek Campground is generally open from mid-April through mid-October and offers 39 campsites, vault restrooms, water faucets, a boat ramp, and swimming beach. Thistle Creek Day-Use Area is open year round and offers picnic sites, vault restrooms, and a boat ramp. The boat ramp at Thistle Creek was recently extended to provide boat access to Green Peter Reservoir during low pool periods. Camping fees are required at Whitcomb Creek and Thistle Creek is free. During the peak use weekends, these facilities are often at or above capacity. Annual visitation estimates are 16,000 for Whitcomb Creek Campground and 17,000 for Thistle

Creek Park.

Green Peter Dam Wayside and Billings Overlook: Both of these sites are managed by the ACOE (See Map #17: Special Management Areas). Green Peter Dam Wayside is a small wayside located directly adjacent to Green Peter Dam, along Quartzville Access Road and offers views of the dam, portable restrooms, parking and a visitor information kiosk with information about the Quartzville Back Country Byway and Green Peter Reservoir. Billings Overlook is located on the south side of Green Peter Dam and also offers parking, portable restrooms and a view of the reservoir. There has been discussion of adding a boat ramp at the overlook, however, providing adequate parking is an issue.

Moose Creek and Trout Creek Camp Areas: Moose Creek and Trout Creek Camp Areas are two semi-developed areas managed by the ACOE. Currently no fees are required at either site. These sites receive continuous use, that often exceeds capacity during weekends from mid-May through mid-September. Both sites have vault toilets, fire rings and barrier rocks to help reduce resource damage from overcrowding.

Undeveloped Camping along Green Peter Reservoir: In addition to Moose Creek and Trout Creek there is a significant amount of dispersed use around Green Peter Reservoir which is also managed by the ACOE. Most of the dispersed use along the north side of the reservoir is concentrated onto several gravel pullouts between Quartzville Road and Green Peter Reservoir from Whitcomb Creek Campground to the slack waters of the reservoir. There is also a limited amount of boat-in camping along the south shore of the reservoir. During the summer months the ACOE conducts regular visitor contact patrols. ACOE also contracts with the Oregon State Police for additional law enforcement coverage.

One of the biggest issues associated with the management of Green Peter Reservoir is the lack of adequate developed parking and camping facilities. In the early 1990's, dispersed camping and boat access on private land along the southern arm of the reservoir was closed. This pushed a significant amount of use onto the already heavily used northern arm of Green Peter Reservoir. Crowding and parking congestion are often a problem during the peak use weekends. Other problems associated with heavy recreational use are addressed under “prohibited uses” later in this chapter. Due to the steepness of the topography of public lands along Green Peter Reservoir, additional facility development is not very feasible at this time. The lands with the best facility development are privately owned.

Recreation on BLM Lands

Most of the BLM and private lands in the Quartzville Watershed are characterized by a forested environment, with obvious modifications such as logging or mining, etc., road access and limited facility development, within an open space context. Moderate social interaction is expected. Most of the activities that occur on BLM and private lands outside of the Green Peter Reservoir and Quartzville Creek Corridor, are associated with upland uses such as hunting,

target shooting, rock hounding, and off-highway vehicle use. Visitation is estimated at low to moderate, however, no field-based, quantitative use information is currently available for areas outside of developed recreations sites.

Yellowstone Special Recreation Management Area (SRMA)

An SRMA is an area that has been administratively designated by the BLM as having high quality recreation opportunities and that have significant recreation investment on BLM lands. The RMP designated approximately 39,000 acres of BLM lands as the Yellowstone SRMA (See Map #17: Special Management Areas). The Yellowstone SRMA includes BLM lands in both the Quartzville and Crabtree Watersheds. Crabtree Lake and the area around Snow Peak Mountain area the major features in the Yellowstone SRMA that fall within the Crabtree Watershed. Green Peter Reservoir, Quartzville Creek, and the Quartzville National Back Country Byway are the major recreational features in the Yellowstone SRMA that fall within the Quartzville Watershed. The intention of a SRMA designation is to provide the BLM with a way of emphasizing both staff and other resources related to recreation in an area, but does not in any way prescribe management objectives for lands not managed by the BLM.

Quartzville National Back Country Byway

Approximately 12.5 miles of the BLM portion of Quartzville Road was designated by the RMP as a National Back Country Byway in May of 1995 . The BLM worked in partnership with Linn County and FS to manage the remaining 37.5 miles of Quartzville Road/ FS Road 11 as part of the byway. The entire byway extends from U.S. Highway 20, near Sweet Home to State Highway 22, near Marion Forks. Two entrance signs and two information kiosks have been placed at each end of the corridor. The Quartzville Recreation Corridor and Back Country Byway brochure was also developed to provide visitors with information about the recreational opportunities along the entire byway. The entire route is currently paved and suitable for passenger car traffic and provides outstanding opportunities for panoramic views of Green Peter Reservoir, Quartzville Creek and
Mt. Jefferson. Visitors also get the opportunity to drive through forests of varying ages from young to old-growth forests. Fall colors and wildlife such as deer, osprey and bald eagles are also an attraction.

The FS does not currently have a formal designation for their portion of the Quartzville Back Country Byway. The BLM and FS could work with Linn County to submit the Quartzville Back Country Byway for State of Oregon “Tour Route” designation to formally recognize the entire route.

Green Peter Watchable Wildlife Area

BLM lands that border both Green Peter Reservoir and Quartzville Access Road have also been identified as a Watchable Wildlife Area. The reservoir offers opportunities to observe bald

eagles and osprey. No special facilities or interpretation have been developed on-site, however opportunities to view wildlife are identified in the Quartzville Recreation Corridor and Back Country Byway brochure.

Quartzville Creek National Wild and Scenic River (WSR)

In 1988, the United States Congress designated a 9.66-mile segment of Quartzville Creek as a National Wild and Scenic River. This segment is managed by the BLM and begins at Galena Creek and ends in the slackwaters of Green Peter Reservoir (See Map#2: Special Management Areas). Quartzville Creek was designated under a *recreational* classification due to the level of development and the easy access provided for by Quartzville Road. The outstandingly remarkable values that were identified include scenic driving, whitewater boating and recreational mining. The National Wild and Scenic Rivers Act (1968) requires that the managing agency protect the free-flowing quality of designated rivers and to maintain or enhance the outstandingly remarkable values the river was designated for. The Quartzville Management Plan was completed in November of 1992. A summary of the management actions proposed in the management plan are provided in Appendix J. The BLM is currently working with the two private landowners in the corridor on potential exchange and purchase opportunities within the Quartzville Creek Wild and Scenic River Corridor Boundaries and other locations in the watershed (See Map #2: Ownership and Map #17: Special Management Areas).

In addition to the outstandingly remarkable values already identified, Quartzville Creek also offers a variety of other recreational opportunities including camping, swimming, fishing, picnicking, and wildlife observation. The peak use season for the designated segment of Quartzville Creek occurs from mid-May through mid-September. The lands along the designated segment of Quartzville Creek are generally characterized by a predominantly natural forest environment with moderate evidence of human modification and control, that are in harmony with a natural setting. Most of the human modifications are associated with roads, timber harvest and recreation facilities. Moderate social interaction is expected.

The BLM manages all of the developed recreation facilities in the Quartzville WSR within the designated corridor boundaries. Below is a description of the developed and undeveloped recreation facilities and use along Green Peter Reservoir.

> **Yellowbottom Recreation Site:** Located beneath an old-growth forest canopy, Yellowbottom has 20 fee camp units available on a first-come-first-serve basis (See Map #17: Special Management Areas). The camping area has two vault restrooms and a new solar powered water system installed in 2001, that provides potable water to two spigots at each end of the park. The camping area at Yellowbottom is open mid-May

through mid-September. During that time, the park has a volunteer campground host. Visitors to the park can hike the one-mile Rhododendron Trail which traverses under a canopy of old-growth trees and through lush green ferns, rhododendrons, and salal. Yellowbottom also has a day-use area that provides parking, picnic sites, a vault restroom and river access trails. The day-use area is open year round. Visitation is estimated to be approximately 6,800 people per year.

In 1998, Yellowbottom Recreation Site became part a federal Fee Demonstration Program. This program allows the fees collected at the park to be retained for use at the park for both maintenance and enhancement needs. Over the last several years, fee demonstration funds from Yellowbottom have been used for a variety of needs including upgrading the water system, replacing fire rings and picnic tables, and helping to fund volunteer staff.

Old Miner's Meadow Group-Use Area: Old Miner's Meadow Group-Use Area is a 3.2 acre group use site located along Quartzville Creek (See Map #17: Special Management Areas). The site is open mid-May through September and can be reserved by a single party of up to 50 people. The site currently has fire rings and a vault restroom. Visitation is estimated to be approximately 400 people per year. This site is also part of the fee demonstration program and funds from the site have been used to install signing, fire rings, improve the entrance gate and to purchase picnic tables which are scheduled to be installed in the summer of 2002.

Dogwood Recreation Site: Dogwood Recreation Site is a developed day-use area that provides picnic sites, a vault restroom and river access trails. Dogwood is open year-round and there are no use fees. Visitation is estimated to be 1,500 people per year.

Quartzville Creek WSR Undeveloped Camping: With Yellowbottom Recreation Site and Old Miner's Meadow Group Use Area, being the only developed overnight recreation facilities in the river corridor, undeveloped dispersed camping makes up the majority of the overnight use. An undeveloped campsite survey was completed in 1992 and 68 undeveloped campsites were identified on both BLM and private industrial timber lands, along the designated segment of Quartzville Creek. Approximately two-thirds of these sites are located on private industrial timber land, making management recreational use in this area challenging. Undeveloped camping is currently limited to sites between Quartzville Road and Quartzville Creek, due to concerns about fire hazards. Sites between the road and the river with resource or safety concerns have also been closed. There is currently no designated campsite system in the corridor, so there are growing problems with groups establishing new sites during the peak summer weekends. Visitation associated with undeveloped day and overnight use is estimated to be 20,000 visitors a year.

In the early 1990s BLM staff began a visitor contact program that involves talking with visitors along the river about good camping ethics and the recreational use guidelines. In addition, four portable toilets have been put out for several years at key larger

dispersed camping sites to help reduce human waste. In 1997, the BLM also initiated a volunteer corridor host program. The corridor host helps maintain Dogwood and Old Miner's Meadow, fills in for the Yellowbottom host, and assists with the corridor visitor contact program and litter patrol.

Quartzville Creek WSR Visitor Profile

A visitor-use survey was conducted along the designated segment of Quartzville Creek during the summer of 1991. Much of the recreation visitation information provided in this section is based on data gathered in the visitor survey. Though a more recent visitor survey has not been conducted, information from the annual visitor contact program indicates that the visitor profile and use characteristics described are still relatively accurate.

Visitors in the survey indicated that swimming, camping, fishing and recreational mining were the primary activities that attracted them to Quartzville Creek. Many of the visitors participated in several activities during one visit. Other activities mentioned included picnicking, boating, sightseeing, nature observation, hiking, exploration, photography, rockhounding and off-road vehicle use.

Almost half of the use to Quartzville Creek is local (Sweet Home, Lebanon, Albany, Scio, or Brownsville) with a relatively high level of repeat visitation. The rest is primarily from other locations in the Willamette Valley. Out-of-state visitors were minimal and it was observed that many of these visitors accompanied a party from an in-state origin.

Spending time with family, resting, and releasing tension were the primary trip purposes selected by visitors to Quartzville Creek. Many commented on the importance of the naturalness and scenic values of the area. Being with family and friends, learning about nature, and talking to new people were also selected by a majority of the users. Learning more about nature and developing skills were often selected by families with children. The average length of stay for the designated segment of Quartzville Creek was 3.5 days.

A majority of the visitors (95 percent), felt that their trip expectations were met, or mostly met. Although most were satisfied, many of the visitors offered comments for related to enhancing their experience. Some of those comments (1991 survey) included the need for more restrooms, better litter control, more camping facilities, better river access, better parking, and more drinking water sources. Concerns were also identified related to road safety, crowding problems, and shooting too close to campsite problems. The BLM continues to work at address these needs and resolving these concerns.

Recreation on FS Lands

Quartzville Creek Wild and Scenic Eligibility

The 1990 Willamette National Forest Land and Resource Management Plan determined

Quartzville Creek to be **Eligible** for consideration as a Wild and Scenic River. The Forest found this river eligible for designation with a *recreation* setting. Scenery, Recreation, Geologic and Hydrologic, and potential Fish Habitat were identified as outstandingly remarkable values. The Forest has not yet completed a suitability study on this river segment, but will protect the outstandingly remarkable values identified until a suitability study is completed and final recommendations are made to Congress.

Undeveloped Camping and Recreation

The headwaters of Quartzville Creek offer a fairly narrow range of dispersed recreation opportunities to visitors. While most of the area is well roaded due to past timber sales, no campgrounds or improvements have been created in the upper basin for recreating visitors. And only two trails, the McQuade Creek and part of the Gordan Peak trails are located within the watershed. But each trail accesses a good trail system in the Middle Santiam watershed.

Visitors are attracted to the area for scenic driving, hunting, fishing and dispersed camping. Others travel through the upper watershed to access the Middle Santiam Wilderness in the adjacent Middle Santiam watershed. Most road systems are surfaced with gravel and cater to high clearance vehicles; though in the past (when funding from timber sales was robust) many of these roads were maintained at higher levels. Since the main Quartzville Road was paved in the early 1990's, recreation use levels in the upper watershed have increased largely from visitors accessing trail systems and from scenic drivers.

In the summer, visitors are drawn to the cool waters of Quartzville Creek and major tributaries for swimming, fishing, and sunbathing. Numerous dispersed sites have developed along Forest Road 11 or on flat gravel bars where trailers or tents can be set up. As summer turns golden, berrypickers come into the mountains to enjoy the scenery and fill containers with huckleberries. Such recreation traffic is not heavy compared to the campers found along the river. But they do visit harvested units and hillsides that others would not normally approach. Once fall arrives, a new wave of visitor traffic moves into the mountains for hunting seasons. Traffic levels on some weekends can be heavy during big game seasons. Small communities of trailers spring up on landings across the landscape for two weeks each year.

Off-Highway Vehicle Use and Designations on Federal Lands

BLM Lands

Use motorized vehicles on BLM lands is allowed, consistent with the Oregon Revised Statues and BLM regulations in the Code of Federal Regulations related to off-road vehicle use and designations. An off-road vehicle is defined by the BLM in the Code of Federal Regulations (Subpart 8340.0-5) as, "Any motorized vehicle capable of, or designed for, travel on or immediately over land, water, or other natural terrain, excluding: (1) Any non-amphibious registered motorboat; (2) any military, fire, emergency, or law enforcement vehicle, while being used for emergency purposes; (3) any vehicle whose use is expressly authorized by the authorized officer, or otherwise officially approved; 4) Vehicles in official use; and (5) any combat or combat support vehicle when used in times of national defense emergencies." The

BLM, as part of a growing industry standard, now refers to off-road vehicle use as off-highway vehicle use (OHV). The Code of Federal Regulations for the BLM, has not yet been updated to reflect this change in terminology. However, for the purposes of this document, off-highway vehicle use will be used interchangeably with off-road vehicle use.

Though BLM roads are not public roads, motorized use of BLM roads by the public does occur. This use is an important resource to many people in accessing public lands. The RMP provides a designation system that sets guidelines for the use of OHV's on all BLM lands in the Salem District. The mapping and updating of OHV designations for the area including the Quartzville Watershed, were recently completed in 1999. OHV's must also be operated on BLM lands in compliance with all state laws. However, maps for public use, brochures, and signs still need to be developed. Staff time and funding for this program has historically been very limited. More support is needed if the program is to be adequately managed. Below are the designations for OHV use in the Quartzville Watershed:

Limited to Existing Roads and Designated Trails (ERDT): Approximately 2,665 acres of BLM lands with a General Forest Management or Connectivity Land Use Allocation are designated as ERDT (See Map #18: Off-highway Vehicle Designations). This designation limits motorized use to existing rock surfaced roads, while still providing an opportunity for the designation of off-road trails. Currently no off-road trails have been designated as open to OHV use and no candidate areas have been identified.

Much of the BLM lands in this designation are intermixed with private industrial forest lands. These landowners currently discourage off-road use by motorized vehicles. This makes it very difficult for the BLM to provide off-road opportunities, without contributing to trespass and resource damage on adjacent private lands. There is also growing concern about the resource impacts of off-road OHV use on BLM lands, such as erosion into streams with threatened fish species, damage to vegetation, and disturbance to wildlife. These impacts could be somewhat mitigated in a managed trail system, however, without the involvement of adjacent landowners, such a system is not realistically feasible. Previous discussions with private landowners in the area indicate that they are not ready to enter into a cooperatively managed off-road OHV trail system due to liability and resource impact concerns. Groups or individual users may still propose existing or new trails for designation, however, obtaining adjacent landowner support and addressing resource damage concerns would be important factors in the approval process.

Limited to Designated Roads (DR): Approximately 28,073 acres of BLM lands with a Late-Successional Reserve Land Use Allocation are limited to designated roads (See Map #18: Off-highway Vehicle Designations). This designation is related to resource concerns listed for ERDT, with special emphasis associated with reducing disturbance to wildlife. Off-road use by motorized vehicles is not generally compatible with Late-Successional Reserve management objectives, so no existing or new trails would be designated for OHV use. The DR designation has not yet been fully implemented, so

use of a majority of the existing roads is still occurring. Even with maps and signage, past observations indicate that the use of roads not designated as open is likely to continue until the road is gated or blocked. To be successful, this DR designation would require more management and decommissioning efforts.

Closed: There are no closed areas in the Quartzville Watershed.

FS Lands

Motor vehicle regulations on National Forest Lands are governed by the State under the Oregon Revised Statues (ORS). ORS provisions allow non-street legal off-highway vehicles (OHV) to operate on most forest roads, unless the Forest Supervisor specifically prohibits them. A FS policy is currently being developed to provide consistent guidance for All-Terrain Vehicles (ATV), Off-Road Vehicles (ORV), Off-Highway Vehicles (OHV), or non-highway vehicles on roads authorized for such use.

FS Manual Section 7705: "Forest development roads are not public roads...[and] are not intended to meet the transportation needs of the public at large. Instead they are authorized for the administration and utilization of national forest system lands. Although generally open and available for public use, that use is at the discretion of the Secretary of Agriculture."

FS Manual Section 7731.1: "Restrictions of access and travel should be the minimum necessary to achieve approved management objectives.... and user safety, environmental considerations and economics." Roads will be "operation and maintained... in a manner to provide cost effective support of resource management direction and safe travel for users of the system while protecting the environment, adjacent resources and the public investment."

FS Manual Section 7731.13: "The Forest Service cannot deny reasonable access over existing roads to any person desiring to reach their private land....Roads may be closed to general use; however, ...The property owner must be liable for any maintenance and damage to closed roads as a result of such use."

Major Recreation Concerns: Providing adequate recreation facilities for the growing demand for recreation is the greatest concern. This is especially difficult along Green Peter Reservoir where the development potential of lands currently managed by public agencies is very limited. Other problems associated with heavy recreational use are addressed under "prohibited uses" later in this chapter.

A limited amount of interagency coordination between the federal, state, local and private landowners in the watershed has occurred to address some of these concerns, however, there are opportunities for improvement.

Visual Resources

Though not a direct human use, the view in or from a particular area is an important resource to both those living in or visiting an area. The Quartzville Watershed is an area with high scenic values which have been nationally recognized through the designation of Quartzville Creek as a National Wild and Scenic River and Quartzville Road as a National Back Country Byway.

The Quartzville Watershed is dominated by a forested setting with a mix of seral stages, interspersed with water and geologic features. The lower portion of the watershed around Green Peter Reservoir has been modified to a greater extent by human use, associated primarily with timber management activities and recreation facilities. The upper portion of the watershed around Quartzville Creek is more natural appearing, however past timber management activities are still observable on both public and private lands. The most recent harvest activities observable in the viewshed have occurred on private lands.

BLM Lands

In an effort to address viewshed resources on BLM lands, a Visual Resource Management (VRM) classification system was developed and used to inventory all BLM lands in the Salem District. Within the VRM system, there are four classes of scenic values. Class I lands have the most outstanding visual values and protection, while Class IV lands are generally in less seen areas with less modification restrictions. The majority of the lands in the Quartzville Watershed are designated as Class IV (See Table 5-28: VRM Classifications).

The RMP provides general guidance for each VRM classification. The following is a summary of the VRM classes on BLM lands in the Quartzville Watershed.

Class I Lands

"Provide for natural ecological changes in visual resource management Class I areas. Some very limited management activities may occur in these areas. The level of change to the characteristic landscape should be very low and will not attract attention. Changes should repeat the basic elements of form, line, color, texture, and scale found in the predominant natural features of the characteristic landscape (RMP, page 37)."

Class I	Class II	Class III	Class IV
16 acres	4,802 acres	9,915 acres	15,993 acres

Table 5-28: VRM Classifications. in the Quartzville Watershed.
Table 5-28: VRM Classifications in the Quartzville Watershed.

Less than one percent (16 acres) of BLM lands in the Quartzville Watershed have a VRM Class I status (See Map #19: Visual Resources). The Class I lands are associated with waterfalls and

edges of the Crabtree Lake and Shafer Creek Areas of Critical Environmental Concern (ACEC). Most of these ACEC's fall within the Crabtree Watershed. All 16 acres are within a Late Successional Reserve Land Use Allocation. Any project proposal in these areas would most likely be associated with a habitat or recreation improvement project. Generally these projects would not be considered to be incompatible with VRM I guidelines, however a site specific evaluation of any project proposals would be necessary.

Class II Lands

"Manage visual resource management Class II lands for low levels of change to the characteristic landscape. Management activities may be seen but should not attract the attention of the casual observer. Changes should repeat the basic elements of form, line, color, texture, and scale found in the predominant natural features of the characteristic landscape (Salem RMP, page 37). "

Approximately 16 percent (4,802 acres) of BLM lands in the Quartzville Watershed have a Class II status (See Map #19: Visual Resources). Most of the Class II lands are those lands that are observable from Quartzville Road, Quartzville Creek National Wild and Scenic River and Green Peter Reservoir. Below is a list of the most sensitive areas:

Quartzville Creek National Wild and Scenic River and Back Country Byway: Most of the VRM Class II lands in the Quartzville Watershed are located along Quartzville Creek. The potential sensitivity of these lands are high, given that scenic driving was one of the outstanding resources values identified for protection in the Quartzville Creek National Wild and Scenic River Plan. Critical viewpoint areas for these lands would be from Quartzville Access Road and Quartzville Creek. Much of the BLM lands in the Wild and Scenic River Corridor has relatively contiguous old-growth forest which are managed under a Late Successional Reserve Land Use Allocation. Some past timber harvest activities are observable, primarily on private lands. Most of these younger forests are at least 30 years old. Visual Resources should be considered in the planning of any project which may potentially affect the viewshed from Quartzville Creek or Quartzville Road.

Green Peter Peninsula: BLM lands along the Green Peter Peninsula are relatively natural appearing with a contiguous cover of mature forest interspersed with patches of old growth trees. The peninsula is a scenic focal point along the reservoir and visitors often stop at several points along Quartzville Road to take photographs. Timber management activities are not observable on the peninsula, but recent timber harvest is observable on private lands in the general area. Green Peter Peninsula is currently managed under a Connectivity or a Late Successional Reserve Land Use Allocation.

Moose and Trout Creek Areas: These areas would be sensitive from Quartzville Road and Green Peter Reservoir. Scenic driving and camping along Quartzville Road make these areas potentially sensitive viewpoints. A significant amount of camping occurs from late spring through early fall along both sides of Quartzville Road where Moose Creek and Trout Creek enter Green Peter Reservoir. This area also has an undeveloped boat ramp that provides the major access to Green Peter Reservoir in this area. Undesignated social trails into the forests

above the camping areas have also been established and are used on a relatively frequent basis. The BLM lands around Moose Creek have a Connectivity Land Use Allocation and the lands around Trout Creek have a General Forest Management Land Use Allocation.

Class III Lands

"Manage visual resource management Class III lands for moderate levels of change to the characteristic landscape. Management activities may attract attention, but should not dominate the view of the casual observer. Changes should repeat the basic elements of form, line, color, texture, and scale found in the predominant natural features of the characteristic landscape."

Approximately 32 percent (9,915 acres) of the BLM lands in the Quartzville Watershed have a Class III status (See Map #19: Visual Resources). The Class III lands tend to be located in the uplands above Quartzville Creek, and a few small patches above Thistle Creek Boat Ramp and Whitcomb Creek Campground. Like the Class II lands the critical viewpoint areas are from Quartzville Creek, Quartzville Road and Green Peter Reservoir, however these areas are less likely to be observable. Approximately 95 percent of the Class III lands in this watershed have a LSR Land Use Allocation and most of the remaining five percent have a General Forest Management Land Use Allocation.

Class IV Lands

"Manage visual resource management Class IV lands for moderate levels of change to the characteristic landscape. Management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the effect of these activities through careful location, minimal disturbance, and repeating the basic elements of form, line, color, and texture (Salem RMP, page 37)."

Approximately 52 percent (15,993 acres) of BLM land in the Quartzville Watershed are classified as Class IV lands (See Map #19: Visual Resources). Class IV lands in this watershed generally have a low visual sensitivity and fall into the "seldom seen" category.

FS Lands

The amended Willamette National Forest Plan classifies lands within the upper watershed as having visual quality objectives of a "Modification" landscape. This may no longer be relevant under current management though technically it hasn't been changed. Visual quality objectives were established largely in the context of timber harvest and road construction, though they could be applied to other construction projects. The frame of reference for assessing effects to visual resources within the upper watershed is as a traveler on Forest Road 11.

A landscape managed with a "Modification" designation would typically provide forest visitors with views of noticeable man-made alterations in the form of harvest units and roads. If implemented properly such alterations would borrow line and form from natural features, and

be temporally or spatially located to soften stark contrasts. But human alteration would be nonetheless evident to the casual observer.

Fortunately much of Forest Road 11 closely parallels Quartzville Creek within a narrow canyon, so that visitors rarely see beyond the majestic old growth forests that form the foreground views near the creek. As the road leaves the creek and climbs out of the canyon onto the upper basin of the watershed, visitors become exposed to more expansive middleground views of landscape. Such views reveal extensive road systems and harvest units created in the 1970s and 80s. The last harvesting in the upper basin occurred in the early 1990's in response to devastating blowdown from a 1990 windstorm.

Major Visual Resource Concerns: The BLM will have limited ability to manage the viewshed of the watershed as a whole, given the land ownership pattern. No specific concerns for BLM lands were identified outside of compliance Visual Resource Management Guidelines.

Prohibited Uses

Prohibited uses on public and private lands in the Quartzville Watershed are most prevalent along Green Peter Reservoir and Quartzville Creek. Green Peter Reservoir experiences many of the same problems a town would face including speeding, driving under the influence, underage drinking, poaching, littering, unauthorized long-term occupancy, drug manufacturing and use, vandalism, garbage dumping, domestic violence and other physical altercations. The Army Corps of Engineers contracts with the Oregon State Police for additional coverage during the busy summer season, but the uses described above continue to be a concern.

Lands managed by the BLM and the FS face many of the same problems described above, but to a much smaller degree and frequency. The availability of BLM and U.S. Forest Service law enforcement has been fairly limited in the past. In 2002 there will be a Linn County Sheriff available to assist in patrolling federal lands in Linn County. The position is being funded through the Title III portion of the "Secure Rural Schools and Community Self-Determination Action of 2000." This law enforcement assistance could continue in subsequent years if Linn County keeps funding the position.
The BLM and FS will also continue to work participate in the Linn Forest Protective Association. The association is made up of private, state, and federal land owners and managers, and was formed to try and reduce the problems described above on public and private forest lands in Linn County, including those lands in the Quartzville Watershed.

Major Prohibited Uses Concerns: Already described above.

Chapter 6 Future Conditions and Trends

Management Objectives and Direction

This chapter projects future trends of vegetation and ecological processes functioning in the watershed on various land ownerships under applicable forest plans, federal and state laws. The applicable forest planning documents include the *Northwest Forest Plan, 1994* (NWFP), the Bureau of Land Management's *Salem District Resource Management Plan, May 1995* (RMP), and the *Willamette National Forest Land and Resource Management Plan, 1990* (LRMP). Lands within the Quartzville Watershed are managed by many landowners for a variety of management objectives.

There are a large number of private landowners in the Quartzville Watershed with varying land management strategies and objectives. During the analysis, private lands were classified as either non-industrial or industrial private lands. Non-industrial private lands are owned by smaller private landowners, and include less than one percent of the land base in the Quartzville Watershed. The majority of the private lands in the watershed are industrial private lands managed by commercial forest landowners, companies or corporations primarily for timber management. Industrial private lands comprise about 27 percent of the watershed. These lands are managed in compliance with the Oregon Forest Practices Act (OFPA), primarily on economic rotation lengths of 40 to 60 years. For the purposes of analysis, rotation lengths for private industrial and private non-industrial lands was assumed to be similar.

Of the 69,025 acres of federal lands in the Quartzville Watershed, 34,629 acres are managed by the U.S. Forest Service (FS), 30,783 acres are managed by the Bureau of Land Management (BLM), and 3,613 acres are managed by the Army Corps of Engineers (ACOE). These lands are managed according to the standards and guidelines of the NWFP to meet or exceed the OFPA. There are several Land Use Allocations (LUAs) within the Quartzville Watershed (See Map #4: Land Use Allocations within the Quartzville Watershed). The majority of federal lands in the Quartzville Watershed (58,888 acres or 85 percent) are in Late Successional Reserve (LSR). According to the NWFP and the Mid-Willamette Late Successional Reserve Assessment, LSRs are to be managed to maintain and enhance late seral conditions over time. The Quartzville LSR (RO212) and Middle Santiam Wilderness complex is 92,400 acres in size and spans four major watersheds from Crabtree to the west, through Quartzville, into the North Santiam to the north towards Detroit Reservoir, and south and east into the Middle Santiam watershed. The majority of the Quartzville LSR/wilderness complex (55,046 acres or 60 percent) falls within the boundaries of the Quartzville Watershed. Contained within the Quartzville Watershed is the Whitcomb LSR (RO212). This LSR is 3,450 acres in size and is located about two to three miles to the southwest of the Quartzville LSR. In addition, there is a small LSR on the tip of the Green Peter peninsula in the vicinity of the Bald Eagle Management Area, which is 352 acres in size.

Contained within the Quartzville Watershed are portions of BLM Connectivity blocks (3,847 acres) identified during the planning process. These blocks are located mostly in the Moose and Whitcomb Creek Sub Watershed Basins (SWBs), with minor amounts in the Green Peter SWB. These lands serve as connectivity between the Quartzville and Whitcomb LSRs. According to the RMP, these lands are to be managed on a 150 year rotation with high green tree retention. These Connectivity (CONN) blocks are also designed to maintain 25 to 30 percent in late seral conditions through time.

There are 2,677 acres of BLM lands with a General Forest Management Area Land (GFMA) Use Allocation (LUA) in the Quartzville Watershed. Most of this land is located in the Moose Creek SWB, with minor amounts in Canal, Packers Gulch, and Whitcomb SWBs. These lands are to be managed on rotation lengths defined by culmination of mean annual increment, which generally is 70 to 100 years. Green tree retention is lower than that required for the Connectivity (CONN) LUA. The GFMA and CONN together form the Matrix LUAs on BLM lands.

Overlaying the entire BLM land base are Riparian Reserves (See Map #3: BLM Land Use Allocations with Riparian Reserves). They have been identified as buffers along all standing and flowing water, intermittent stream channels, ephemeral ponds, and wetlands. Riparian Reserves are to be managed to maintain and enhance riparian and late seral conditions to meet Aquatic Conservation Strategy objectives. The reserves were designated to help maintain and restore riparian structures and functions, benefit fish and other riparian-dependent species, enhance habitat conservation for organisms dependent on the transition zone between uplands and riparian areas, improve travel and dispersal corridors for terrestrial animals and plants, and provide greater connectivity of late successional forest habitats. The width of the riparian buffer varies depending on stream order and the height of site potential trees. All fish-bearing streams have a minimum width that is equal to twice the average height of a site potential tree, on each side of the stream. On non-fish bearing streams, this width is the average height of one site potential tree. Since not all these streams are mapped, some adjustments will be made as site-specific areas are mapped. For this watershed analysis, site tree height was designated as 220 feet for the lands less than 1,500 foot elevations, 200 feet for elevations between 1,500 and 3,000 feet, and 180 feet for all elevations above 3,000 feet. Stream densities in the Quartzville Watershed are very high and it is estimated that 54 percent of the total federal land base is within a Riparian Reserve. Refer to the NWFP and RMP for more details regarding standards and guidelines, and best management practices for the various land use allocations (See Table 2-2, Federal Land Use Allocations.

Terrestrial

Vegetation Patterns

The existing conditions of the terrestrial domain are the result of altered processes (see Chapter 4). The current (altered) conditions in combination with the human processes that now influence the ecosystem within the Quartzville Watershed are expected to continue. Allowing the

LSRs to mature into late seral over time, minimizing the role of wildfire, and resource extraction in the Matrix and on private lands will continue to be the dominant forces influencing the future conditions. However, natural processes such as erosion, mass wasting, disease, insect infestations, and storm-related changes will continue to affect the terrestrial domain across the watershed. The current proportion of forest/non-forest types is expected to remain approximately the same at 95 percent forest, and 5 percent non-forest types.

Seral Stages

The Quartzville Watershed has the potential to support a fairly solid matrix of older forest across the landscape. Ownership patterns are not as disrupted as adjacent watersheds to the north, west and south, where scattered federal ownership has limited potential to contribute to late seral conditions across the landscape over time.

Currently, about 47 percent of the watershed (all ownerships) is in late seral habitat. The total amount of late seral habitat on federal lands is expected to increase as younger stands in Riparian Reserves and LSRs mature. The distribution of late seral habitat would generally follow riparian reserves on Matrix lands, and would include LSRs and the 25 percent late seral in Connectivity blocks. As LSRs and Riparian Reserves are allowed to mature, about 64 percent of the watershed would have the potential to become late seral habitat within 80 years under current management.

According to the NWFP and the RMP, a minimum of 15 percent of the federal lands in any given watershed should be in late successional (late seral) conditions over time. Currently, about 60 percent of the federal lands in the watershed are in late seral habitat. In the long term, the watershed has the potential to support about 88 percent late seral habitat on federal lands. Ultimately, the Matrix (excluding Riparian Reserves) across all ownerships in the watershed will consist of early to mid seral stages 0 to 80 years of age.

Late seral habitat on private lands is expected to decrease from the current level of 12 percent as landowners harvest mature timber. Assuming an average rotation of 60 years on non-federal lands with even flow of harvestable acres over time, approximately a third of the forest types would be distributed between each of the 20 year age classes (0 to 20; 20 to 40; and 40 to 60 years of age). OFPA riparian buffers and resource protection sites on non-federal lands are expected to contribute to late seral habitat in the future.

Late Seral Habitat Quality

The amount of interior late seral habitat is expected to increase on federal lands as LSRs and Riparian Reserves mature into late seral habitat. Interior forest habitat on private/state lands is expected to decrease as late seral habitat is harvested. Following the guidelines for LSR silvicultural treatments described in the Mid-Willamette Assessment and road closures will enhance the quality of interior late seral in the upper portion of the watershed.

Special Habitats

The majority of the identified special habitats on federal lands within the Quartzville Watershed are within LSR and/or located on very steep hillsides and would be protected from most human intrusion. However, these areas are not immune to degradation. Meadows, wetlands, and lakes can be diminished by the regrowth of trees and invading brush. In the past, disturbance caused by wildfires have helped maintain these systems. Based on comparisons of aerial photos from the 1950s and 1998, some of the meadows exhibit signs of encroachment due to fire exclusion. This process can be expected to continue unless prescribed fire or other means is used to limit forest encroachment on meadow ecosystems.

Standing Dead/Down Logs

The number of standing dead trees (snags) and down coarse woody debris (CWD) are expected to increase as stands continue to age. Over the long term, the amount of standing dead on federal lands is expected to approach 60 percent of potential cavity dwelling wildlife populations as late seral matures in LSRs and Riparian Reserves and green tree retention guidelines are implemented. On non-federal lands, OFPA requirements for standing dead and stream buffers would help contribute to the standing dead resource across the watershed.

Over the long term, down CWD on federal lands is expected to increase as LSRs and Riparian Reserves mature into late seral and green tree retention guidelines are implemented. The OFPA requirements for down logs and buffers would help contribute to down CWD on non-federal lands in the future.

Roads and Transportation

Road densities are expected to increase slightly within the watershed as additional roads are constructed for timber harvest on non-federal lands. Average total road density on federal lands is estimated at about four miles per section. On federal lands, road densities are expected to remain about the same, or decrease over time as unnecessary roads are decommissioned or revegetate.

Fires and Fuels

The Quartzville area is popular area for hunters, hikers, and berry pickers. Recreational miners and prospectors camp along the main streams during the summer months. More and more people are drawn into this area as the Quartzville Back Country Byway becomes more popular. Human caused fires or lightning incidents are present and may continue to increase.

Special Status/Special Attention Species

Plants

Habitat conditions for riparian and old growth associated species are expected to improve in the long term, especially on federal lands where reserves such as the LSRs and Riparian Reserves are established. The species identified previously, *Huperzia occidentalis,* fir clubmoss, known to occur in the Quartzville Watershed is associated with riparian areas. Other species suspected or known to occur in the watershed that are associated with old growth forests include: *Cimicifuga elata, Bridgeoporus nobilissimus* and *Corydalis aquae-gelidae.* Potential habitats for *Corydalis aquae-gelidae,* a riparian dependent species, would increase as Riparian Reserves mature over time.

Invasive plant species have become established in the ecosystem, and are expected to continue to compete with native vegetation. The trend would be for more species to invade especially along the roads and well-used areas. Control efforts on new highly invasive species will deter their establishment. Control efforts on already established species would help limit their population. Until weed management partnerships are formed and land managers implement coordinated weed control and management, efforts to restore native plant communities, water quality, fish and wildlife habitat, recreational sites, forests, and farmlands would continue to be negated by increasing and more varied weed infestations.

Animals

Habitat conditions for late seral species of concern are expected to improve in the long term. The amount of late seral habitat in the watershed is expected to increase as younger stands in Riparian Reserves and LSRs mature. The distribution of late seral habitat would generally follow riparian reserves on matrix lands, and would include LSRs.

Habitat conditions for early and mid seral stage species in LSRs are expected decline as LSRs on federal lands mature over time. Adjacent federal matrix and non-federal lands will contribute to early seral conditions as stands reaching harvestable age are harvested. However, without fire or human disturbance, there will be large areas of federal lands lacking early seral stage conditions within LSRs.

Habitats for priority species that use snags and/or down logs are expected to increase in the long term with increased retention requirements on both federal and non-federal lands, and the maturation of late seral in LSRs and Riparian Reserves.

Threatened and Endangered Species

Bald Eagle

Habitat conditions for the bald eagle are expected to improve over time as late seral habitat

matures in riparian areas and LSR providing more trees suitable for nesting and perching. This is especially the case in the vicinity of lower Quartzville Creek and around Green Peter Reservoir where there are currently two nesting pairs.

Northern Spotted Owl

Overall, habitat conditions for spotted owls is expected to decline then stabilize in the long term. The Quartzville Watershed will continue to be an integral and important link in the predominant north-south LSR/wilderness network where the majority of dispersal between known spotted owl sites in the Cascades Range takes place. However, spotted owl dispersal into and out of the Quartzville Watershed will continue to be limited by the scattered federal ownership in the Thomas Creek Watershed to the north and northwest, the Crabtree Watershed and Willamette Valley to the west and the Hamilton Creek Watershed and South Santiam River Corridor to the south and southwest. The most significant lands in the watershed for spotted owl movement are the sub-watershed basins on the east end of the watershed in the Upper Quartzville, Lone Star and Canal Creek SWBs, where much of the dispersal to adjacent watersheds in the Cascades Range takes place. The connectivity between the Quartzville LSR and Whitcomb LSR is expected to remain viable over time.

Within the Quartzville LSR there are several thousand acres of non-federal lands in early seral stages, completely surrounded by LSR and Critical Habitat. Most of this non-federal land is capable of becoming suitable habitat in the long term. It is expected that these non-federal lands will be managed primarily for timber production, and will not contribute suitable habitat to the surrounding LSRs and Critical Habitat.

In the long term, Canal Creek, Lone Star, Packers Gulch and Upper Quartzville will remain viable for nesting of spotted owls. The Moose Creek, South Green Peter and Whitcomb will be non-viable to limiting for nesting spotted owls. Most of the watershed will remain viable for dispersal of spotted owls in the long term, with the exception of Whitcomb and South Green Peter SWBs. Dispersal will remain the most limiting in the South Green Peter, and Whitcomb SWBs, in the vicinity of Green Peter Reservoir.

Of the 35 known spotted owl sites (KOS) in Quartzville Watershed, 23 are currently considered to be viable, 10 are limiting and two are possibly non-viable. With improvements in late seral conditions in LSRs over time, the number of viable KOSs is expected to increase. A habitat analysis of the current KOSs showed that 27 would be viable, three would be limiting, and five would be non-viable over time.

Barred owls have been known to occur for over 10 years in the Moose Creek and Whitcomb SWBs where they have bred in the vicinity of Green Peter Reservoir. Recently, barred owls have been observed as far east as the Packers Gulch SWB. They appear to be increasing, spreading up the Quartzville Creek corridor from the south and Thomas Creek to the north. There are no known sightings in the upper end of the watershed in Lone Star, Canal Creek or Upper Quartzville SWBs. At this point, barred owls are common at lower elevations in the vicinity of

Green Peter Reservoir and the lower Quartzville Creek Corridor. In the long term, it is unknown to what extent barred owls will displace spotted owls in the Quartzville Watershed.

Potential future conditions of the spotted owl and its habitat in the Quartzville Watershed was estimated and the results are shown in Table 6-1.

Table 6-1 Potential Future Conditions of the Spotted Owl and its Habitat Within Quartzville Watershed

	Total in WA	Total in LSR (%)	Total not in LSR (%)
Acreage within Boundary	**95,468**	**58,848 (62%)**	**36,620 (38%)**
Acreage of Federal	**69,025**	**58,848 (85%)**	**10,177 (15%)**
Federal Suitable Spotted Owl Habitat	**61,680**	**57,562 (93%)**	**4,120 (7%)**
Federal Dispersal Plus Spotted Owl Habitat	**63,225**	**57,562 (91`%)**	**5,665 (9%)**
Federal Capable Plus Spotted Owl Habitat	**64,783**	**57,562 (89%)**	**7,221 (11%)**
Federal Critical Habitat	**62,435**	**57,124 (92%)**	**5,311(8%)**

(% suitable habitat)	Total in WA	Total Protected	Total Unprotected
Spotted owl sites (>40%)	**27**	**27**	**0**
Spotted owl sites (20-40%)	**3**	**3**	**0**
Spotted owl sites (<20%)	**5**	**0**	**5**
Total Spotted Owl Sites	**35**	**30**	**5**

Aquatic

Hydrology

Peak flows, low flows, and annual water yields will continue to fluctuate depending on precipitation and temperatures. Yearly precipitation in the area tends to cycle between wetter

than average periods and dryer than average periods approximately every 20 years. Stream flow in forested basins is also affected by evapotranspiration. Forest harvest has been shown to reduce evapotranspiration. Harvesting may also affect snow accumulations and melt.

Future harvesting and the addition of new roads may affect water yields, peak flows and stream dynamics, depending on the timing of harvest and road locations. Roads affect stream flows and yields in a different way than harvesting. While harvesting affects evapotranspiration, roads influence hillslope flow paths by converting subsurface flow to surface flow and allowing it to enter the stream more quickly. The combination of harvesting and roads in small basins has been shown to increase peak flows, produce higher storm volumes, and produce earlier rises in stream flow response to storms (Jones et al. 1996).

The major uses in the watershed will continue to be forest products, wildlife habitat, and water. The potential conflicts over allocation of stream flow during low flow periods could escalate due to an increase in consumptive use over time.

On federal lands, the average age of forest stands will increase as Riparian Reserves and LSRs mature. Road densities on federal lands will probably decrease as unneeded roads are decommissioned and removed. Private land road densities may remain stable or increase as roads are added to access stands for harvest in the future.

FS lands in the upper portion of the Quartzville Watershed, stream flows will remain constant and risk of ran on snow will be reduced as areas recover through time. The LSR land use allocation status of the headwaters will reduce the risk of management affects. It is anticipated that through time the area will drop below its anthropogenic levels of flow due to the control of fire across the landscape. Fire control will allow density levels of vegetation to increase and reduce the ability of the area to accumulate snow. This change is anticipated to be so minor that noticeable changes in peaks will not occur.

Water Quality

In general, private forest lands are harvested under a rotation age of approximately 50 to 60 years. While harvesting in the watershed occurs almost constantly, large tracts of forests which were previously harvested and regenerated are approaching 50 years in age, and could be harvested within the next decade. This harvest cycle will continue into the future resulting in a disturbance regime much shorter than the pre-European settlement disturbance cycles.

Water quality in the watershed will continue to be affected primarily by commercial forestry activities. The current disturbance cycle will continue to affect steam dynamics and sediment regimes. Roads will continue to have a major influence on storm water routing and stream sediment loading.

Under current management guidelines, the trend on the federal forest lands will be stable or improving as forest stands and stream buffers mature. Improved OFPA protection measures, and

requirements of the NWFP will improve overall water quality within the watershed. Stream shade and woody debris recruitment will improve in the long term as forest practices evolve and young stream adjacent forests mature in Riparian Reserves. This could result in lower stream temperatures, improved fish habitat and stream structure.

Soils

On BLM lands, soil properties, classifications, series descriptions, and soil maps of the Quartzville Watershed are contained within the *Soil Survey of Linn County Area Oregon*. On FS lands, these factors are contained with the *Willamette National Forest Soil Resource Inventory*.

Soil Stability

The relationship between pyroclastic rock and slope stability was studied by the FS on the H.J. Andrews Experimental Forest by Dyrness (1967). In this study, 94 percent of mass soil movement events occurred on the 37 percent of the area made up of pyroclastic material, and 8 percent of the area made up of green tuff and breccias. Comparative rates of soil movement from various land uses have been inventoried over a twenty five year period in the experimental forest in the Cascade Range. Mass erosion rates were calculated to be 0.87 cubic meters per hectare per year for undisturbed forests, 2.45 cubic meters per hectare per year for clearcuts, and 26.19 cubic meters per hectare per year associated with roads. In a summary of several studies, McNutt and McGreer (1985) calculated natural slumping rates of 0.0224 per square mile per year; or one slump in 45 years per square mile in areas of undulating topography with slope gradients of less than 60 percent. Natural failure rates on areas of steep to extremely steep slopes (70 to 100 percent) occur in old-growth Douglas-fir stands.

Natural and human caused landsliding and erosion will continue to occur throughout the watershed as a result of past management, future management, and climatic conditions. Future mass erosion and slumping rates will be influenced by logging and roading activities in the watershed, which will cycle as large tracts of forest land reach harvest age. Upper reaches of the watershed under federal control and designated as LSRs will approach natural erosion rates, except where influenced by existing roads.

Fisheries

Management of federal lands under the standards and guidelines of the *Northwest Forest Plan* (NWFP) is expected to result in increasing levels of large woody debris (LWD) loading and instream habitat complexity. This should result in improving trends in fish populations. If fish passage conditions at Green Peter Dam are improved at some time in the future, coincidental with a decision by the fish management agencies to manage the watershed for anadromous fish, habitat exists in the watershed, although marginal in quality, to support some steelhead and spring chinook, both of which occupied the watershed prior to the closure of the dams. Chinook

would utilize mainstem habitat, probably as far upstream as Yellowbottom. Steelhead would utilize the mainstem as well as any low to moderate gradient tributaries not blocked by waterfalls. Juvenile outmigration through Green Peter Reservoir would still be problematic due to the large size of the pool, associated slow currents, as well as predatory fish species such as Northern pikeminnow and smallmouth bass.

Improvement in the LWD recruitment potential on federal lands is likely to occur due to retention of NWFP Riparian Reserves, and will benefit fish populations. Specific management policies and actions expected to result in improvement in fish habitat conditions are retention of NWFP Riparian Reserves, attainment of Aquatic Conservation Strategy Objectives and watershed restoration, in upland as well as riparian and instream areas.

Fish habitat conditions on non-federal lands, managed under Oregon Forest Practices Act are expected to continue to decline until a considerably more conservative revision of the Act is completed. However, voluntary restoration and conservation measures conducted by private landowners and state and local governments inspired by the *Oregon Plan for Salmon and Watersheds* and the *Willamette Restoration Initiative* may lead to improvement in fish habitat conditions on non-federal lands.

Human Uses

With Linn County's proximity to the I-5 travel corridor and the relatively high quality of life it offers, migration into the county is the major driving force of expected increases in the population. The population of Linn County was 103,069 in 2000 and is expected to increase by more than 45,000 residents by 2040. Linn County's proximity to the I-5 corridor make it a prime location for future business development. This is beginning to pay off even now, as firms and businesses look further south of the Portland area into the Willamette Valley. Though smaller cities and rural areas may not see as rapid rate of growth, some residential and business development would be expected.

Forest Products

Federally Managed Lands

Forest products would continue to be provided from BLM lands consistent with the RMP. The majority of wood products would most likely come from lands in the GFMA and CONN Land Use Allocations. No specific estimates of volume have been forecasted in this analysis. Forest products from FS lands would be relatively limited under a LSR Land Use Allocation, however

there may be some forest products harvested associated with habitat improvement forest stand thinnings.

Special Forest Products on Federal Lands

The demand for special forest products (SFP's) is growing. Permits for the collection of SFP's would continue to be issued as staff time and funding allow in compliance with SFP harvest guidelines for both the BLM and FS.

Industrial Timber Lands and State of Oregon Lands

It is expected that unless a desirable and cost effective substitute becomes available, demand for wood products is likely to continue. Some of this demand will be met through the importation of wood products, however, domestic wood products would also be an important component of supply. This makes it likely that the predominant land use on private lands in the Quartzville Watershed would continue to be industrial forestry. It is also expected that the general rotation age will continue to be 40 to 60 years. However, harvesting levels and practices may vary depending on individual company policy, as well as economic and regulatory factors. Similar trends are expected for lands managed by the State of Oregon.

Residential and Agriculture

Growth in residential and other non-forest land uses in the Quartzville Watershed is expected to be relatively limited due to the high amount of public ownership and the private land zoning for forest uses.

Water Rights

Existing water rights would most likely be maintained. Other trends associated with water quality and beneficial uses are described aquatic section of this chapter.

Roads and Access

Due to decreasing road maintenance funding and in an effort to reduce road impacts to water and wildlife resources, the BLM is evaluating the potential decommissioning, blocking, or gating some of BLM-controlled roads in the Quartzville Watershed. Main access roads and rights-of-way agreements would continue to be maintained, however, decreasing funding may result in lower maintenance levels. Overall public access to roads would mostly decrease with the closure of BLM-administered roads. If private landowners also increase road gating on private lands, public road access in the Quartzville Watershed may further decrease.

On FS lands, historic roads are being decommissioned within the area and the effect of the roads on routing water is also anticipated to be minimal. It is anticipated that future conditions of the streams, hydrology, and water quality would be within the range of natural variability for this

type of stream.

On FS lands access and travel management would continue to be a public, interagency, and interdisciplinary process that accomplishes management area directions as stated in the Willamette National Forest Land and Resource Management Plan. Roads analysis is another tool used to accomplish transportation management. The Sweet Home Ranger District is committed to ecosystem management, which considers the role, importance and interdependency of all resources, including people. The basic FS philosophy is that all travel corridors are open unless designated otherwise. However, due to significant reductions in the District's operating budgets and ability to maintain an extensive road system, some roads would be removed from the system. Other may be closed until further access is needed and many others kept open at the lowest possible maintenance levels.

Lands and Minerals

Mining of locateable minerals, or mineral materials which are used for rock quarries for road building and maintenance are expected to continue on federal lands in the Quartzville Watershed. Rock quarries for road building and maintenance on private lands are also expected to continue. No other specific future proposals or uses have been identified at this time.

Recreation

With growing time and economic constraints, recreational opportunities close to the larger populations in the Salem District will only become more important. Given the proximity of the Quartzville Watershed to the I-5 corridor, the demand for local developed and undeveloped recreational opportunities in the watershed are expected to increase. The challenge of balancing access to public lands for a wide variety of uses while meeting other resource management objectives will only become more complex with growing populations near the Quartzville Watershed and the Willamette Valley.

Green Peter Reservoir and Quartzville Creek will continue to be significant recreational features that attract use. The problems associated with public use of these areas is likely to increase if more is not done to either manage use or provide additional facilities, especially along the reservoir.

It is likely that the watershed would continue to provide for undeveloped recreational activities and as evidence of past harvesting activities in the upper portion of the watershed decline, the area may be come more desirable for those seeking a more natural appearing setting and a more semi-primitive experience.

While motorized activities are likely to decrease in the watershed, opportunities for non-motorized activities may increase, if non-motorized recreational opportunities such as trails are

developed in the watershed.

Visual Resources

If current management guidance for BLM lands with a LSR Land Use Allocations continues, modifications to BLM lands in the viewshed would be expected to be relatively minor. Past harvest areas on BLM lands would become less evident, and the viewshed would become more natural appearing, where not intermixed with private land. BLM lands with a CONN or GFMA Land Use Allocation would most likely receive modifications associated with timber harvest activities. Riparian reserves and green tree retention requirements may help buffer the resource impacts of harvest activities on BLM lands. Recreation facilities and signing along the main Quartzville Corridor may also increase in an effort to better manage increasing recreation use. In general, it is expected that most of the future modifications to the viewshed on private lands would be associated with timber harvest activities.

On FS lands, vegetative growth under a Late Successional Reserve designation should improve visual resources over time. Resource objectives for LSRs would tend to manage visual resources within this watershed as if "Retention" were the visual quality objective. Road systems would begin to close-in due to lack of maintenance or use, harvest units would grow up with trees, and very little harvesting is expected to occur within the watershed in the next 10 years. An exception possibly would be thinning sales within older plantations in an attempt to accelerate late successional habitat in these units. Within fifteen years, a traveler's view from Forest Road 11 would once again be confined to foreground views of the roadside forests, as dense trees grow up and block views of the middleground**.**

Prohibited Uses

With the expected growth in population in communities near the watershed and in the Willamette Valley as a whole, the potential for increases in prohibited uses also increases. If cooperative efforts between private, local, state and federal land managers and law enforcement entities may help off set the potential growth. At a time of decreasing budgets, new and innovative funding sources are needed to meet the growing demand for visitor management and law enforcement services.

Chapter 7 Management Findings and Recommendations

This section describes the types of actions or activities that the Bureau of Land Management (BLM) and the U.S. Forest Service (FS) could implement in the Quartzville Watershed to improve conditions and positively influence trends. These findings and recommendations along with the rest of this document can help provide a base of resource information necessary to guide agencies in identifying site specific projects and determining priorities for projects both within the Quartzville Watershed and in comparison to other watersheds

Terrestrial

Findings:

Terrestrial Finding #1- Mature and Old-Growth (Late Seral or Late Sucessional) Forest Habitat: The analysis of current conditions shows 47 percent late seral forest across all ownerships. Approximately 33 percent in is old growth forests more than 200 years of age. Ninety-three percent of the late seral forest in Quartzville Watershed is on federal lands. Late seral forests comprise 60 percent of the federal ownership in the watershed. Approximately 46 percent of the federal ownership in the watershed is in old-growth forests.

Acres of late seral forest in the Quartzville Watershed was further broken down by ownership and Sub Watershed Basins (SWBs). The Lone Star, Upper Quartzville, Canal Creek, and Packers Gulch SWBs are the most viable SWBs in terms of the amount of late seral forest habitat, all with over 50 percent in late seral conditions. The amount of late seral in Moose Creek and Whitcomb SWBs is 34 percent and 24 percent, respectively. The amount of late seral forest in the South Green Peter SWB is the lowest in the watershed at 18 percent.

About 50 percent of the late seral forests in the watershed are functioning as interior late seral forest habitat. The Quartzville Watershed has a lot of potential to support a fairly solid matrix of older forest across the landscape. Ownership patterns are not as disrupted as adjacent watersheds to the north, west and south, where scattered federal ownership has limited potential to contribute to late seral conditions across the landscape over time. As Riparian Reserves and Late Successional Reserves (LSRs) on federal lands are allowed to mature, the entire watershed (all ownerships) has the potential to support about 64 percent late seral forest habitat within 80 years under current management.

Terrestrial Finding #2 - Standing Dead/Down Coarse Woody Debris (CWD): Overall, there is not enough large, harder material as either snags or down CWD in younger stands that will persist in the long term. The inventory and stand exam data for the watershed show that snags are scarce in most of the younger stands less than 40 years old. There are adequate numbers of

snags present in closed sapling, mature and old growth stands. Since mature and old growth (late seral) stands are scattered throughout the watershed mostly on the federal land, there is currently an adequate amount and quality of standing dead material over the most of the watershed.

The amount and condition of down CWD appears to be fairly good in the short term, with over half of the inventory plots meeting the Northwest Forest Plan (NFP) standard of 240 lineal feet per acre of hard material over 20 inches in diameter. Most of the younger stands have down CWD left from previous logging in the more advanced stages of decay, much of which is smaller diameter material. In the long term, there will be a lack of large down CWD as these stands mature, due to the current lack of standing dead material available for recruitment. The closed sapling and late seral stands have snag components that will contribute down CWD in the long term. According to the Mid-Willamette LSR Assessment (LSRA), CWD should cover 10-15 percent ground cover of all diameters and tree species in the LSR. Most of the stands in the LSR currently fall below this recommendation..

Over the long term, the amount of standing dead material and down CWD on federal lands is expected to exceed 60 percent of potential cavity dwelling wildlife populations as LSRs and Riparian Reserves mature and green tree retention guidelines are implemented. There would be a slight increase of standing dead/down CWD on private/state lands as relatively new OFPA requirements continue to be implemented.

Terrestrial Finding #3 - LSR Boundaries: LSR boundaries in the vicinity of Harry Mountain Ridge, and Green Peter Peninsula delineated by the Salem District RMP follow interior section lines rather than topographic features and/or known Special Status/Special Attention Species occurrence. Managing along legal boundaries irrespective of ecological features and species occurrence would be inconsistent with the management of these LSRs as ecosystems and protection of known Special Status/Special Attention Species. Adjustment of LSR boundaries along topographic features, type changes, or even roads rather than legal boundaries would make the LSRs more ecologically sound.

Terrestrial Finding #4 - Special Habitats: Small natural forest openings such as wet meadows, dry meadows, ponds, dry grass hillsides with shallow soils, Sitka alder/brush patches, cliffs, crevices and talus slopes are present and scattered throughout the watershed. The most prevalent special habitats in the Quartzville Watershed include rock/outcrops/cliffs (2500+ acres), dry meadows (800+ acres), and talus slopes (300+ acres). These types of special habitats are most commonly associated with the major peaks and ridges, and many are shared with adjacent watersheds. Wet meadows and ponds (25+ acres) are not as prevalent due to the steepness of the landscape. They are often associated with headwaters of major tributaries such as Boulder Creek and Little Meadows Creek.

The majority of the identified special habitats on federal lands within the Quartzville Watershed are within LSR and/or located on very steep hillsides and would be protected from most human

intrusion.

However, encroachment in the form of growth and establishment of trees and invading brush is evident in some of the meadows due to fire exclusion. In the past, disturbance caused by wildfires have helped maintain these systems. This process can be expected to continue unless prescribed fire or other means is used to limit forest encroachment on meadow ecosystems.

Terrestrial Finding #5 - Road Densities: There are approximately 586 total miles of road on all ownerships within the watershed. Currently, the average total road density across all ownerships is estimated at about 4 miles per section. The highest road densities occur in the Packers Gulch and Whitcomb Creek SWBs. The lowest road densities occur in the Lone Star SWB.

Of the 586 total road miles in the watershed, 362 miles are on federal lands (62 percent). Average total road density on federal lands is estimated at about 3.35 miles per section. Road densities on federal lands are highest in the Canal Creek and Packers Gulch SWBs on BLM lands. Road densities on federal lands are lowest on Forest Service (FS) lands in the Lone Star SWB and on BLM lands in South Green Peter SWB.

Terrestrial Finding #6 - Special Status/Special Attention Plant Species: There are four known populations of BLM special status plant species populations and numerous known survey and manage species sites in the watershed. These species include tall bugbane (*Cimicifuga elata),* fir clubmoss *(Huperzia occidentalis),* meadow sidalcea (*Sidalcea campestris),* and noble fir polypore fungus *(Bridgeoporus nobilissimus).* A FS Sensitive Species is Thompson's mistmaiden (*Romanzoffia Thompsonii).*

Terrestrial Finding #7 - Noxious Weeds: New invader and established infestation noxious weed species are present along many roadsides in the watershed. These noxious weeds are present and will continue to invade native plant habitats if no action is taken. Noxious and invasive weeds will continue to be a concern over time because of the increased human use of the watershed, especially at lower elevations and in travel corridors.

Terrestrial Finding #8 - Special Status/Special Attention Animal Species: There is one Survey and Manage mollusk species that is documented to occur in the Quartzville Watershed. The Oregon megomphix *(Megomphix hemphilli),* a Survey and Manage Bureau Sensitive species, is found in moist conifer/hardwood forests with big-leaf maple in association with duff and leaf litter at low to mid elevations.

The red tree vole, a Survey and Manage species, is likely to occur in the Quartzville Watershed. This arboreal vole is found in mid to late seral forests with closed canopies, primarily below 3500 feet elevation. The Quartzville Watershed is 72 percent federal ownership, of which 65 percent is suitable habitat for the red tree vole. Red tree vole habitat occurs in all SWBs, but surveys for this species are lacking in the Quartzville Watershed.

Four bat species identified in the NFP as species in need of additional protection are highly likely to occur in the Quartzville Watershed. They are the silver-haired bat, long-legged myotis, long-eared myotis, and Townsend's big-eared bat.

Ten Bureau Sensitive and/or FS Sensitive species have been documented or are highly likely to occur in the watershed. These include the harlequin duck, peregrine falcon, goshawk, common nighthawk, and the fisher (See Appendices C-1 and C-2).

There is one peregrine falcon eyrie in the vicinity of Rocky Top in the South Green Peter SWB. In addition, the peregrine falcon is highly likely to occur as a migrant and winter visitor and could occur elsewhere in the watershed as a nesting species. Suitable cliff habitat for nesting is present in the Quartzville Watershed, especially in the Upper Quartzville, Lone Star and South Green Peter SWBs.

The harlequin duck, a FS and Bureau Sensitive species, is a common breeding species on Quartzville Creek and some of its major tributaries, where it occurs in good numbers on private, BLM and FS lands.

Terrestrial Finding #9 - Bald Eagles: There are two known bald eagle nest sites in the watershed in the vicinity of Green Peter Reservoir. Both nest sites are located on BLM lands on Green Peter Peninsula. Associated with these bald eagle sites is a Bald Eagle Management Area (BEMA) of approximately 935 acres in size. The BEMA is located in both LSR and the matrix in the Connectivity (CONN) Land Use Allocation (LUA). Less than one third of the BEMA is in LSR and the remainder is in CONN.

Terrestrial Finding #10 - Nesting Spotted Owls/Habitat: Currently, approximately 47 percent of the Quartzville Watershed is considered to be suitable habitat for nesting and/or foraging (suitable), 57 percent is functional as dispersal and 43 percent is non-habitat. Of the non-habitat, 88 percent is capable of becoming suitable habitat over time. All of the SWBs were found to be viable for nesting spotted owls with the exception of Whitcomb, Moose Creek and South Green Peter SWBs. Whitcomb and Moose Creek SWBs were found to be limiting and the South Green Peter SWB is possibly non-viable for nesting spotted owls. The Lone Star and Upper Quartzville SWBs were found to be highly viable for nesting spotted owls.

Of the 35 known spotted owl sites (KOS) in Quartzville Watershed, 23 are currently considered to be viable, 10 are limiting and two are possibly non-viable. With improvements in late seral conditions in LSRs over time, the number of viable KOSs is expected to increase.

Terrestrial Finding #11 - Connectivity/Dispersal and the LSR Network: The Quartzville Watershed was found to be viable for dispersal of spotted owls. The Quartzville LSR (RO213) and Middle Santiam Wilderness complex is about 92,400 acres in size and spans four major watersheds from Crabtree to the west, through Quartzville, into the North Santiam to the north

towards Detroit Reservoir, and south and east into the Middle Santiam Watershed. This very large reserve is an integral and important link in the predominant north-south LSR/wilderness network where the majority of dispersal between known spotted owl sites in the Cascades Range takes place. Dispersal is most limiting in the South Green Peter, and Whitcomb SWBs, in the vicinity of Green Peter Reservoir.

Contained within the Quartzville Watershed is the majority of the Quartzville LSR/wilderness complex (61 percent). Within the Quartzville LSR there are several thousand acres of non-federal lands in early seral stages, completely surrounded by LSR and Critical Habitat. Most of this non-federal land is capable of becoming suitable habitat in the future. It is expected that these non-federal lands will be managed primarily for timber production, and will not contribute suitable habitat to the surrounding LSRs and Critical Habitat over time.

Contained within the Quartzville Watershed is the Whitcomb LSR (RO212). This LSR is 3,450 acres in size and is located about two to three miles to the southwest of the Quartzville LSR. Connectivity between the Quartzville and Whitcomb LSRs is somewhat disrupted by the ownership pattern, but there is a contiguous connection of BLM lands in the Moose Creek SWB across matrix lands. Connectivity between the Quartzville LSR and Whitcomb LSR is expected to remain viable over time. In addition, there is a small LSR 352 acres in size on the tip of the Green Peter Peninsula in the vicinity of the Bald Eagle Management Area.

Spotted owl dispersal out of the Quartzville Watershed is limited by the scattered federal ownership and the North Santiam River Corridor to the north and west, the South Santiam River Corridor to the southwest and the Willamette Valley to the west. The Quartzville Watershed is significant for spotted owl dispersal because it contains the bulk of the Quartzville LSR, which is an integral and important link in the predominant north-south LSR/wilderness network where the majority of dispersal between known spotted owl sites in the Cascades Range takes place. Dispersal is especially significant on the east end of the watershed in the Upper Quartzville, Lone Star and Canal Creek SWBs.

Terrestrial Finding #12 - Critical Habitat for the Northern Spotted Owl: Most of the federal lands in the Quartzville Watershed are designated as Critical Habitat for the spotted owl in Critical Habitat Unit OR-14. There is a total of 62,435 acres of Critical Habitat in the Quartzville Watershed, spread across all SWBs. Approximately 91.5 percent (57,124 acres) is in LSR and 8.5 percent (5,311 acres) is in the Matrix LUAs. Approximately 48 percent of the Critical Habitat in the matrix is in General Forest Management Area (GFMA) and 52 percent is in CONN. In addition, there are 1,932 acres designated as LSR under the NFP that are not designated as Critical Habitat.

Most of the Critical Habitat in the Matrix is in the Moose Creek and Whitcomb SWBs between the Whitcomb LSR and the larger Quartzville LSR to the east. The percentage of suitable habitat in LSR Critical Habitat was not found to be significantly different than in adjacent Matrix Critical Habitat. However, the condition of the suitable habitat in LSR versus the Matrix was

found to be considerably better. Critical Habitat in LSR was found to be viable for both nesting and dispersal of spotted owls.

However, Critical Habitat in the Matrix was found to be limiting for nesting, but viable for dispersal of spotted owls.

Terrestrial Finding #13 - Fire and Fuels: Opportunities to reintroduce fire into the ecosystem on FS lands in the Quartzville Watershed are desirable for several reasons. The tribes of the Grande Ronde and Siletz are interested in reestablishing major travel routes and cultural burning patterns. This would open up the stands, provide more and better huckleberry habitat, and more big game forage. In addition, sugar pine habitat could be enhanced.

Recommendations:

Terrestrial Recommendation #1 - Density Management/Thinnings (Terrestrial Findings #1, 2, 10, 11 and 12): Density management and thinnings should emphasize enhancement and restoration opportunities that target stands in Riparian Reserves, LSR, CONN and GFMA lands in Critical Habitat that have been managed primarily for timber in the past. 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.

Criteria for Density Management/Thinnings: Objectives in all stands would be to develop and maintain late seral forest conditions, meet Aquatic Conservation Strategy (ACS) Objectives and maintain and enhance existing habitat for the spotted owl. Density Management would be prescribed primarily in mid-seral stands in the stem exclusion stage to encourage the development of late seral conditions. Priorities for density management to accelerate the development of late seral forest conditions would be high in Riparian Reserves, LSR, CONN and GFMA lands in Critical Habitat.

The Quartzville portion of the LSR assessment provides the framework for identifying which areas are critical to improve habitat in the earliest time frame possible. Commercial thinning in the LSR is exempted from REO review where all of the following criteria are met (REO Review Exemption Criteria, Page 13, Appendix K of the Mid-Willamette Late Successional Reserve Assessment, August 24th 1998).

> The objective is to develop late successional conditions or reduce the risk of large scale disturbance that would result in loss of key late successional structure. Treatments would in the long term, result in the development of snags, coarse woody debris and other late successional stand characteristics.

Negative short term effects are outweighed by the long term benefits and will not lessen the short functionality of the LSR as a whole.

The leave tree criteria provide for such things as culturing individual trees for large crowns and limbs, retaining characteristics that induce disease, damage and other mortality or habitat that is consistent with LSR objectives.

Within limits of acceptable fire risk, CWD objectives should be based on research that shows optimum levels of habitat for late successional forest species. Timber is a by product and not in and of itself an objective of the thinning prescription.

Density management treatments should be done with caution in stands experiencing moderate infestations of Swiss needle cast (SNC) or drainages where there is a high incidence of this disease. Caution is advised in SNC infected areas because a 30 tree per acre retention treatment in a highly infected area of the Oregon Coast Range resulted in greatly reduced tree growth because of accelerated SNC development. SNC infections can reduce diameter and height growth because of decreased photosynthetic ability due to the loss of older needles. Severe SNC infestations may result in near cessation of Douglas-fir growth, or mortality from competition by non-susceptible species, pathogens or insects and sometimes directly from the disease itself. Initial indications in the Coast Range are that stocking levels greater than 60 trees per acre may allow stand development with minimal growth reductions.

A. FS Lands:

Precommercial Thinning: During the last decade, about 1,200 acres of FS lands have been precommercially thinned in the watershed. The Quartzville Watershed is all LSR on Forest Service land. Currently, there is a backlog of stands that are ready for precommercial thinning. As a result, FS will be precommercially thinning about one thousand acres per year over the next eight years if funds through the receipts to county dollars are attained. Stands will be thinned with species diversity in mind with a variety of thinning density prescriptions. Thinning will allow stands to develop larger diameter trees in a shorter time frame for riparian and spotted owl habitat benefits.

The LSR assessment encourages thinning to create small gaps, with variable densities, that promotes species diversity and will create structural components. Trees to be thinned will be less than eight inches in diameter. No ground based harvesters will be used, and thinning will be only by hand with chain saws. Thinning will be prescribed for those stands that are over stocked. The overstocked conditions could cause a significant delay of reaching the management objective of late successional conditions or where desirable components of the stands may be eliminated because of stocking levels (REO Review Exemption Criteria, Page 6, Appendix K of the Mid-Willamette Late Successional Reserve Assessment, August 24th 1998).

Commercial Thinning: Over the next few decades, the stands that were created by timber harvest over the last fifty years will be ready for commercial harvest. Stand exam information

suggests that FS could commercially thin about 2,500 acres a decade for the next 40 years. Some portions of the

original stands will not be ready to commercially thin, and other portions are in areas that are set aside from timber harvest.

All proposed thinning projects would comply with REO Review Exemption Criteria. Creating openings may not occur during the first commercial thinning in some stands, especially in riparian areas or stands where future flexibility needs to be maintained.

B. BLM Lands

In young stands less than 30 years of age generally having less than commercial diameters, additional criteria for identifying and implementing projects include:

a. Use a range of residual tree densities. Consider creating small isolated openings, less than 1/4 to ½ acre in size, over less than 5 percent of the area, and leaving 10 percent unthinned.

b. Stocking control: Highest priority are overstocked even-aged stands in excess of 250 dominant/co-dominant trees per acre or 20 percent over target levels of 200-250 trees per acre.

c. Species composition control: favor minor species including hardwoods by increasing growing space around them.

d. Retain developing understories that do not interfere with the development of dominant and co-dominant trees in the stand.

e. Standing dead/down CWD recruitment: retain enough green tree capital for recruitment in future stands.

f. Identify stands for treatment through GIS queries, aerial photo interpretation, stand exams, riparian surveys and/or stocking surveys.

g. These projects could be implemented through restoration funding and/or accomplished collaterally with timber stand improvement projects on GFMA and/or CONN lands.

In 30 to 80 year old aged stands: These age classes generally provide the greatest opportunities for acceleration of tree diameter growth and understory development through density management. Criteria for identifying projects include:

a. Maintain average 40 to 50 percent crown closures. Use a wide range of residual tree densities. Density management leaving 30 to 60 trees per acre residual stocking should occur over 5 to 15 percent of the area. Consider creating small isolated openings, less than 1 acre in size, over 5 to 15 percent of the area, and leaving 10 percent unthinned.

b. Stocking control: Highest priority are overstocked even-aged stands of over 40 Relative Density (Curtis, 1982). Relative Density is a measure that estimates stocking density of stands using stand basal area and tree diameters.

c. Species composition control: maintain minor species in treatment areas including hardwoods.

d. Enhance developing understories where present by reducing overstory stocking to

allow for understory growth.

e. Understories can be developed by natural regeneration, planting in openings or beneath density management treatments.

f. Standing dead/down CWD recruitment: retain enough green tree capital for recruitment in future stands. Consider creating smaller standing/down dead material to meet criteria as outlined in Recommendation #2 and the LSRA.

g. In LSR, openings larger than 10 acres in size created by stand replacement events such as insects, disease and/or windthrow can be treated where canopy closure is less than 40%. Retain all standing live trees likely to survive. In other LUAs, openings created by disease and/or windthrow can be treated where canopy closure is less than 40%. Timber harvesting followed by site preparation may occur in any LUA, provided standing dead/down coarse woody debris recruitment requirements are met to the degree possible. Native disease resistant conifer and/or hardwoods can be planted. Highest priority for disease/windthrow treatment would be on GFMA lands.

h. Identify stands for treatment through GIS queries, aerial photo interpretation, stand exams, riparian surveys and/or stocking surveys.

i. These projects can best be implemented through commercial timber sales. Logs may be removed provided standing dead/down CWD recruitment goals and ACS objectives are met to the degree possible.

Mature stands 80 to 150 years of age: Density management treatment of stands over 80 years of age is expected to be rare. Such stands would normally qualify as late seral forest habitat suitable for the spotted owl. However, age is a less important factor than the forest structure present. Late seral characteristics may be lacking in some stands due to timber management activities in the past which simplified forest structure. Past timber management practices such as salvage operations targeting dead, down and dying trees have removed important elements of late seral forest and habitat suitable for the spotted owl. High stocking levels may delay the attainment of late seral forest conditions in some stands due to small tree sizes and poor understory development.

In stands where late seral characteristics are lacking, treatment to create structure and/or reduce high stocking levels could occur. The primarily objectives of such treatments would be to create standing dead/down CWD, develop layering of understory vegetation and increase diameter growth and structure of the residual trees. Commercial timber sales would not occur in stands over 80 years of age in LSR, with the exception of (g) below, stand replacement events in excess of 10 acres. The primary objectives would be achieved through standing dead/down CWD creation without removal of commercial forest products. Criteria for identifying projects include:

a. Enhance suitable spotted owl habitat conditions. Variable density management silviculture treatments could occur in stands previously managed for timber production, to create more natural, late seral conditions, where elements of suitable habitat for spotted owls are lacking.

b. Highest priority are single story overstocked even-aged stands that lack components of late seral structure, such as standing dead/down coarse woody debris, large limby/cull

trees, and multilayered canopies, and do not qualify as habitat suitable for the spotted owl.
c. Species composition control: Manage for species diversity in treatment areas.

d. Enhance developing understories where present by reducing overstory stocking to allow for understory growth.
e. Understories can be developed by natural regeneration or planting in openings or beneath density management treatments.
f. Create enough large, hard material to achieve standing dead/down coarse woody debris criteria (see Recommendation #2). Large material could be created adjacent to streams for recruitment as large woody debris and/or placed in streams.
g. In LSR, openings larger than 10 acres in size created by stand replacement events such as insects, disease and/or windthrow can be treated where canopy closure is less than 40%. Retain all standing live trees likely to survive. In other LUAs, openings created by disease and/or windthrow can be treated where canopy closure is less than 40%. Timber harvesting followed by site preparation may occur in any LUA, provided standing dead/down coarse woody debris requirements are met to the degree possible. Native disease resistant conifer and/or hardwoods can be planted. Highest priority for disease/windthrow treatment would be on GFMA lands.
h. Identify stands for treatment through GIS queries, aerial photo interpretation, stand exams and/or riparian surveys.
i. Projects outside LSR can best be implemented through commercial timber sales or topping/falling contracts to create standing dead/down CWD in LSR. Logs may be removed provided standing dead/down coarse woody debris requirements goals are met to the degree possible.

Terrestrial Recommendation #2 - Standing Dead/Down CWD (Terrestrial Findings #1 and 2): Implement NFP and Salem District RMP standards and guidelines for green tree retention for the recruitment and development of standing dead/down CWD and to contribute to the development of late seral forest stand characteristics. Protect existing material and leave additional green trees in future harvest units to make up for deficiencies in current conditions.

Criteria: For **GFMA and CONN**, leave trees should be over 12 inches dbh and represent the current range of conifer species, size and diameters. In GFMA, leave 6 to 8 green trees per acre; and in CONN, leave 12 to 18 trees per acre for recruitment of standing dead/down CWD and development of a large green tree component in future stands. Leave additional green trees in areas where standing dead/down CWD does not meet Northwest Forest Plan (NWFP) and Salem District Resource Management Plan (RMP) standards. Typically, up to four additional trees per acre are left in areas where standing dead/down CWD is lacking. Create enough large, hard standing material to meet the 40 percent level of potential cavity dwelling wildlife populations. It is anticipated that natural decay/falldown and blowdown of green tree retention will meet or exceed NWFP requirements for down CWD. For **Riparian Reserves and LSR**, standing dead/down CWD requirements should approximate those cited in the Mid-Willamette LSRA. Treatment objectives in these allocations would be for individual tree growth and/or stand

structure enhancement for the purposes of accelerating late seral forest development in younger age classes. Landscape level considerations include connectivity for species, past management and natural disturbances such as fire, insects, and disease. The long term landscape level goal is for 15 percent ground cover of all decay classes of down wood . Twenty-five percent of that cover is expected to be represented by sound wood. When decayed logs are deficient, compensation in sound logs can be achieved over time. Snag levels range from 10 to 50 trees per acres of which 50 percent are in the soft stage and 50 percent are the largest available. In general, small snags will not persist as long as large snags, nor provide the same wildlife habitat. Leaving trees to grow and become snags later is appropriate in early to mid seral stands.

Terrestrial Recommendation #3 - Adjust LSR Boundaries (Terrestrial Findings #3, 9 and 10): Adjust boundaries of LSRs to better protect Special Status/Special Attention Species in the Green Peter Peninsula and Harry Mountain Ridge areas.

Criteria:

Use more ecologically meaningful features to define LSR boundaries such as watershed boundaries, topographic features, roads, forest type breaks, and Special Status/Special Attention Species buffers and management areas rather than interior section lines.

Adjust the Green Peter Peninsula LSR on to coincide with the Bald Eagle Management Area (BEMA), established to protect two existing bald eagle nest sites, as shown on Map #20: Proposed BLM Land Use Allocation Changes. As a result of this proposed change, there would be an net increase in LSR and protected acres of 583 acres, all of which would be in the Quartzville Watershed.

Adjust the Quartzville LSR boundary to approximate the Harry Mountain ridge which separates Thomas Creek Watershed from Quartzville and Crabtree Watersheds. For simplicity and clarity, the new proposed boundary could follow Harry Mountain Road between Crabtree/Quartzville and Thomas Creek as shown on Map #20: Proposed BLM Land Use Allocation Changes. Adjusting this LSR boundary to approximate the topography would make this LSR more ecologically sound and better protect adjacent known spotted owl sites. As a result of this proposed change, there would be an net increase in LSR and protected acres of 1,212 total acres, of which 539 acres are in the Quartzville Watershed and 38 acres in the Crabtree Watershed to the west and 635 acres are in the Thomas Creek Watershed to the north.

With the completion of Quartzville Watershed Analysis, the majority of the watersheds in the Cascades Resource Area of the Salem District BLM has been completed. A number of recommendations for LUA changes have been made in various watershed analyses. Consider balancing recommended LUA changes to achieve no net gain or loss of LSR/Matrix LUAs across BLM ownership in the Cascades Resource Area.

Terrestrial Recommendation #4 - Special Habitats (Finding #4): Some special habitats in the

Quartzville Watershed are exhibiting evidence of encroachment in the form of growth and establishment of trees and invading brush due to fire exclusion. This is particularly true of meadow habitats, such as those present on the ridge separating Quartzville and Crabtree Watersheds. Restore meadow and other special habitats where encroachment is evident through prescribed fire, manual control or other means.

Terrestrial Recommendation #5 - Road Densities: 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. On BLM lands, allow motorized vehicle use on designated roads only, especially in LSRs to reduce disturbance effects to wildlife, particularly the spotted owl. Highest priorities for reducing road densities would be in Canal Creek and Packers Gulch SWBs.

Future commercial thinning projects will provide opportunities to reconstruct or maintain roads that will be required for future thinning entries and decommission or close those roads that will not be needed in the future. Some of the stands were logged downhill and will need to have a helicopter system used for commercial thinning to avoid building new system roads. A roads analysis will be completed during the assessment of those stands as they become commercial in size and volume.

Terrestrial Recommendation #6 - Noxious Weeds (Terrestrial Finding #7): Use the principles of integrated weed management to eradicate, control, and prevent the spread of established and new invader noxious weed infestations. Integrated weed management means using all suitable methods (cultural, physical, biological, chemical) in a compatible manner to reduce weed populations.

Past management efforts to eradicate the knapweed infestations included hand pulling of the plants. This method has not been effective at any of the sites. Chemical treatments followed by hand pulling and establishing competitive native vegetation may be more successful.

Control established infestations primarily by biological control agents and by revegetating disturbed ground with desirable species. Make biological control releases in the Quartzville Watershed as new agents become available.

Encourage washing of ground disturbing equipment from off site to limit the spread of all exotic and noxious weed species.

Terrestrial Recommendation #7 - Land Acquisition (Terrestrial Findings #8, 10, 11 and 12): Pursue Land exchange/acquisition opportunities with willing private landowners to acquire private parcels contained within the Quartzville LSR. These parcels are key private land inholdings within the Quartzville LSR and designated Critical Habitat (CHU OR-14), which provide habitat for the spotted owl. The portion of Quartzville Creek within this parcel also provides key breeding habitat for the highest known concentration of harlequin ducks (BLM/FS

Sensitive Species) in Oregon. The acquisition of private parcels is consistent with the Salem BLM RMP and is recommended in the

Quartzville WSR Management Plan and Mid-Willamette LSR Assessment (Mid-Willamette LSRA, Quartzville LSR Summary, April, 1998, p. 162).

Terrestrial Recommendation #8 - Fire and Fuels (Terrestrial Finding #13): Opportunities to reintroduce fire into FS lands in Quartzville Watershed are desirable for several reasons. The tribes of the Grande Ronde and Siletz are interested in reestablishing major travel routes and cultural burning patterns. This would open up the stands, provide more and better huckleberry habitat, and more big game forage. In addition, sugar pine habitat could be enhanced.

Aquatic

Findings:

Aquatic Finding #1 - Riparian Condition: Current riparian vegetation on federal lands in all of the SWBs is composed of greater than 50 percent mature timber (>80 years), while riparian vegetation on private lands in all of the SWBs is composed of less than 25 percent mature timber. The SWBs with the highest proportions of federal land (Lone Star and Upper Quartzville) have the highest percentages of late seral timber within riparian areas, while the SWB with the lowest proportion of federal land (South Green Peter) has the lowest.

Aquatic Finding #2 - Large Woody Debris (LWD): The combination of a lack of large woody structure in streams and several torrential flow events in the early 1970s and 1996, resulted in some channelization of the streams in the watershed, and a further reduction of LWD in the system. Generally, LWD is severely lacking in the watershed. Downstream of the National Forest boundary, streams with the highest LWD loading levels are Moose Creek, Trout Creek and the East and West Forks of Packers Gulch. Streams with the lowest LWD loading levels are Mainstem Quartzville Creek, Boulder Creek and the Thomas Fork of Packers Gulch.

Aquatic Finding #3 - Stream Flows: August and September have the greatest potential for conflict between consumptive uses and instream water needs with only 34 and 31 cfs (cubic feet per second) of water discharge available for other uses, respectively, at an 80 percent exceedence flow. This total amount of consumptive use and instream water need is still below the total water available.

Aquatic Finding #4 - Water Quality: In the Oregon Department of Environmental Quality (ODEQ) publication, *1988 Oregon Assessment of Non-point Sources of Water Pollution* (ODEQ 1988), also known as the *319 Report*, Quartzville Creek water quality is listed as being moderately impacted, supported by data in the upper reaches. Problems identified include sediment, nutrients, and insufficient stream structure. The probable causes were listed as vegetation removal, and riparian vegetation and bank disturbance. Impacted values were

identified as fisheries, aquatic life, water recreation, wildlife, and downstream municipal water supply.

Packers Gulch SWB is listed as having greater than 15 percent steam channel expansion due to roads, which is considered moderately high.

Aquatic Finding #5 - ODEQ 303(d) listing: In the *Oregon Department of Environmental Quality's 303(d) List Of Water Quality Limited Waterbodies*, also known as the *303(d) report*, Quartzville Creek is listed as water quality limited for summer stream temperature, from river mile 5 upstream to its headwaters. Summer temperatures have been found to be above the 64 degrees F. threshold for fish rearing for notable periods of time.

Aquatic Finding #6 - Stream Temperatures: Summer water temperatures in Quartzville Creek were above the standard for extended periods of time at all temperature gaging stations. Because the data represent a seven day running average, it is apparent that water temperatures are high for extended periods of time during the summer. In early summer, water temperatures, generally, increase in a downstream direction which is expected.

Aquatic Finding #7 - Slope Stability and High Water Flows: The flood of February 1996 affected much of northwest Oregon, and effects were especially notable in Quartzville Creek. 1998 aerial photos of Quartzville Creek display an open riparian canopy, and the creek appears to have suffered high flows and large sediment loads. Sediment has been deposited on the flood plain, removing vegetation and allowing direct solar input.

Aquatic Finding #8 - Non-point Pollution: Tetra Tech (1993) estimated non-point pollution annual loads of nitrogen, phosphorous, and total suspended solids for watersheds in the Willamette River basin. Results suggest the non-point pollution levels are 5 to 20 percent higher in the Santiam sub-basin than the Willamette basin average, however sources have not been identified. Quartzville Creek Watershed appears to be within State standards.

Aquatic Finding #9 - Soils: Several major geologic hazards exist in the Quartzville Watershed which affect streams and water quality. Earth flows and slumps occur in large scattered areas of the watershed, and result in the delivery of soil material to streams through streambank erosion of the toe of the failure. Slope failures occur in steeply sloping, rocky mountainous terrain and include rockslides, debris avalanches and earth flows. Stream erosion and deposition are common within portions of the watershed resulting in higher turbidity, siltation of salmon spawning gravels, and a decrease in channel stability. Lone Star and Packers Gulch SWBs appear to have the greatest acreage of upland in an unstable condition. The SWBs with the most extensive BLM ownership classified as unstable are Packers Gulch and Moose Creek sub-watersheds (231 and 208 acres, respectively).

Aquatic Finding #10 - Fisheries: No anadromous fish are found within the watershed. All of the reaches of Mainstem Quartzville Creek and many tributary reaches have low habitat

complexity and would benefit from instream restoration, generally placement of LWD. Any instream restoration

projects implemented would generally be intended to benefit resident populations of cutthroat trout and mountain whitefish.

Recommendations:

Aquatic Recommendation #1 - Riparian Condition and LWD on federal lands (Aquatic Findings #1 and 2): 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. Criteria for treatment are included under Recommendation #1, of the Terrestrial Section. Improve and restore riparian habitat through planting and seeding with native vegetation. Activities could include planting, density management, thinning, road decommissioning, culvert replacement/removal and erosion control in Riparian Reserves, such as seeding or planting.

Aquatic Recommendation #2 - Riparian Condition and LWD on non-federal lands (Aquatic Findings #1 and 2): Improve riparian conditions, and promote large conifer development in riparian areas through density management and thinnings. Work with the South Santiam Watershed Council and other landowners in the watershed to improve riparian condition and overstory by implementing projects designed to accelerate growth of riparian conifers to improve potential for LWD recruitment. Bringing in and anchoring large logs and rootwads in channels may work in some areas to improve fish habitat and stream structure.

Aquatic Recommendation #3 - Stream flows (Aquatic Finding #3): Cooperate with Oregon Department of Fish and Wildlife to ensure instream flows are protected in summer and fall during extremely low flow years.

Aquatic Recommendation #4 - Water Quality (Terrestrial Finding #6, Aquatic Findings #4 and 7): Reduce roaded miles that contribute flow or sediment to streams. Reclaim/decommission roads to reduce road densities in the watershed. Where roads cannot be decommissioned, close and storm proof unnecessary roads. Pursue road reconstruction and improvement projects on permanent access roads to reduce sediment to streams or prevent future water quality problems. Highest priorities for reducing roaded miles would be in Canal Creek and Packers Gulch SWBs. Existing roads in the watershed were evaluated using Transportation Management Objectives and additional criteria and the results are displayed in Appendix H.

Aquatic Recommendation #5 - Water Quality (Aquatic Findings #4, 7 and 11): Cooperate with state and private landowners to improve water quality. Improve drainage from existing roads and replace culverts that do not meet 100- year flood standards, to reduce loss of roads during large storms and addition of sediments and rock materials to streams. Divert runoff off from unstable slopes and stabilize slide areas.

Aquatic Recommendation #6 - ODEQ 303(d) listing (Aquatic Findings #4 and 5): ODEQ is scheduled to set the Total Maximum Daily Load for temperature in Quartzville Creek during 2002. After ODEQ sets the maximum load, BLM is expected to produce a Water Quality Restoration Plan (WQRP) for BLM lands within the watershed. The plan must include detailed restoration activities and time lines. The FS has the same criteria for the lands that they manage in Quartzville Creek.

Aquatic Recommendation #7 - Stream Temperatures (Aquatic Findings #4 and 6): Develop projects to improve stream shade on BLM lands. Work with other landowners and the South Santiam Watershed Council to increase effective stream shade, expand the temperature monitoring network and locate sources of high water temperatures. Expanded temperature monitoring would provide data for development of the WQRP discussed above.

Aquatic Recommendation #8 - Soils, Slope Stability and High Water Flows (Aquatic Findings #4, 7 and 11): Conduct an assessment of landslides and erosion problems in the watershed. The pending WQRP for the Quartzville Watershed should address erosion problems and restoration actions. Stabilize slides where possible, by seeding, diverting water from unstable slopes, installation of erosion matting, and unweighting slides at the top. Improve road drainage, and replace culverts where needed. Improve riparian cover where possible. Restore vegetative cover on bare slopes. Work on joint projects with other landowners to improve upland conditions on lands in all ownerships.

Aquatic Recommendation #9 - Non-point Pollution (Aquatic Finding #9): Support the South Santiam Watershed Council, and ODEQ efforts to quantify non-point sources of pollution.

Human Uses

Findings:

Human Uses Finding #1 - General: Public lands in the Quartzville Watershed are an important resource to those living within rural and urban communities in the mid-Willamette Valley for a variety of commodity and non-commodity values. Finding a balance between providing commodity based products such as timber with other values such as water quality, fish, wildlife, recreation, and visual resources will be an ongoing challenge that will only increase as rural and urban communities in the mid-Willamette continue to grow. These issues are further complicated by the intermixed ownership pattern of private and BLM-administered lands. The BLM's ability to develop partnerships with interested groups and adjacent landowners on a variety of issues and projects will be a key component of successful public land management in this watershed.

Human Uses Finding #2 - Timber Management: Timber harvest activities on federal lands under current land use allocations would likely be relatively limited. For BLM lands, timber harvest activities will continue to occur at various levels in compliance with the Salem District

RMP, relative to the land use allocations in the Quartzville Watershed. Timber harvest activities will include regeneration harvest, thinnings, density management and salvage operations conducted according to the NFP. Greater harvest would be expected on BLM lands with a GFMA or CONN land use allocation. Habitat enhancement projects in LSRs that involve some timber management are also expected on BLM and FS lands in the watershed. Timber harvest is also expected to continue on private industrial forest lands in the watershed.

Human Uses Finding #3 - Roads and Access: Speeding, reckless driving and driving under the influence along Quartzville Road is an ongoing concern among all the road's managing agencies.

In general motorized access to both public and private lands in the Quartzville Watershed would most likely decrease in the long term. This is due to efforts to meet other resource objectives and as a result of declining road maintenance funding. Vehicle access on private lands may also decrease if problems with garbage dumping, erosion, damage to vegetation, vandalism, theft, long term occupancy, and reckless fire and firearm use continue to increase. The restriction of vehicle access to both private and public forest lands is a growing trend in many of the watersheds in western Oregon that are near rural and urban areas.

The FS does not currently have a formal designation for their portion of the Quartzville Back Country Byway.

Human Uses Finding #4- Minerals: The Quartzville Recreational Mining Corridor that the BLM manages in partnership with private landowners, is a popular area and provides many recreational miners with a place to prospect without conflicts associated with private mining claims. Some resource damage has been observed as a result of the removal of soil and vegetation from river banks. Visitor contact and patrols have helped to significantly increase compliance with obtaining the state permits required for dredging. No major issues associated with recreational mining were identified.

There are private land in-holdings within the National Forest Boundary in the Quartzville Watershed that are associated with patented claim blocks. Acquiring these lands (on a willing seller basis) would be beneficial for several reasons. If acquired, these lands provide the FS with opportunities for interpretation of mining history and protection of the remaining items of historical value. It would also help minimize the fragmentation of dispersal habitat for the spotted owl. Many of the plantations associated with the claims are now commercial thinning size and over stocked. Without thinning, these stand may contribute to increased fuel loads.

Human Uses Finding #5 - Off-highway Vehicle Use: Due to concerns associated with erosion, vegetation damage, water quality and fisheries, wildlife disturbance, off-road use by four wheel drives, all terrain vehicles, and motorcycles is not compatible with resource management objectives on BLM-administered lands in the Quartzville Watershed. However, use of these vehicles would still be allowed on roads, consistent with the Oregon Revised Statues and BLM regulations in the Code of Federal

Regulations related to off-road vehicle use and designations. More work in implementing these off-highway vehicle designations is stilled needed.

Motor vehicle regulations on National Forest Lands are governed by the State under the Oregon Revised Statues (ORS). ORS provisions allow non-street legal off-highway vehicles (OHV) to operate on most forest roads, unless the Forest Supervisor specifically prohibits them. A FS policy is currently being developed to provide consistent guidance for All-Terrain Vehicles (ATV), Off-Road Vehicles (ORV), Off-Highway Vehicles (OHV), or non-highway vehicles on roads authorized for such use. ATV, ORV and OHV use is often not compatible with resource management objectives on many FS lands.

Though not expressly authorized, use of private forest land may currently occur unless the area is physically restricted.

Human Uses Finding #6 - Green Peter Reservoir: Managing the recreational use along Green Peter Reservoir is probably the greatest recreational issue in the Quartzville Watershed. While use densities on the reservoir itself are not high, existing use during peak periods already exceeds the capacity of both developed and undeveloped recreation areas along Green Peter Reservoir. Given that water-based recreation is one of the fastest growing activities, along with the development of new technologies like personal water crafts, the challenges associated with managing this reservoir are likely to increase. The undeveloped nature of the recreational use, the large size of many groups, and crowding issues associated with camping along the reservoir also contribute to problems with higher levels of undesirable activities such as litter, underaged drinking, irresponsible campfire use, drug use and manufacturing, and domestic violence and fighting. Long-term occupancy is also an ongoing management issue along the reservoir. The lack of publicly owned sites that are suitable for facility development only further limits management options currently available for reducing or resolving these management concerns.

Human Uses Finding #7 - Quartzville Creek Wild and Scenic River: The main issue associated with the Quartzville Wild and Scenic River is the management of undeveloped camping along the river. The BLM faces many of the same challenges as Army Corps of Engineers faces along Green Peter Reservoir, but to a lesser degree. With growing demand, the establishment of new sites on both public and private lands is a concern. Minimizing the impacts (trash, fire rings, sanitation, etc.) associated with existing use is also an ongoing concern. The fact that much of the undeveloped camping occurs on private land further complicates the BLM's ability to manage undeveloped camping as a whole. The planned removal and restoration of the road maintenance shop site along Quartzville Creek will greatly enhance the visual appearance of the area.

Human Uses Finding #8 - Recreation: Even with decreases in road densities in the Quartzville Watershed, there will still be opportunities for dispersed recreational activities on federal lands such as hunting, fishing, target shooting. Private lands in the watershed may also provide similar opportunities to the extent allowed by individual landowners. There may be potential for improving opportunities for non-motorized uses by developing a trails for hiking, mountain biking, and horseback riding utilizing existing roads and trails and constructing new

trails. This could include the development of a trail leading from Crabtree Lake to Green Peter Peninsula, as proposed in the RMP.

Human Uses Finding #9 - Visual Resources: There are approximately 16 acres of BLM-administered land in the Quartzville Watershed with a Class I rating, requiring the highest level of protection under the Visual Resource Management system. These lands include the outer edges of both the Shafer Creek and Crabtree Lake Areas of Critical Environmental Concern (ACEC). Most of these ACEC's are in the Crabtree Watershed. Also included are a few waterfalls scattered in the watershed. There are approximately 4,802 acres of BLM-administered land in the Quartzville Watershed with a Class II rating, requiring that low levels of change to the characteristic landscape. Most of the Class II lands in the watershed are located along Green Peter Reservoir and Quartzville Creek. The remaining 25,908 acres of BLM-administered land within the watershed fall into a Class III or IV rating. Outside of Class I lands, the most sensitive visual resources in the watershed would be those lands observable from Green Peter Reservoir, Quartzville Creek, or Quartzville Access Road.

The viewshed on federal lands is expected to improve on federal lands in LSR, as past harvest activities mature into older forests. Harvest activities are expected to continue to be observable on private lands in the watershed. The removal and restoration of the road maintenance shop would enhance the visual appearance of the area.

Human Uses Finding #10- Prohibited Uses: The occurrence of prohibited uses such as speeding, driving under the influence, underage drinking, poaching, littering, unauthorized long-term occupancy, drug manufacturing and use, vandalism, garbage dumping, domestic violence and other physical altercations is increasing on both public and private in the Quartzville Watershed. Cooperative management and law enforcement efforts between public and private landowners in the watershed will continue to play a critical role in addressing these problems. Additional law enforcement assistance in 2002 from Linn County, through the "Secure Rural Schools and Community Self-Determination Action of 2000," may also help address these problems. However, the additional law enforcement assistance is only funded through 2002, so continued support would be necessary if any long term reductions in these problems is to be accomplished. If the closure of private lands to motorized access by the public increases, the incidence of these prohibited uses on public lands may increase.

Recommendations:

Human Uses Recommendation #1 - Visual Resource Management (Human Uses Findings #2 and 9): The following is a list of mitigating actions that could be taken to reduce the visual impacts of timber harvest activities on BLM-administered lands, depending on the proposed action and the site specific characteristics.

* Early in project planning, consider reducing visual or other disturbance factors in designing the

size, shape, and location of the timber harvest units or project. Consider small patch cuts, thinnings, or uneven aged management to better maintain forest cover.

* Where possible utilize green retention trees and riparian reserves to buffer the visual impacts from view. Consider leaving additional trees for added buffering were needed.

* Where possible, consider using alternative reforestation site preparation prescriptions to broadcast burning.

Human Uses Recommendation #2 - Minerals (Human Uses Finding #4): Continue to provide recreational mining opportunities in manner that reduces resource impacts and is in compliance with state laws and regulations. Continue to provide information on mining guidelines and user ethics.

On a willing-seller basis, pursue private land inholdings associated with patented claims, within FS lands in the Quartzville Watershed.

Human Uses Recommendation #3 - Roads and Off-Highway Vehicle Use (Human Uses Findings #3 and 5): In an effort to reduce speeding and reckless driving , conduct a speed analysis along the BLM portion of Quartzville Road and post a speed limit along the road that could be enforced by law enforcement officers. Also work to provide better signing, maps, and information about appropriate off-highway vehicle use on BLM-administered lands in the Quartzville Watershed and coordinate this information with FS and adjacent private landowners.

Human Uses Recommendation #4 - Quartzville Back Country Byway (Human Uses Finding #3): Its recommend that the BLM and FS work with Linn County to submit the Quartzville Back Country Byway for State of Oregon "Tour Route" designation to formally recognize the entire route.

Human Uses Recommendation #5 - Green Peter Reservoir (Human Uses Finding # 6): Continue to work with the Army Corps of Engineers on managing boat-in camping on BLM lands along Green Peter Reservoir.

Human Uses Recommendation #6 - Quartzville Creek Wild and Scenic River (Human Uses Finding #7): In the short term the BLM should work with the private landowners along the Wild and Scenic segment of Quartzville Creek to establish a designated campsite system. In the long term the BLM should work with willing private landowners on acquiring the private land within the Quartzville Creek Wild and Scenic River Corridor boundaries. No significant issues were identified, that would warrant the need for an immediate update of the Quartzville Creek Wild and Scenic River Management Plan, November 1992. However, if significant private lands are acquired, the Quartzville Creek Wild and Scenic River Management Plan should be updated to reflect the new opportunities that such an acquisition would represent.

Human Uses Recommendation #7 - Recreation (Human Uses Finding #8): Evaluate the

potential of establishing multi-use, non-motorized trails in the on BLM lands in the Quartzville Watershed including the trail leading from Crabtree Lake to the Green Peter Peninsula as proposed in the RMP.

Human Uses Recommendation #8 - Partnerships and Coordination (Human Uses Findings #3, 4, 5, 6, 7, 8, and 10): To the extent possible work in partnership with private, local, state and federal entities that manage lands or have interest in the Quartzville Watershed on managing public use in a consistent, safe, and efficient manner.

Chapter 8 Data Gaps, Inventory and Monitoring Needs

Terrestrial

Data Gaps

1. Special Status /Special Attention vertebrate species occurrence in the Quartzville Watershed, especially the peregrine falcon, goshawk, red tree vole, fisher, shrews, and bat species (see Appendix E.4).

2. Special Status/Special Attention invertebrate species occurrence such as Oregon megomphix (see Appendix E.2 and E.4).

3. Presence and abundance of nonvascular plants and fungi, particularly *Bridgeoporus nobilissimus,* to determine appropriate management areas.

4. Density Management or thinning opportunities across all LUAs, particularly Riparian Reserves, LSR, CONN, and Critical Habitat in GFMA and CONN.

5. Noxious weed sites in the watershed on both federal and non-federal lands.

6. Swiss needle cast infection levels and trends in the watershed.

Inventory/Monitoring Needs

Recommendations:

1. Survey for priority vertebrate species in the watershed. Special emphasis should be placed on the peregrine falcon, goshawk, red tree vole, fisher, shrews, and bat species. Continue cooperative efforts with adjacent non-federal landowners and the State to survey and manage known spotted owl sites in the lower portion of the watershed.

2. Survey for priority invertebrate species in the watershed. Special emphasis should be placed on strategic surveys for Oregon Megomphix.

3. Survey for priority plant species in the watershed. Special emphasis should be placed on Survey and Manage nonvascular plants and fungi, particularly *Bridgeoporus nobilissimus*. Surveys for this species are in progress and are recommended for BLM lands east of Snow Peak and in the Harry Mountain Ridge vicinity along the divide between Crabtree, Quartzville, and Thomas Creek Watersheds.

4. Stand exams, including CWD and standing dead components, across all LUAs to identify restoration/enhancement treatment opportunities in stands previously managed for commercial forest products, especially in appropriate Riparian Reserves and LSRs.

5. A comprehensive inventory of noxious weed sites in the watershed and coordination with other public and private parties for the development of weed control plans. Continue surveying and monitoring of noxious and invasive weeds. Develop partnerships and actively pursue funding for weed control projects.

6. Establish monitoring plots to measure current levels of defoliation due to Swiss needle cast and determine trends in the watershed over time.

Aquatic

Data Gaps

1. Stand ages and seral stages on non-federal lands for the purpose of estimating cumulative effects associated with future projects.

2. Adequate water temperature and stream modeling data to determine where temperature enrichment to streams may be occurring. Some of this work has already been accomplished.

3. Sediment sources and potential failures associated with roads to identify road decommissioning and storm proofing opportunities. A couple locations have already been designated (i.e., along main stem of Quartzville Creek and up Yellowstone Creek where road restoration has taken place).

4. Riparian treatment opportunities in the watershed to enhance stream shade and increase LWD recruitment potential, such as conifer planting in riparian areas.

5. Fragile soils on non-federal lands and landslide activity and erosion potential across the entire watershed.

6. The upstream limits of resident fish distribution on federal lands are not known on many streams within the watershed. Currently, where no field data are available, resident fish are assumed to be present in streams that are 3rd order and larger.

Inventory/Monitoring Needs

Recommendations:

1. Inventory of stand ages and seral stages on non-federal lands to create an accurate GIS layer for the purpose of estimating cumulative effects associated with future projects.

2. Increase water temperature data collection to help determine where temperature enrichment to streams is occurring. Model streams in the watershed using either the *Heet Source* model or *Shadow* model to help determine where temperature enrichment is occurring.

3. Inventory of roads on all ownerships to determine which are contributing sediment, have the highest risk of failure, and which could be decommissioned or storm proofed.

4. Stand exams, including photographic interpretation, in appropriate Riparian Reserves to identify projects that could enhance stream shade.

5. Inventory of fragile soils on non-federal lands and a detailed landslide and erosion inventory across the entire watershed.

6. Inventory streams on federal lands to determine the upstream limits of resident fish. Much of this inventory work will occur for site specific analysis of future projects proposed in the watershed.

Human Uses

Data Gaps

1. Visitation levels and recreational activities in the watershed.

2. Information on the dispersed campsites, shooting areas, and Off-highway vehicle trails in the watershed.

Inventory/Monitoring Needs

Recommendations:

1. As time and funding allow, collect additional field data on visitation levels and recreational activities.

2. As time and funding allow, inventory dispersed campsites, shooting areas, and OHV trails in the watershed.

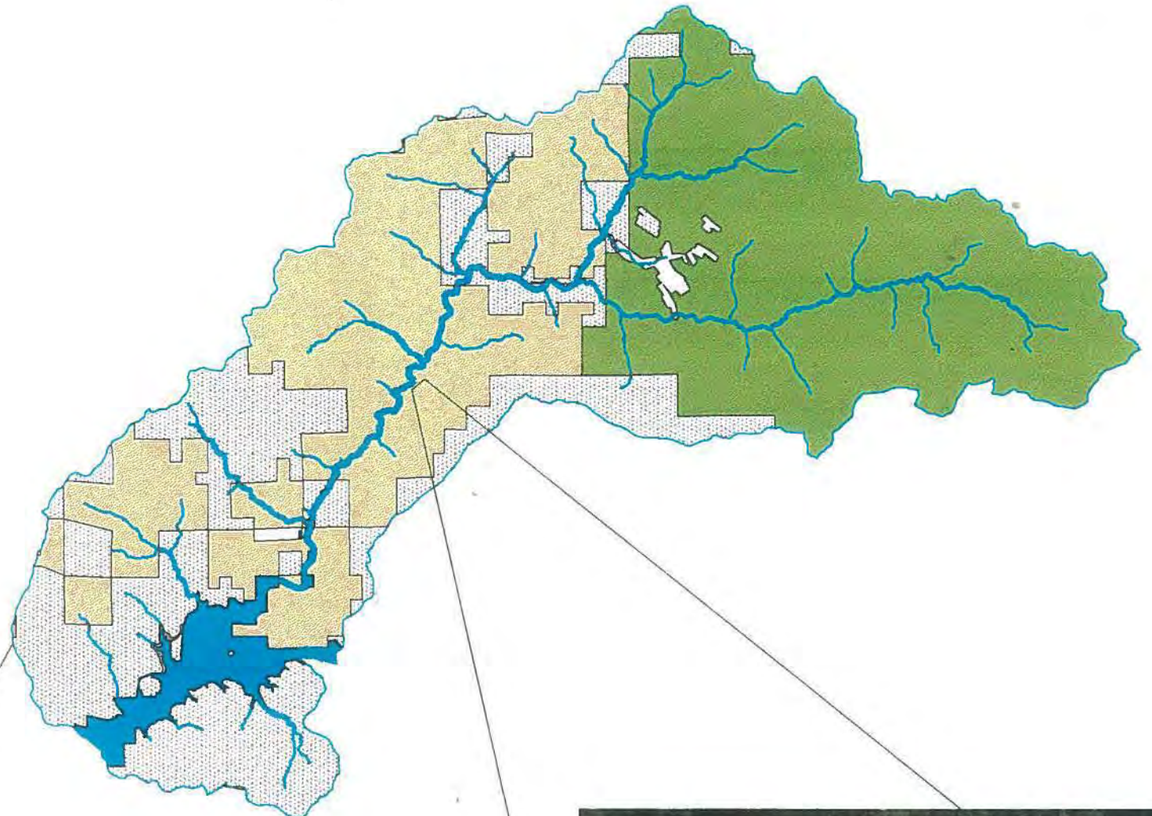
Quartzville Watershed Analysis

September 2002

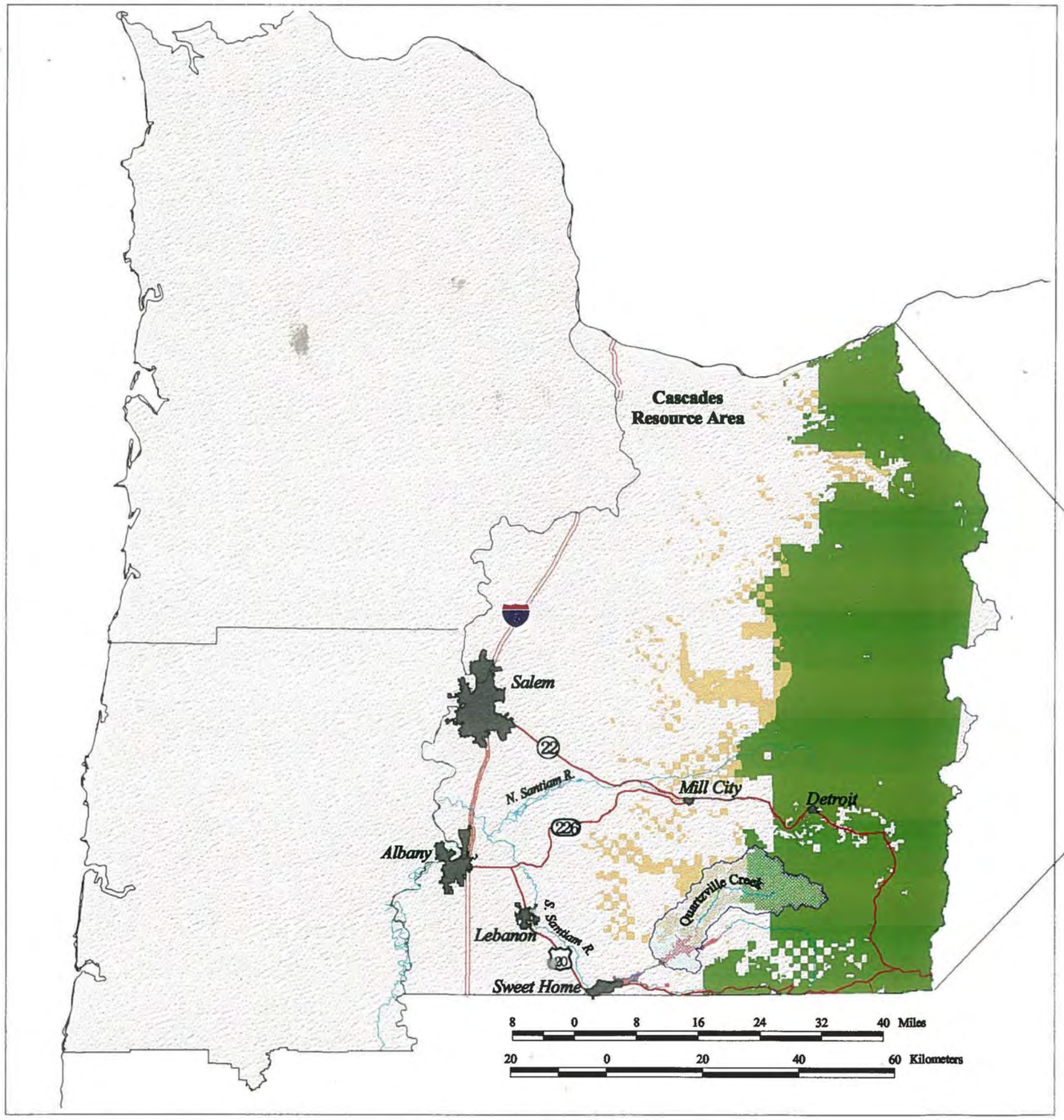
Sweet Home Ranger District
Willamette National Forest
U.S. Forest Service

Cascades Resource Area
Salem District Office
Bureau of Land Management

Maps



Quartzville Watershed Analysis



N

Map Created:
2/22/2001

Watershed Analysis Area

Location Map

Quartzville
Watershed Analysis Area

Federal Ownership

- BLM
- US Forest Service
- Corps of Engineers

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Map#: 1

Quartzville Watershed Analysis

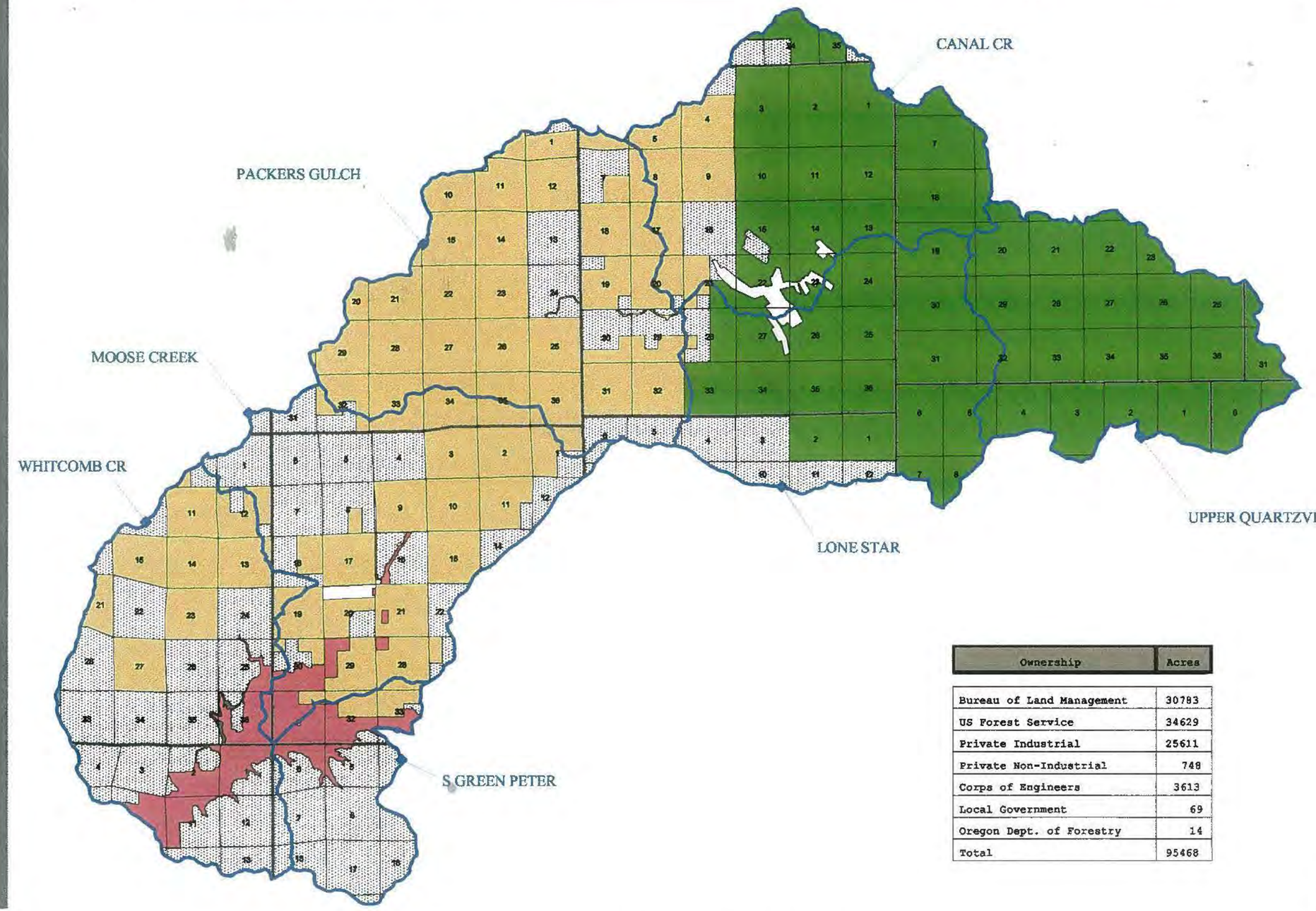
R2E R3E R4E R5E

T10S

T11S

T12S

T13S



Ownership	Acres
Bureau of Land Management	30783
US Forest Service	34629
Private Industrial	25611
Private Non-Industrial	748
Corps of Engineers	3613
Local Government	69
Oregon Dept. of Forestry	14
Total	95468

1 0 1 2 3 4 Miles

2 0 2 4 6 Kilometers

N

Map Created:
2\23\2001

Ownership
Subwatershed Basins

LEGEND

Ownership
- BLM
- US Forest Service
- Private Industrial
- Private Non-Industrial
- Corps of Engineers
- Local Government
- Oregon Dept. of Forestry

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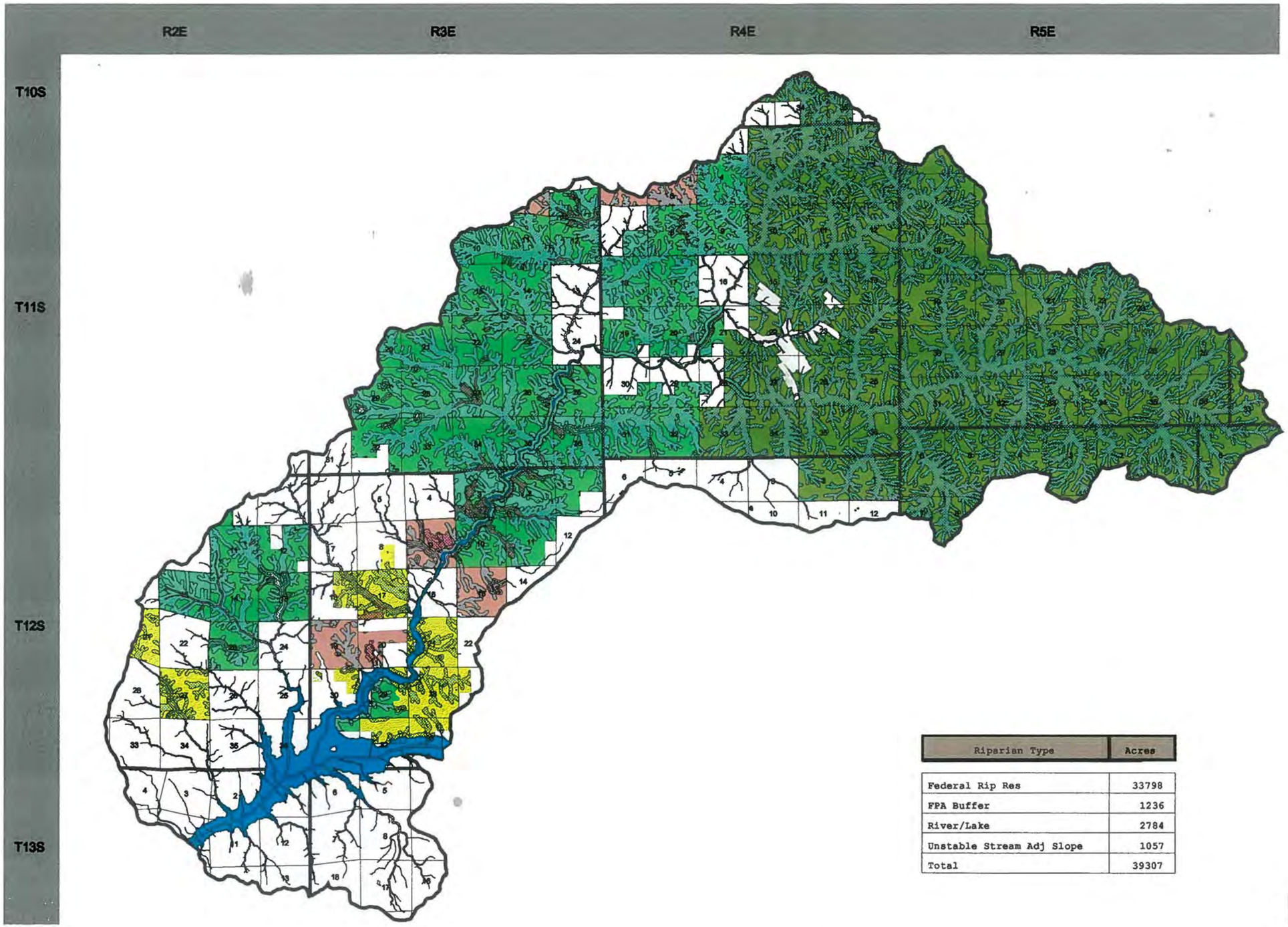
Map#: 2

Quartzville Watershed Analysis



Riparian Type	Acres
Federal Rip Res	33798
FPA Buffer	1236
River/Lake	2784
Unstable Stream Adj Slope	1057
Total	39307

1 0 1 2 3 4 Miles

2 0 2 4 6 Kilometers

N

Map Created:
2\23\2001

Federal Land Use Allocations with Riparian Reserves/ Oregon Forest Practices Act Stream Buffers

LEGEND

Riparian Reserve Category
- Federal Rip Reserve
- Forest Practice Act Buffer
- Unstable Stream Adjacent
- River/Lake

BLM Land Use Allocations
- GFMA
- Connectivity
- LSR

US Forest Service Lands
- LSR

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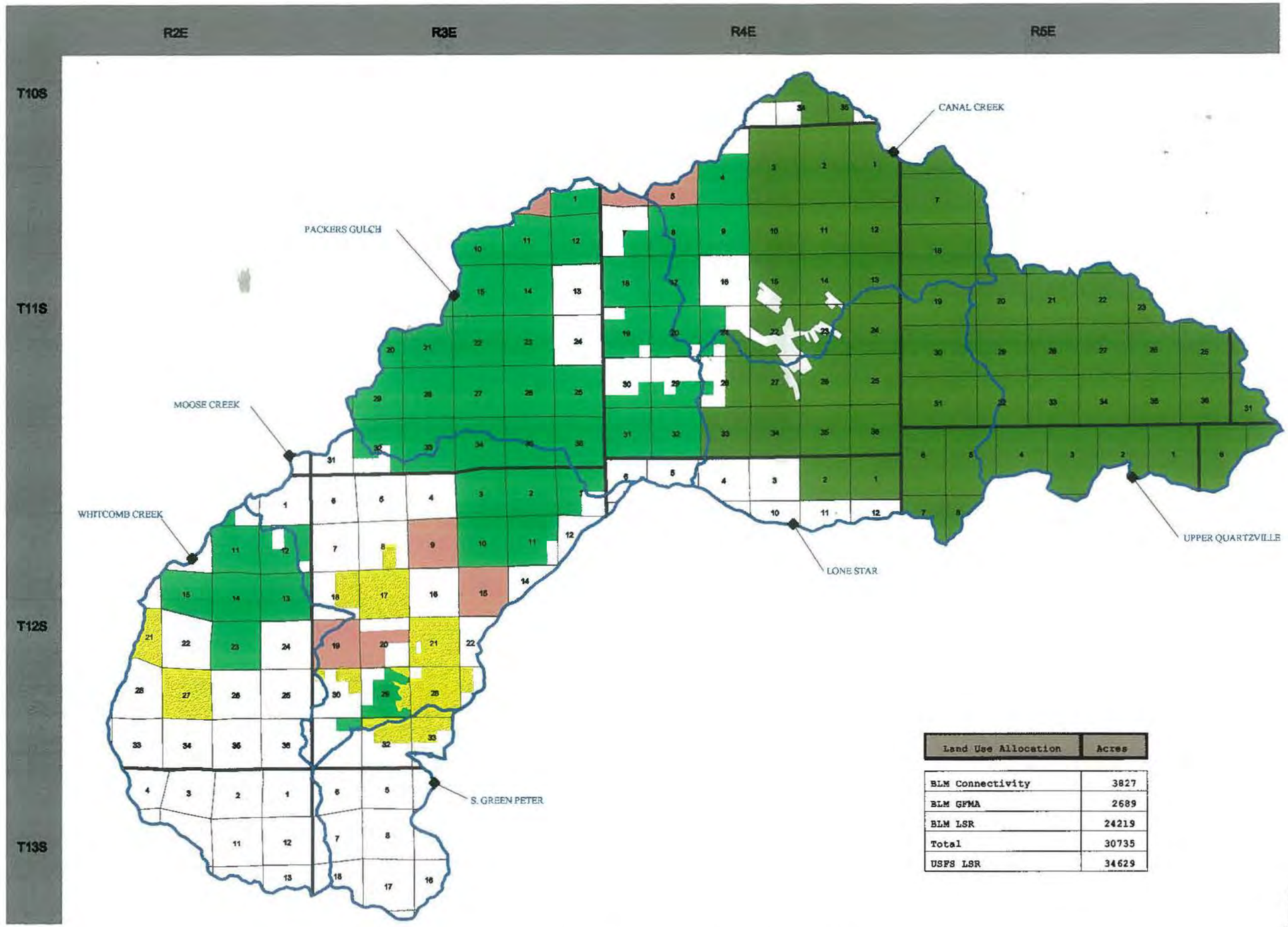
Map#: 3

Quartzville Watershed Analysis



Land Use Allocation	Acres
BLM Connectivity	3827
BLM GFMA	2689
BLM LSR	24219
Total	30735
USFS LSR	34629

1 0 1 2 3 4 Miles

2 0 2 4 6 Kilometers

N

Map Created:
2\23\2001

Federal Land Use Allocations

LEGEND

BLM Land Use Allocations
- GFMA
- Connectivity
- LSR

US Forest Service Lands
- LSR

Subwatershed Basin

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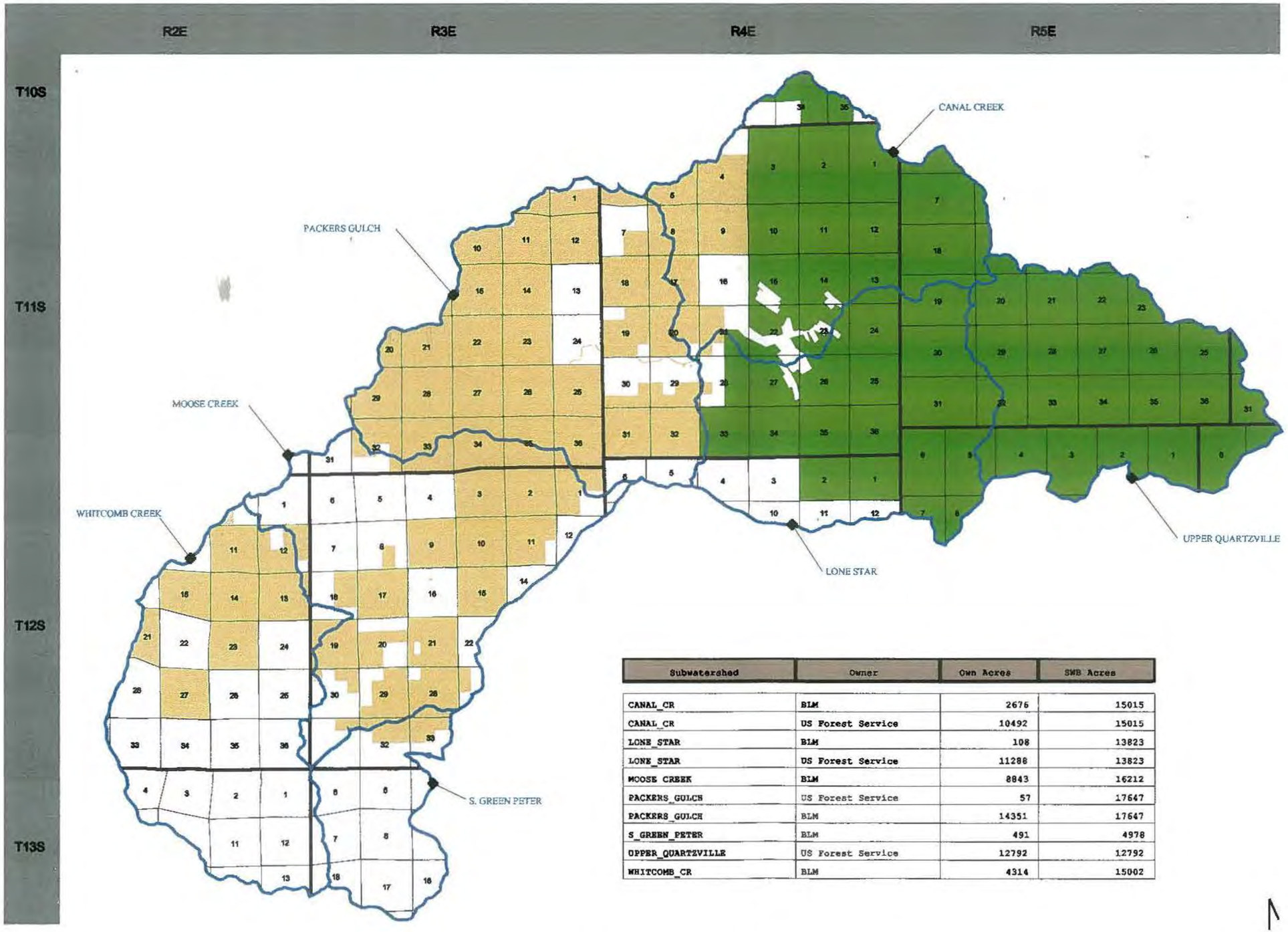
Map#: 4

Quartzville Watershed Analysis



Subwatershed	Owner	Own Acres	SWB Acres
CANAL_CR	BLM	2676	15015
CANAL_CR	US Forest Service	10492	15015
LONE_STAR	BLM	108	13823
LONE_STAR	US Forest Service	11288	13823
MOOSE CREEK	BLM	8843	16212
PACKERS_GULCH	US Forest Service	57	17647
PACKERS_GULCH	BLM	14351	17647
S_GREEN_PETER	BLM	491	4978
UPPER_QUARTZVILLE	US Forest Service	12792	12792
WHITCOMB_CR	BLM	4314	15002

1 0 1 2 3 4 Miles

2 0 2 4 6 Kilometers

N

Map Created:
2023\2001

Subwatershed Basins

BLM Administered Lands

US Forest Service Administered Lands

Subwatershed Basin

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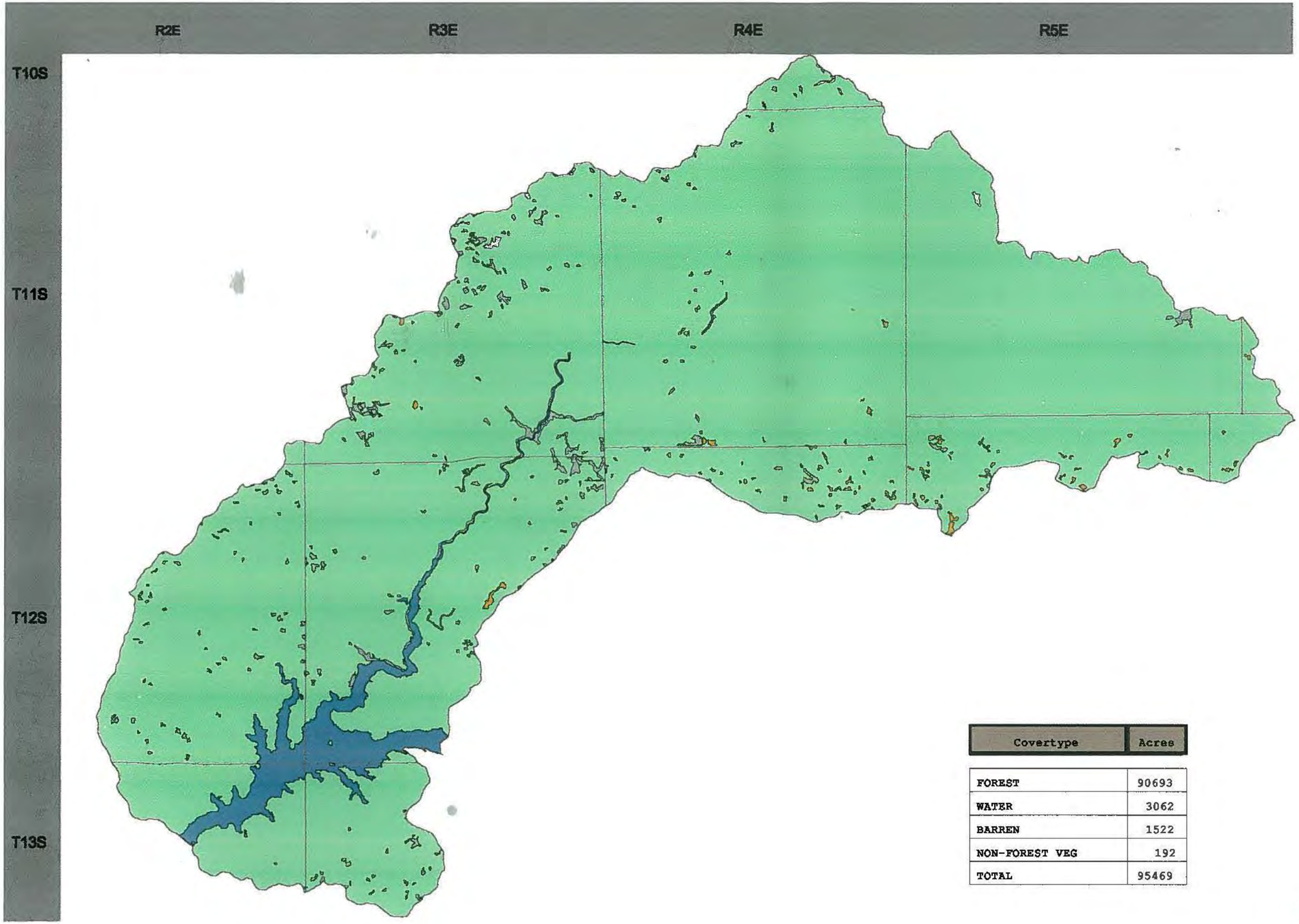
Map#: 5

QuartzvilleWatershed Analysis



Covertype	Acres
FOREST	90693
WATER	3062
BARREN	1522
NON-FOREST VEG	192
TOTAL	95469

1 0 1 2 3 4 Miles

2 0 2 4 6 Kilometers

N

Map Created:
2.26/2001

Vegetation
Cover Type

LEGEND

Cover Type
- Forest
- Non-Forest Veg
- Water
- Barren

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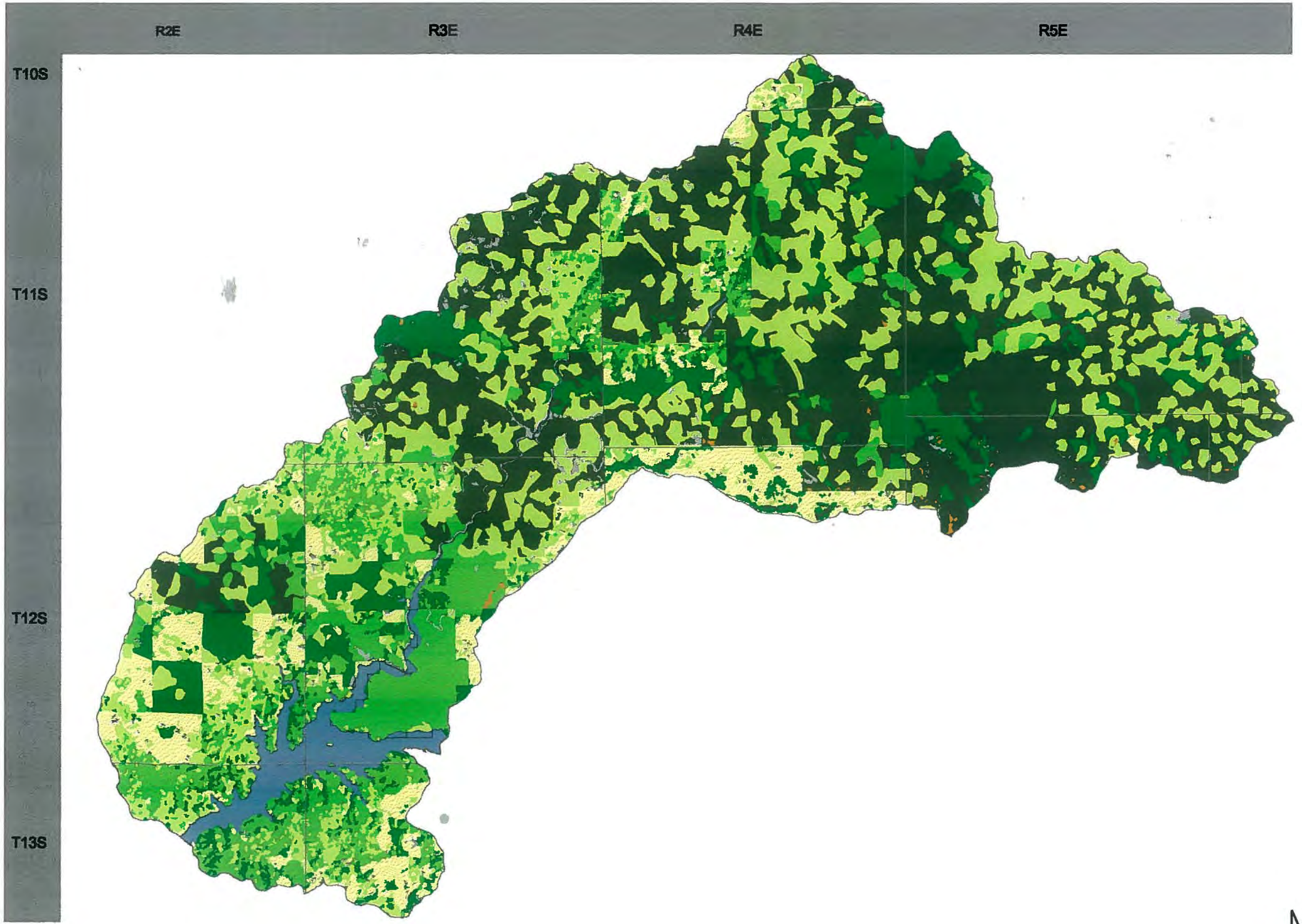
Map#: 6

Quartzville Watershed Analysis



1 0 1 2 3 4 Miles

2 0 2 4 6 Kilometers

N

Map Created:
2/27/2001

Vegetation Age

LEGEND

Forest Cover Age Class
- <10
- 10-30
- 30-80
- 90-180
- 190+

Non-Forest
- Non-Forest Veg
- Water
- Barren

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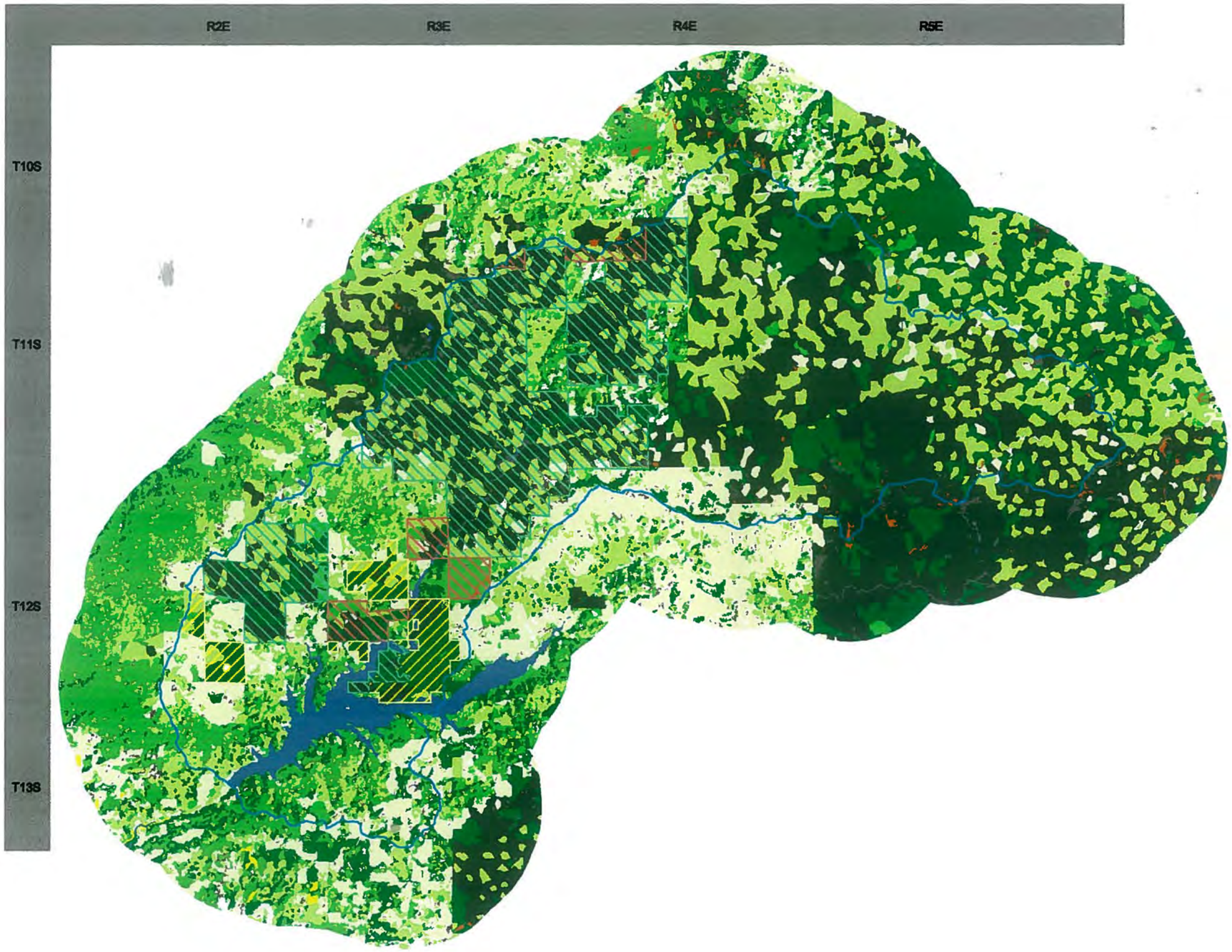
Map#: 7

Quartzville Watershed Analysis



1 0 1 2 3 4 Miles

2 0 2 4 6 Kilometers

N

Map Created:
2/27/2001

Seral Stage

LEGEND

Forest Land Seral Stage
- Early/Grass/Forb
- Open Sapling/Brush
- Closed Sapling
- Mature
- Old-Growth

Non-Forest
- Agricultural
- Non Forest Vegetation
- Water
- Barren

BLM Land Use Allocations
- General Forest Management
- Connectivity
- Late Successional Reserve

Watershed Analysis Area Boundary

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Salem District Office
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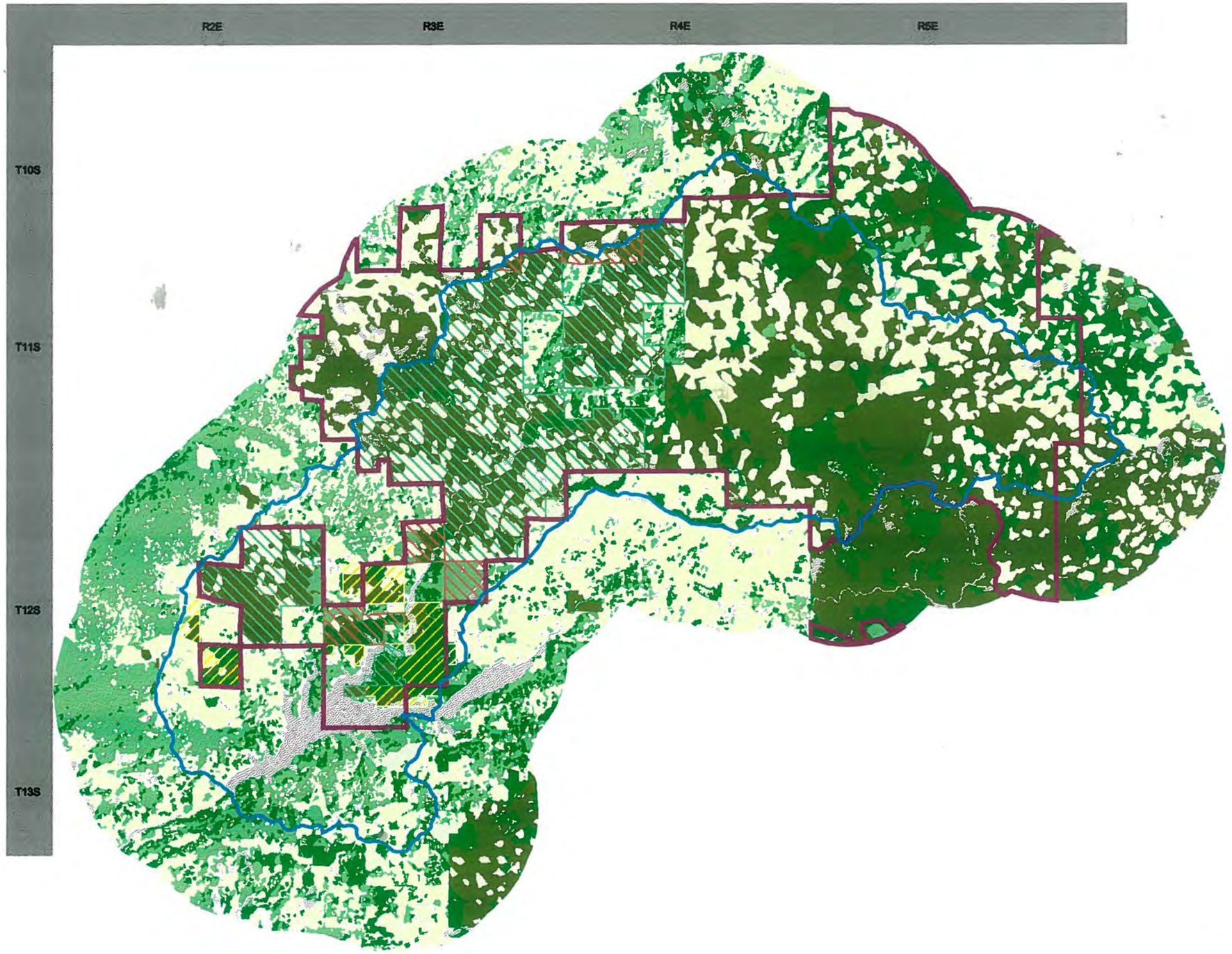
Map#: 8

Quartzville Watershed Analysis



1 0 1 2 3 4 Miles

2 0 2 4 6 Kilometers

N

Map Created:
3/20/2001

Spotted Owl Habitat

Critical Habitat

Land Use Allocations

LEGEND

Spotted Owl Habitat Capability
- CAPABLE
- DISPERSAL
- FORAGING
- NESTING
- NON_CAPABLE

Spotted Owl Critical Habitat

Land Use Allocations
- General Forest Management
- Connectivity
- Late Successional Reserve

Watershed Analysis Area Boundary

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Salem District Office
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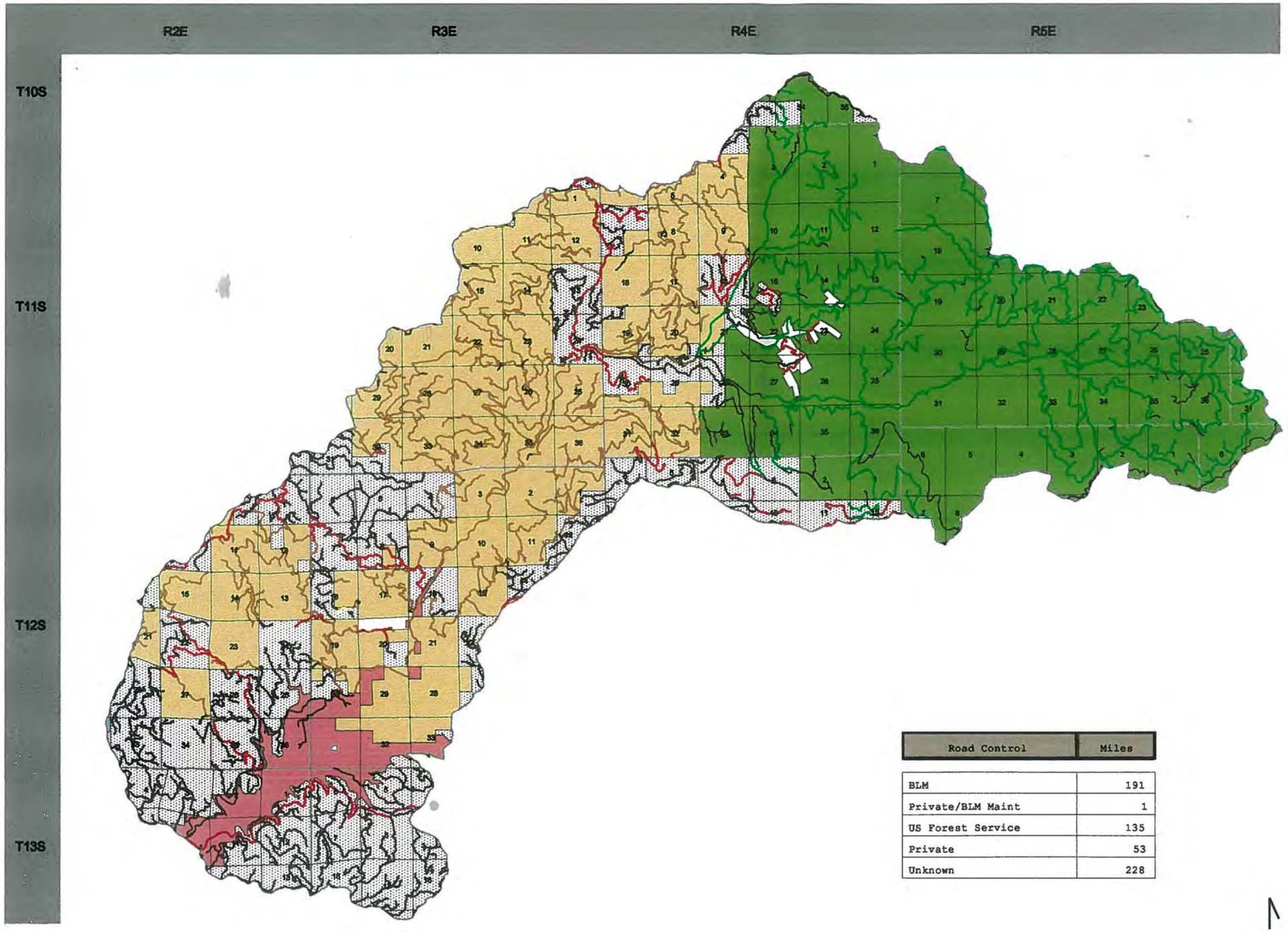
Map#: 9

Quartzville Watershed Analysis



Road Control	Miles
BLM	191
Private/BLM Maint	1
US Forest Service	135
Private	53
Unknown	228

1 0 1 2 3 4 Miles

2 0 2 4 6 Kilometers

N

Map Created:
3/30/2001

Transportation

LEGEND

Road Control
- BLM
- Private/BLM maint
- US Forest Service
- Private
- Unknown

Ownership
- BLM
- US Forest Service
- Private Industrial
- Private Non-Industrial
- Oregon Dept. of Forestry
- Corps of Engineers
- Local Government

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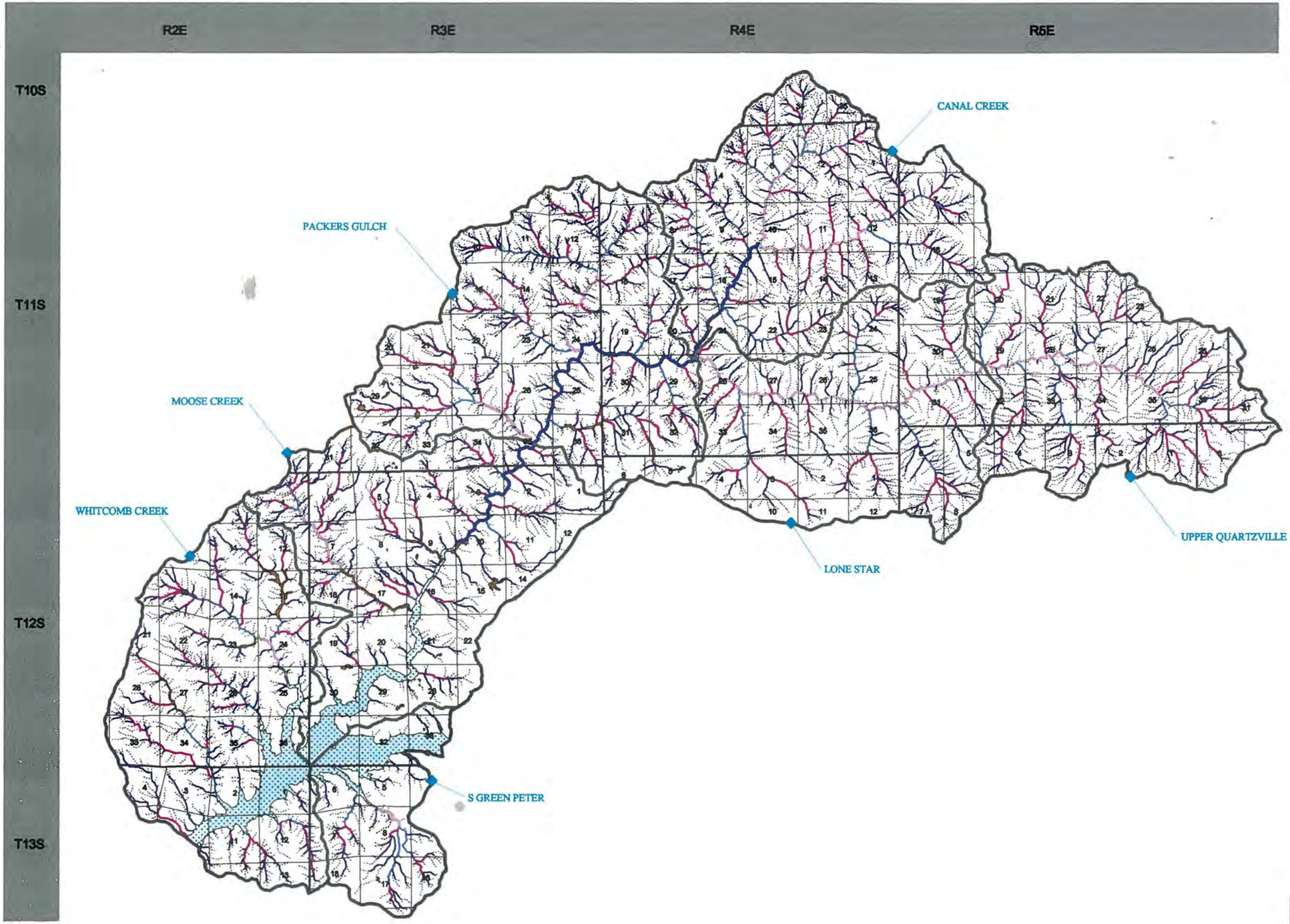
Map#: 10

Quartzville Watershed Analysis



Map Created:
3/6/2001

Stream Order

LEGEND

Stream Order
- 1st
- 2nd
- 3rd
- 4th
- 5th
- 6th

- Reservoir
- Lake
- Wetland

- Subwatershed Basins

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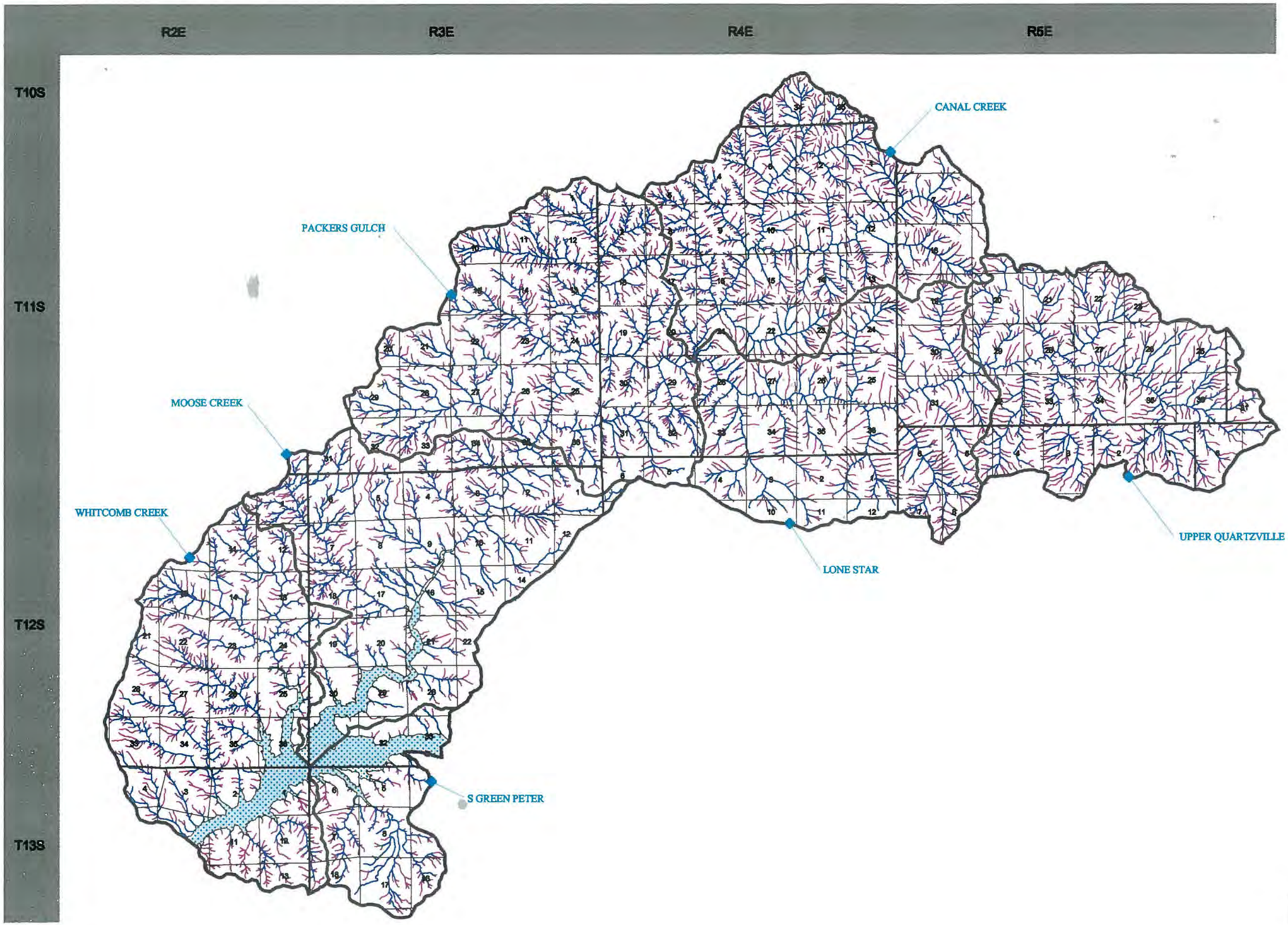
Map#: 11

Quartzville Watershed Analysis



Map Created:
3/6/2001

Stream Flow

LEGEND

Stream Flow
- Perennial
- Intermittent

Reservoir

Subwatershed Basins

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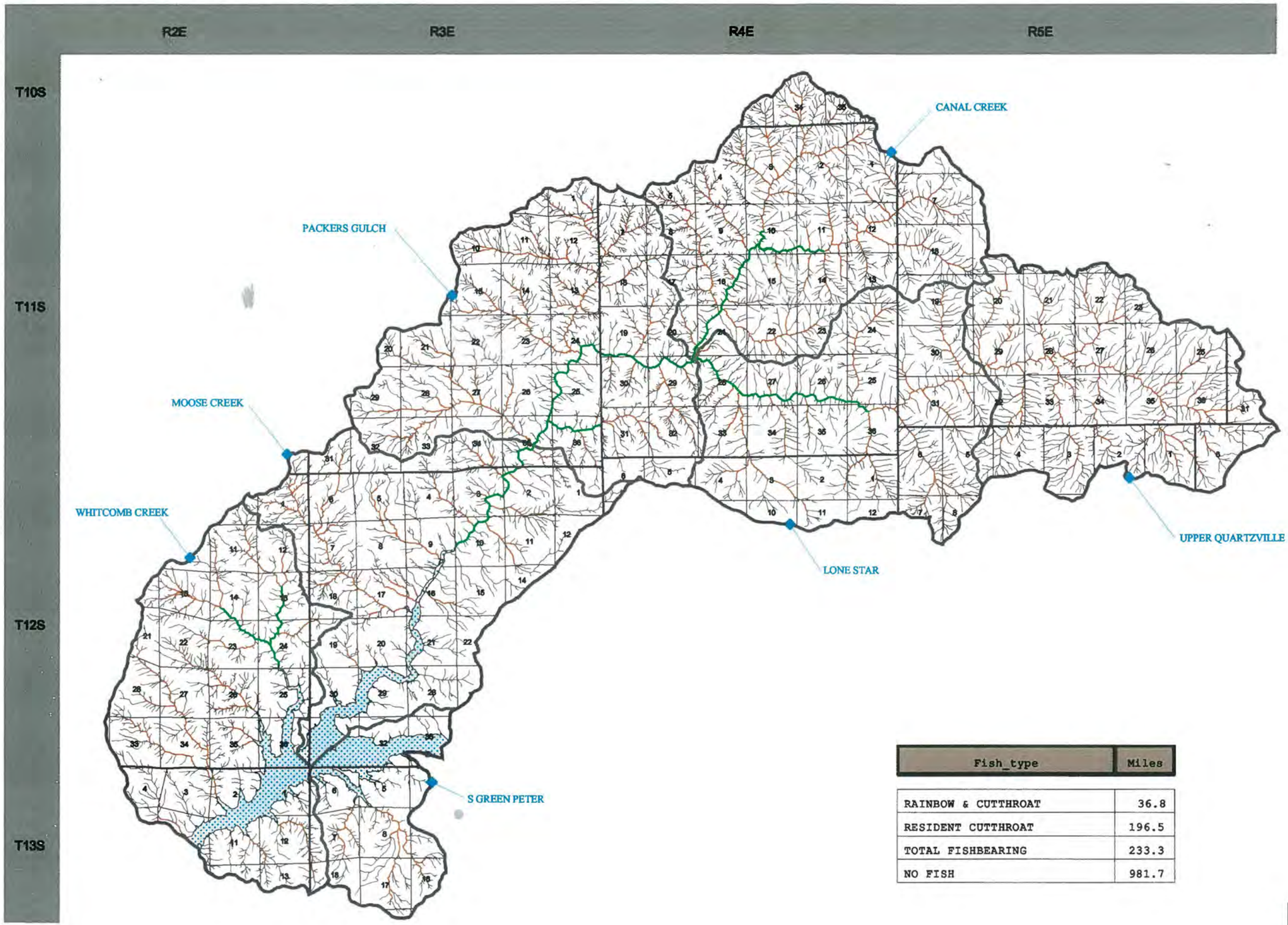
Map#: 12

Quartzville Watershed Analysis



Fish_type	Miles
RAINBOW & CUTTHROAT	36.8
RESIDENT CUTTHROAT	196.5
TOTAL FISHBEARING	233.3
NO FISH	981.7

1 0 1 2 3 4 Miles

2 0 2 4 6 Kilometers

N

Map Created:
3/6/2001

Fish Presence

LEGEND

Fish Species
- Rainbow & Cutthroat
- Resident Cutthroat
- No Fish Presence

Fishbearing Lake

Subwatershed Basins

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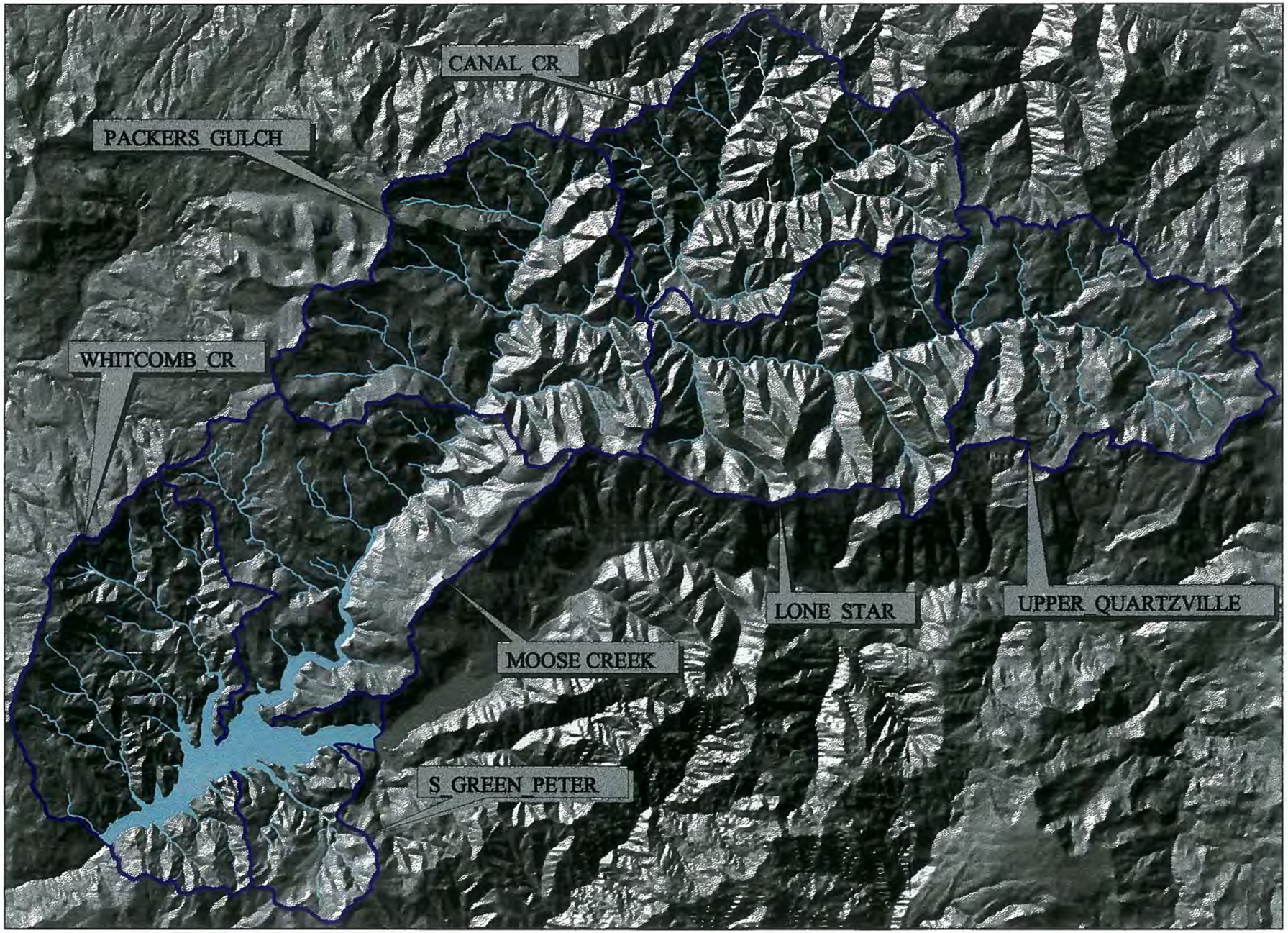
Map#: 13

Quartzville Watershed Analysis



Hill Shade

LEGEND

Subwatershed Basins

Major Streams

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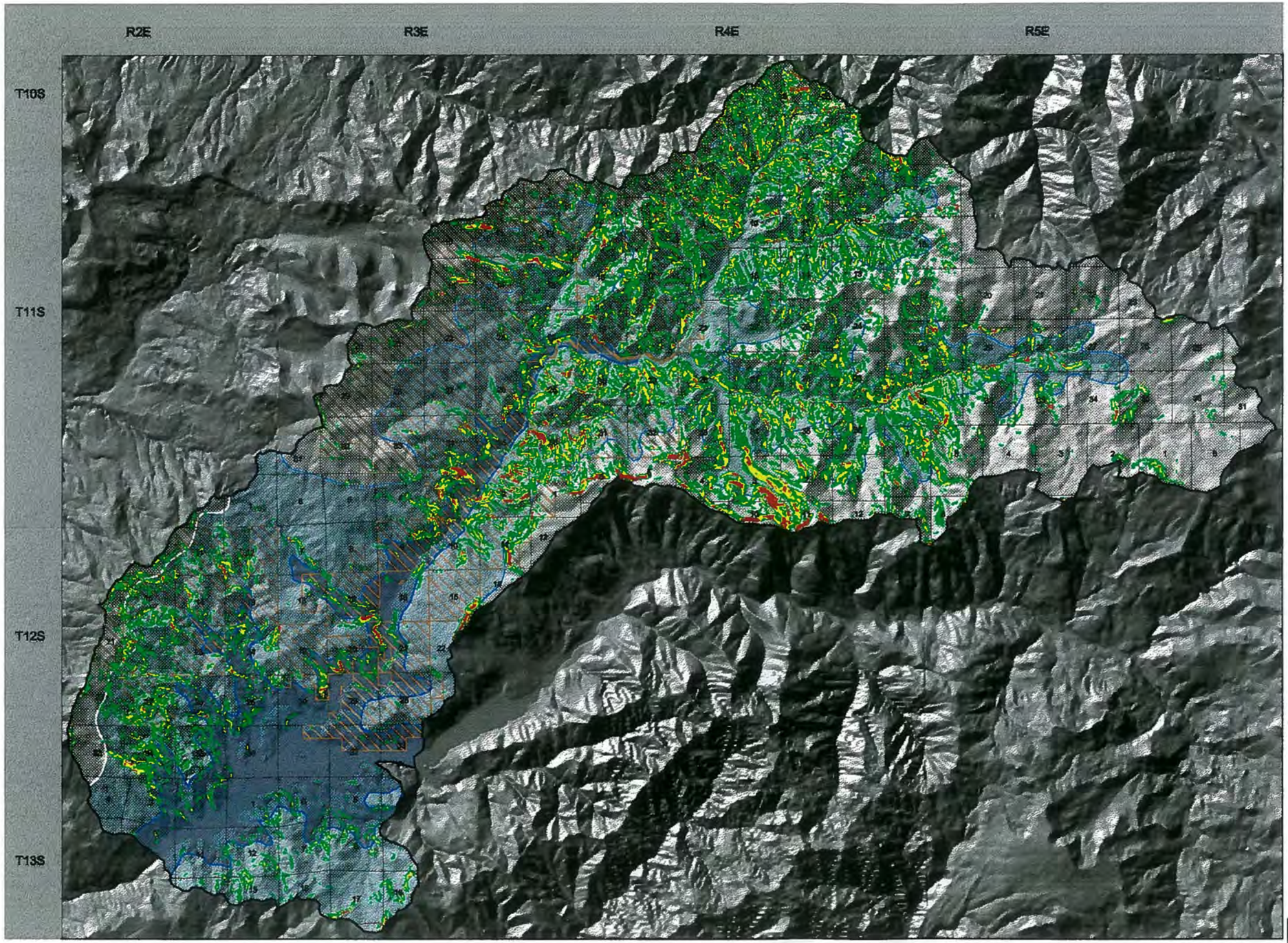
Map#: 14

Quartzville Watershed Analysis



1 0 1 2 3 4 Miles

2 0 2 4 6 Kilometers

N

Map Created:
4/6/2001

Precipitation Zones / Slope Stability Hazard

LEGEND

Slope Hazard
- Severe
- High
- Moderate

Precipitation Zone
- Rain
- Transient Snow
- Snow

BLM Lands

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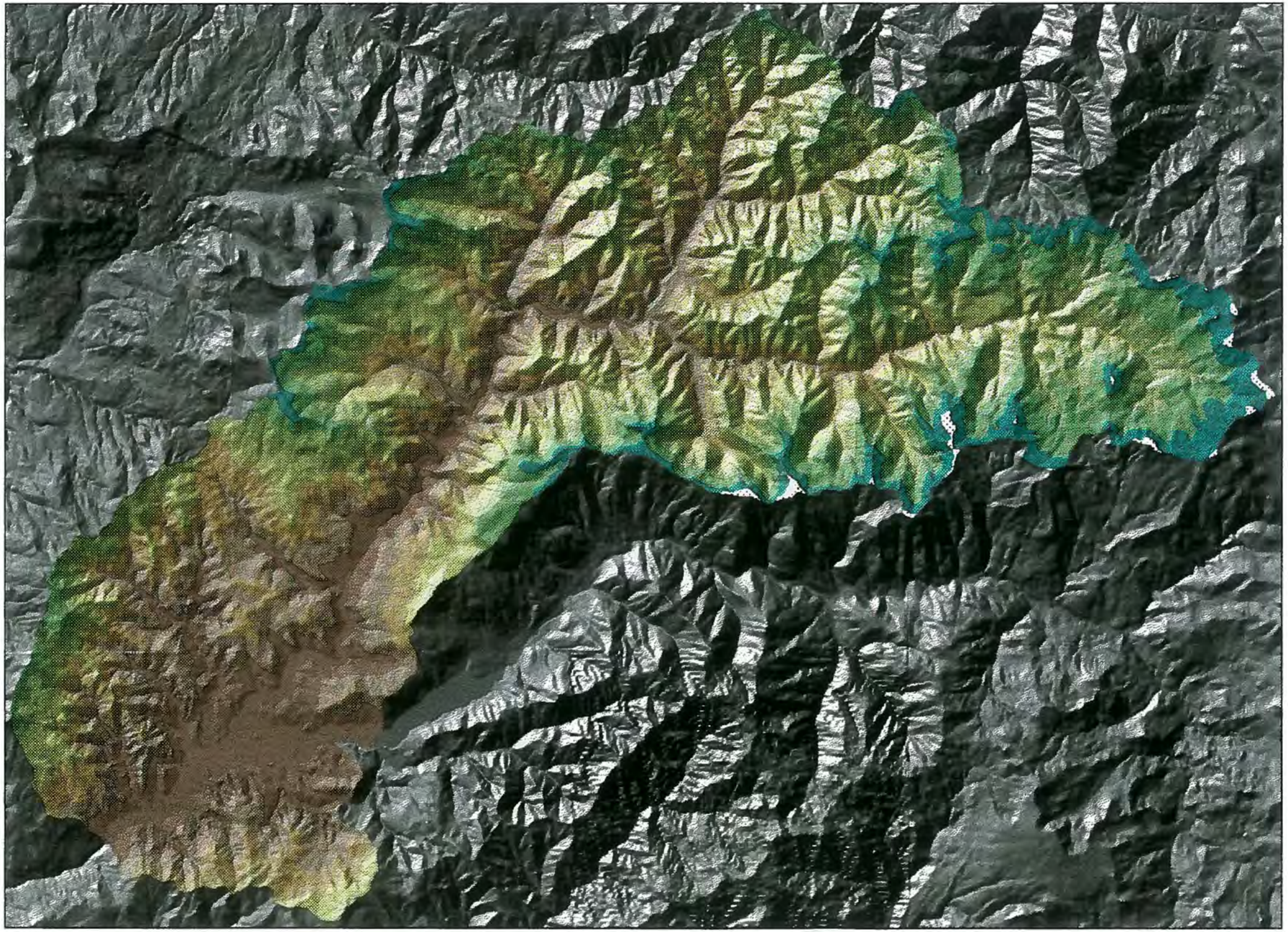
Map#: 15

Quartzville Watershed Analysis



1 0 1 2 3 4 Miles

2 0 2 4 6 Kilometers

N

Map Created:
4/27/2001

Digital Elevation Model

LEGEND

Elevation Range
(Approximate)

- 4999
- 4500
- 4000
- 3500
- 3000
- 2500
- 2000
- 1500
- 1000 Feet

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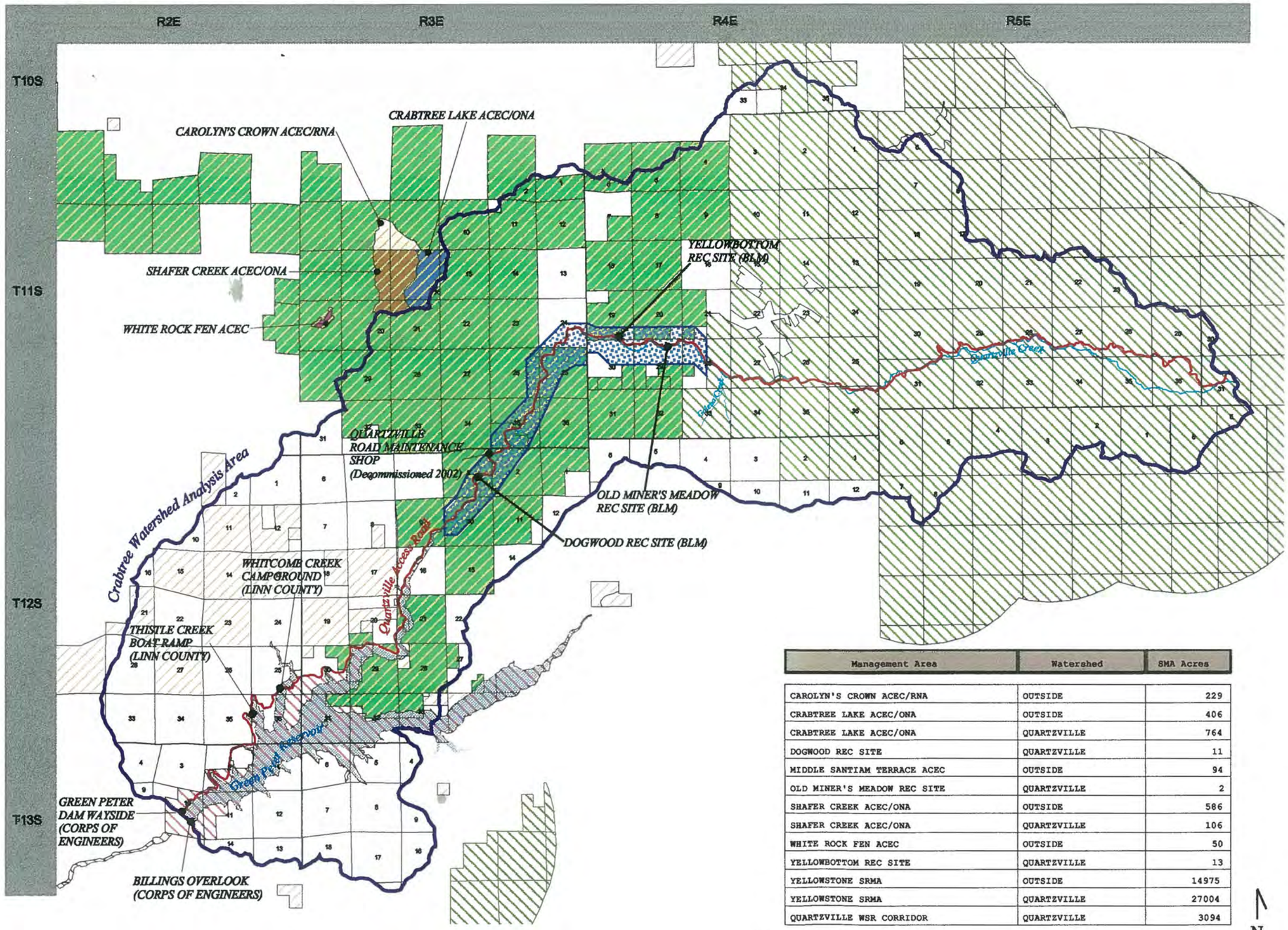
Map#: 16

Quartzville Watershed Analysis



Management Area	Watershed	SMA Acres
CAROLYN'S CROWN ACEC/RNA	OUTSIDE	229
CRABTREE LAKE ACEC/ONA	OUTSIDE	406
CRABTREE LAKE ACEC/ONA	QUARTZVILLE	764
DOGWOOD REC SITE	QUARTZVILLE	11
MIDDLE SANTIAM TERRACE ACEC	OUTSIDE	94
OLD MINER'S MEADOW REC SITE	QUARTZVILLE	2
SHAFER CREEK ACEC/ONA	OUTSIDE	586
SHAFER CREEK ACEC/ONA	QUARTZVILLE	106
WHITE ROCK FEN ACEC	OUTSIDE	50
YELLOWBOTTOM REC SITE	QUARTZVILLE	13
YELLOWSTONE SRMA	OUTSIDE	14975
YELLOWSTONE SRMA	QUARTZVILLE	27004
QUARTZVILLE WSR CORRIDOR	QUARTZVILLE	3094

1 0 1 2 3 4 Miles

2 0 2 4 6 Kilometers

N

Map Created: 2/14/2002

Special Management Areas

LEGEND

Special Management Areas

- Yellowstone Special Recreation Management Area
- Quartzville Wild & Scenic River Corridor

Federal Ownership

- BLM
- US Forest Service
- Corps of Engineers

- Quartzville Watershed Analysis Area Boundary

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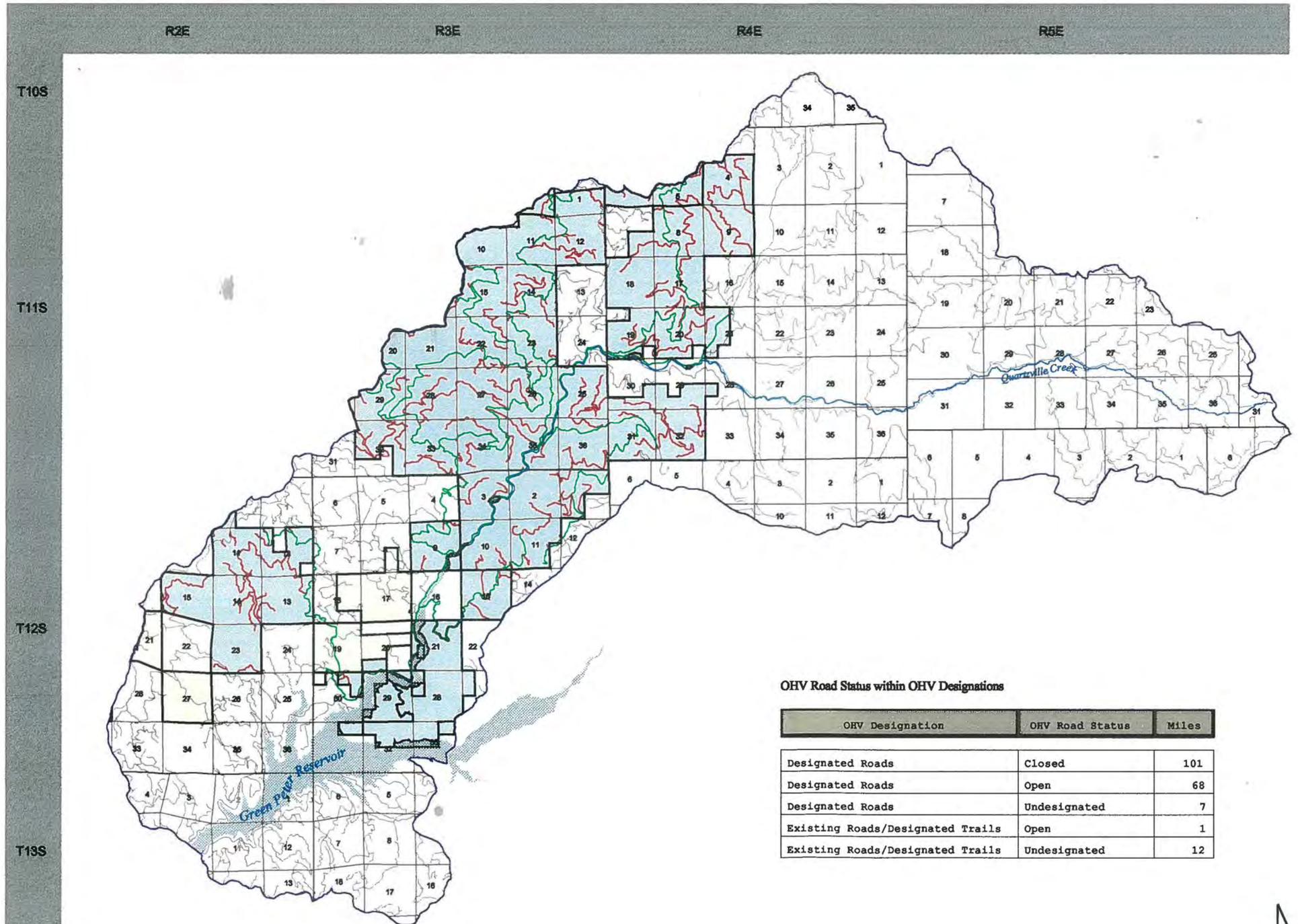
Map#: 17

Quartzville Watershed Analysis



Off-Highway Vehicle Designations

LEGEND

OHV Designations

- Limited to Designated Roads: 28073 Acres
- Limited to Existing Roads/ Designated Trails: 2665 Acres

OHV Road Status

- Closed
- Open
- Undesignated

OHV Road Status within OHV Designations

OHV Designation	OHV Road Status	Miles
Designated Roads	Closed	101
Designated Roads	Open	68
Designated Roads	Undesignated	7
Existing Roads/Designated Trails	Open	1
Existing Roads/Designated Trails	Undesignated	12

1 0 1 2 3 4 Miles

2 0 2 4 6 Kilometers

N

Map Created: 2/21/2002

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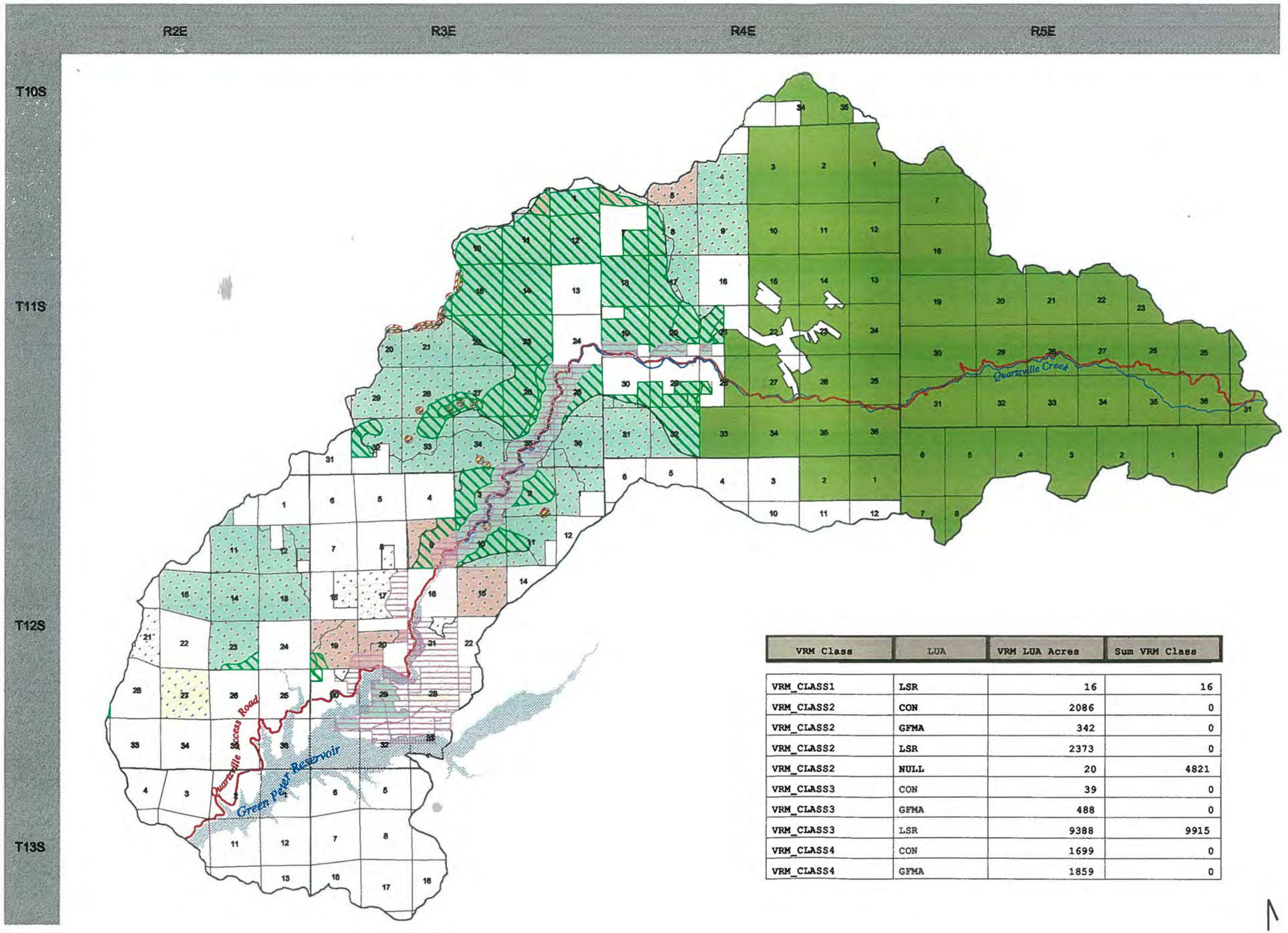
Quartzville Watershed Analysis



VRM Class	LUA	VRM LUA Acres	Sum VRM Class
VRM_CLASS1	LSR	16	16
VRM_CLASS2	CON	2086	0
VRM_CLASS2	GFMA	342	0
VRM_CLASS2	LSR	2373	0
VRM_CLASS2	NULL	20	4821
VRM_CLASS3	CON	39	0
VRM_CLASS3	GFMA	488	0
VRM_CLASS3	LSR	9388	9915
VRM_CLASS4	CON	1699	0
VRM_CLASS4	GFMA	1859	0

1 0 1 2 3 4 Miles

2 0 2 4 6 Kilometers

N

Map Created:
2/22/2002

BLM Visual Resource Management Classifications

LEGEND

VRM Classification

- VRM_CLASS1 (Buffered)
- VRM_CLASS2
- VRM_CLASS3
- VRM_CLASS4

BLM Land Use Allocations

- General Forest Management
- Connectivity
- LSR

- USFS Administered Lands

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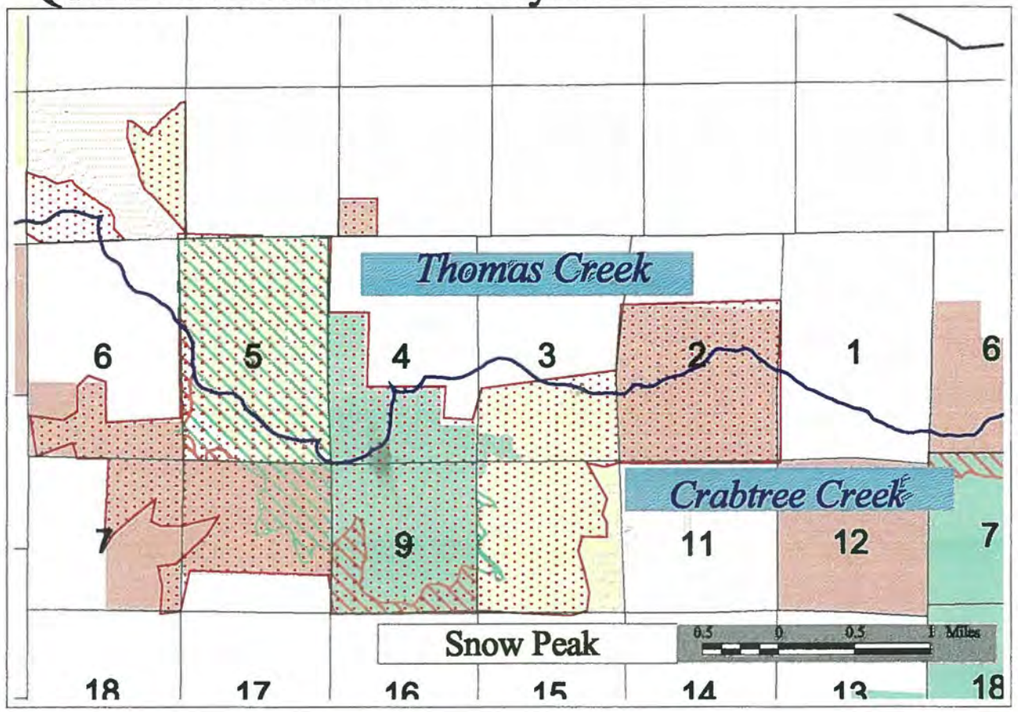
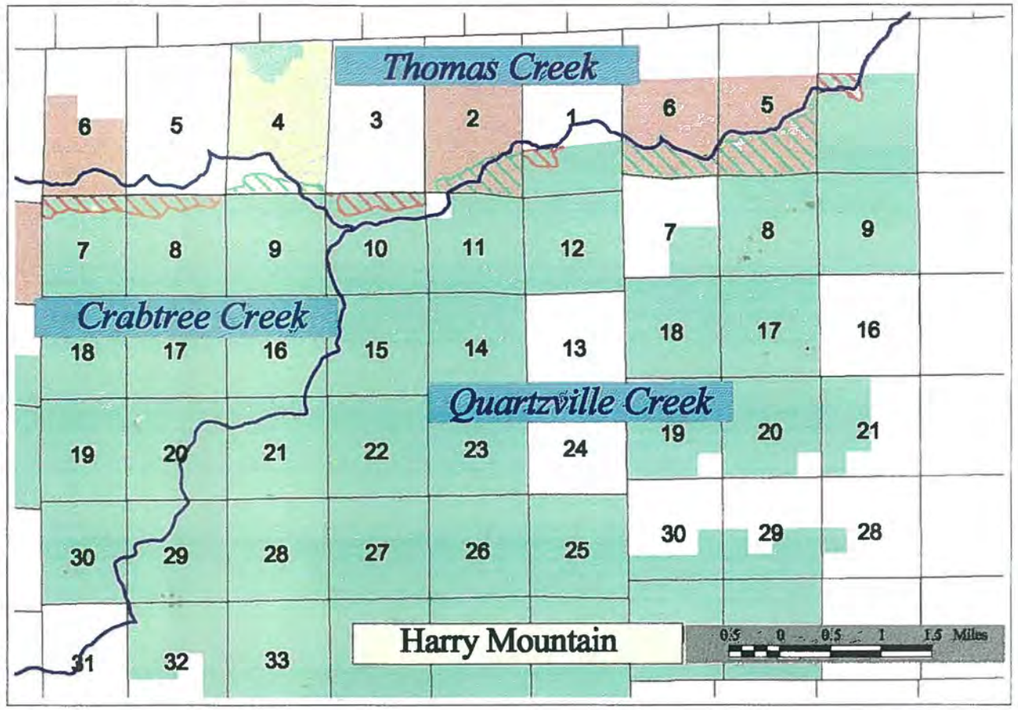
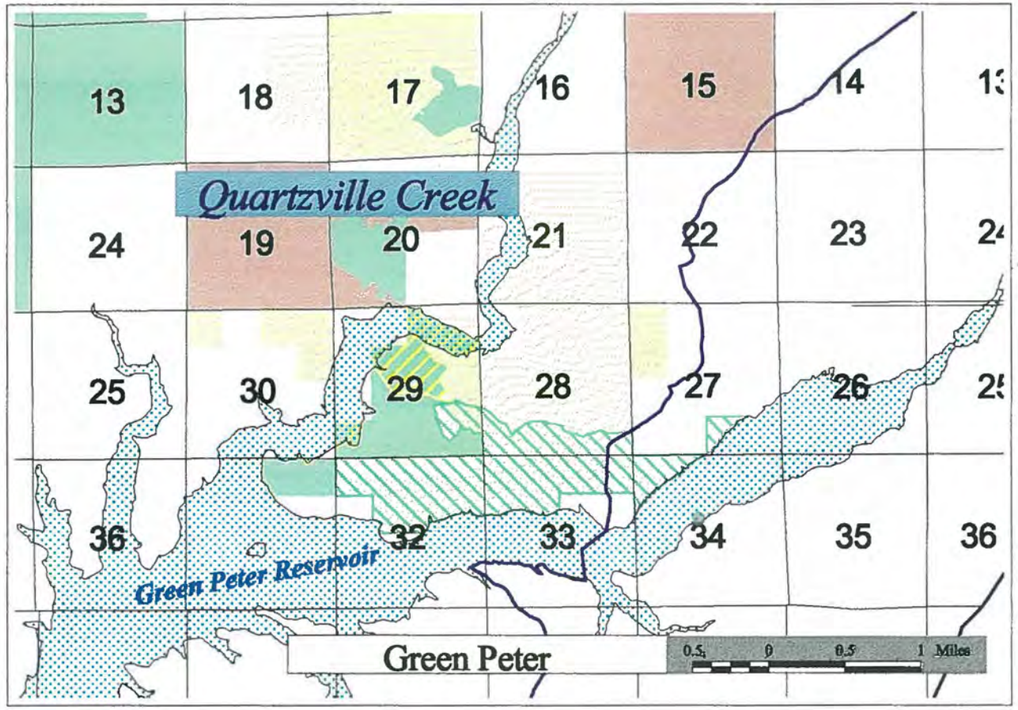
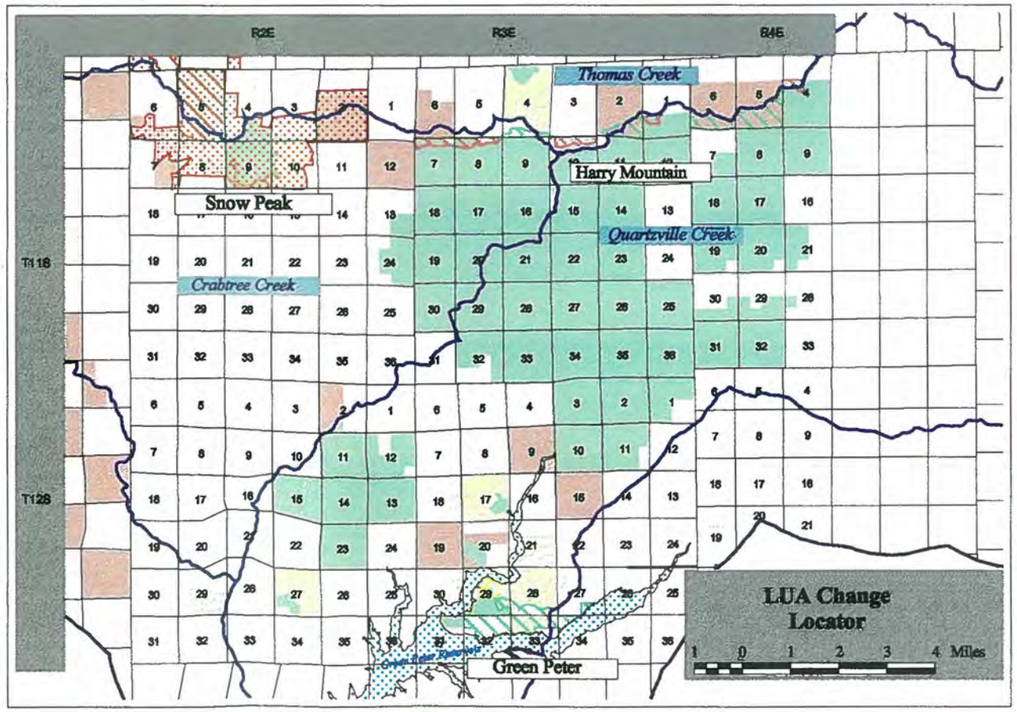
Quartzville Watershed Analysis









Proposed BLM Land Use Allocation Changes

LEGEND

Proposed LUA Change
- General Forest Management
- Connectivity
- Late Successional Reserve

Existing LUA
- General Forest Management
- Connectivity
- Late Successional Reserve

Proposed Snow Peak Bridgeoporous Management Area

Snow Peak — Proposed LUA Change Area

Thomas Creek — Watershed Analysis Area

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2/25/2002

Map#: 20

Appendix A

Acronyms

The following list of acronyms are used in this document:

ACEC Area of Critical Environmental Concern

ACS Aquatic Conservation Strategy

ACSO Aquatic Conservation Strategy Objectives

BLM Bureau of Land Management

BMPs Best Management Practices

BCA Bird Conservation Area

BCI Biotic Condition Index

CCC Civilian Conservation Corps

CFS Cubic Feet per Second

CONN Connectivity

CTQ Community Tolerant Quotient

CWD Coarse Woody Debris

DBH Diameter Breast Height

DEQ Department of Environmental Quality

ECA Equivalent Clearcut Acres

ERDT Existing Roads and Designated Trails

ESA Endangered Species Act

FEIS Final Environmental Impact Statement

Appendix B

Glossary

Age Class - One of the intervals into which the age range of trees is divided for classification or use.

Alluvial - Deposited by a stream or running water.

Anadromous Fish - Fish that are born and reared in freshwater, move to the ocean to grow and mature, and return to freshwater to reproduce. Salmon, steelhead, and shad are examples.

Aquatic Ecosystem - A water based ecosystem (see Ecosystem). An interacting system of water with aquatic organisms (plants and animals).

Aquatic Habitat - Habitat that occurs in free water.

Area of Critical Environmental Concern - An area of BLM-administered lands where special management attention is needed to protect and prevent irreparable damage to important historic, cultural or scenic values, fish and wildlife resources or other natural systems or processes; or to protect life and provide safety from natural hazards.

Basin Programs - Sets of state administrative rules that establish types and amounts of water uses allowed in the state's major river basins and form the basis for issuing water rights.

Best Management Practices - Methods, measures, or practices designed to prevent or reduce water pollution. Not limited to structural and nonstructural controls, and procedures for operations and maintenance. Usually, best management practices are applied as a system of practices rather than a single practice.

Biological Diversity - The variety of life and its processes, including the variety in genes, species, ecosystems, and the ecological processes that connect everything in ecosystems.

Biological legacies - Components of the forest stand (e.g., large trees, downed logs, and snags) reserved from harvest to maintain site productivity and to provide structure and ecological functions in subsequent forest stands.

Bird Conservation Area - According to the *Conservation Strategy for Land Birds in Lowlands and Valleys of Western Oregon and Washington* (American Bird Conservancy, 2000), areas which were selected based on the presence or potential for priority habitats and/or focal land bird species. These areas are intended to provide a focus for any agencies, non-governmental organizations, companies, or private individuals to prioritize where conservation efforts should

occur, and where actions have the greatest opportunity for regional success.

Bureau Assessment Species - Plant and animal species on List 2 of the Oregon Natural Heritage Data Base, or those species on the Oregon List of Sensitive Wildlife Species (Oregon Administrative Rule 635-100-040), which are identified in BLM Instruction Memo No. OR-91-57, and are not included as federal candidate, state-listed or bureau sensitive species.

Bureau Sensitive Species - Plant or animal species eligible for federal listed, federal candidate, state-listed, or state candidate (plant) status, or on List 1 in the Oregon Natural Heritage Data Base, or approved for this category by the state director.

Bureau Tracking Species - Plant and animal species on List 3 or 4 of the Oregon Natural Heritage Data Base, and/or those species listed as Undetermined Status on the Oregon List of Sensitive Wildlife Species (Oregon Administrative Rule 635-100-040), and are not included as federal candidate, state-listed, bureau sensitive, or bureau assessment species.

Candidate Species - Those plants and animals included in Federal Register "Notices of Review" that are being considered by the U.S. Fish and Wildlife Service for listing as threatened or endangered.

Cavity Nesters - Wildlife species, most frequently birds, that require cavities (holes) in trees for nesting and reproduction.

Channel (watercourse) - An open outlet either naturally or artificially created which periodically or continuously contains moving water, or which forms a connecting link between two bodies of water. River, creek, run, branch, and tributary are some of the terms used to describe natural channels. Natural channels may be single or braided.

Climax Community - The final or stable biotic community in a successional series which is self-perpetuating and in dynamic equilibrium with the physical habitat.

Closed Sapling Seral Stage - See Seral Stages.

Coarse Woody Debris (CWD) - Logs on the forest floor that are at least 20 inches in diameter at the large end and twenty feet in length.

Commercial Thinning - The removal of merchantable trees from an even-aged stand to encourage growth of the remaining trees.

Community - An aggregation of living organisms having mutual relationships among themselves and to their environment.

Concern - A topic of management or public interest that is not well enough defined to become a

planning issue, or does not involve controversy or dispute over resource management activities or land use allocations or lend itself to designating land use alternatives. A concern may be addressed in analysis, background documents, or procedures or in a non-controversial decision.

Connectivity - A measure of the extent to which conditions between late-successional/old-growth forest areas provide habitat for breeding, feeding, dispersal, and movement of late-successional/old-growth-associated wildlife species. Connectivity (CONN) is also a Federal Land Use Allocation which is considered to be part of the Matrix. CONN is designed to maintain a minimum of 25 to 30 percent late successional habitat at any given point in time. These lands are managed on a 150 year rotation with greater green tree retention than GFMA.

Core Area - That area of habitat essential in the breeding, nesting and rearing of young, up to the point of dispersal of the young. Most often used in conjunction with nesting spotted owls to describe the area which includes the nest tree and a primary area where the young are reared after leaving the nest.

Critical Habitat - Under the Endangered Species Act, the specific areas within the geographic area occupied by a federally listed species on which are found physical and biological features essential to the conservation of the species, and that may require special management considerations or protection.

Culmination of Mean Annual Increment - The peak of average yearly growth in volume of a forest stand (total volume divided by age of stand).

Cultural Resource - Any definite location of past human activity identifiable through field survey, historical documentation, or oral evidence. Includes archaeological or architectural sites, structures, or places, and places of traditional cultural or religious importance to specified groups whether or not represented by physical remains.

Cultural Site - Any location that includes prehistoric and/or historic evidence of human use or that has important sociocultural value.

Cumulative Effect - The impact which results from identified actions when they are added to other past, present, and reasonably foreseeable future actions regardless of who undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.

Debris Slide/Avalanche - A mass wasting process characterized by a relatively shallow failure plane, which generally corresponds to the soil/bedrock interface. The distinction between an avalanche and a slide is that a slide moves slower, and retains more of a coherent slide mass. An avalanche generally fails rapidly, with the slide mass disaggregating, and sometimes flowing, depending on the water content.

Debris Torrent - Rapid movement of a large quantity of materials (wood and sediment) down a

stream channel during storms or floods. This generally occurs in smaller streams and results in scouring of streambed.

Density Management - Cutting of trees for the primary purpose of widening their spacing so that growth of remaining trees can be accelerated. Density management harvest can also be used to improve forest health, to open the forest canopy, or to accelerate the attainment of old-growth characteristics if maintenance or restoration of biological diversity is the objective.

Desired Condition - Objectives for physical and biological conditions within the watershed. They may be expressed in terms of current conditions, ecosystem potential, or social expectations. They describe the conditions that are to be achieved and are phrased in the present tense.

Desired Future Condition - See Desired Condition.

Developed Recreation Site - A site developed with permanent facilities designed to accommodate recreation use.

Diameter at Breast Height (DBH) - The diameter of a tree 4.5 feet above ground on the uphill side of the tree.

Dispersed Recreation - Outdoor recreation in which visitors are diffused over relatively large areas. Where facilities or developments are provided, they are primarily for access and protection of the environment rather than comfort or convenience of the user.

Domestic Water Supply - Water used for human consumption.

Early-Grass/Forb Seral Stage - See Seral Stages.

Ecosystem - The complex of a community of organisms and its environment functioning as an ecological unit in nature.

Ecosystem Management - The management of lands and their resources to meet objectives based on their whole ecosystem function rather than on their character in isolation. Management objectives blend long-term needs of people and environmental values in such a way that the lands will support diverse, healthy, productive, and sustainable ecosystems.

Eligible River - A river or river segment found, through interdisciplinary team and, in some cases, interagency review, to meet Wild and Scenic Rivers Act criteria of being free flowing and possessing one or more outstandingly remarkable values.

Endangered Species - Any species listed through the Endangered Species Act as being in danger of extinction throughout all or significant portion of its range and published in the Federal

Register.

Endemic - Restricted to a specified region or locality.

Environment - The complex of climatic, soil and biotic factors that act upon an organism or ecological community and ultimately determine its form and survival.

Ephemeral Streams - Streams that contain running water only sporadically, such as during and following storm events.

Erosion - The group of processes whereby earthy or rock material is worn away, loosened or dissolved, and removed from any part of the earth's surface. It includes the processes of weathering, solution, corrosion, and transportation. Erosion is often classified by: The eroding agent (wind, water, wave, or raindrop erosion); the appearance of the erosion (sheet, rill, or gully erosion); the location of the erosional activity (surface or shoreline); and/or by the material being eroded (soil erosion or beach erosion).

Eyrie - A raptor's cliff nest, such as a peregrine falcon.

Exotic Species - Non-native species which occur in a given area as the result of deliberate or accidental introduction of the species from a foreign country.

Fauna - All animals, including birds, mammals, amphibians, reptiles, fish, and invertebrates (clams, insects, etc.).

Fifth Field Watershed - Fifth largest level in watershed classification hierarchy. Generally refers to an area between 20-200 square miles. For the Quartzville Creek Watershed, the 4th field is the South Santiam Subbasin and the 5th field is the Quartzville Creek Watershed.

Flora - All plants, including trees, shrubs, forbs, and grasses, and considered as a whole.

Forest Canopy Closure - The cover of branches and foliage formed collectively by the crowns of adjacent trees and other woody growth.

Forest Land - Land that is now, or is capable of becoming, at least 10 percent stocked with forest trees and that has not been developed for nontimber use.

Forest Succession - The orderly process of change in a forest as one plant community or stand condition is replaced by another, evolving towards the climax type of vegetation.

Fragmentation - Breaking up of contiguous areas into progressively smaller patches of increasing degrees of isolation.

General Forest Management Area (GFMA) - A Federal Land Use Allocation which is considered to be part of the Matrix. GFMA is managed on a regeneration harvest cycle of 70 to 110 years and a biological legacy of six to eight green trees per acre is retained to provide habitat components over the next management cycle.

Green Tree Retention - A stand management practice in which live green trees, as well as snags and large down wood, are left as biological legacies within harvest units to provide habitat components over the next management cycle.

Habitat Fragmentation - The breaking up of habitat into discrete islands through modification or conversion of habitat by management activities.

Hazardous Materials - Anything that poses a substantive present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

Historic Site - A cultural resource resulting from activities or events dating to the historic period (generally post AD 1830 in western Oregon).

Impact - A spatial or temporal change in the environment caused by human activity.

Infiltration (soil) - The movement of water through the soil surface into the soil.

Interior Habitat Area (IHA) - According to *Northwest Oregon State Forests Management Plan* (Oregon Department of Forestry, 2001), areas of various shapes and sizes consisting of older forest structure and layered stands designated in specific areas to protect municipal watersheds, sensitive fisheries, recreation and scenic areas, and provide spotted owl habitat.

Intermittent Stream - Any nonpermanent flowing drainage feature having a definable channel and evidence of scour or deposition. This includes what are sometimes referred to as ephemeral streams if they meet these two criteria.

Issue - A matter of controversy or dispute over resource management activities that is well defined or topically discrete. Addressed in the design of planning alternatives.

Key Questions - Questions that watershed analysis attempts to answer. These are the interdisciplinary team's expectations for the analysis. Key questions are designed to: Focus on ecosystem elements that influenced by potential management activities; be measured at the watershed scale; and promote integration among elements.

Landscape - A heterogeneous land area with interacting plant communities and non-forest lands across a large area such as a watershed.

Landscape Diversity - The size, shape and connectivity of different plant communities and non-forest lands across a large area.

Landscape Features - The land and water form, plant communities, structures, elements, and non-forest lands which compose the characteristic landscape.

Land Use Allocations - Federal allocations which define allowable uses/activities, restricted uses/activities, and prohibited uses/activities according to the various Forest and Resource Management Plans. Each Land Use Allocation is associated with specific management objectives.

Large Woody Debris - See Coarse Woody Debris.

Late-Successional Forests - Forest seral stages which include mature and old-growth age classes, generally 80 years and older.

Late-Successional Reserves (LSR) - A Federal Land Use Allocation which is reserved and managed to maintain, protect, and promote late successional forest habitat and associated species.

Long Term - The period starting 10 years following implementation of the resource management plan. For most analyses, long-term impacts are defined as those existing 100 years after implementation.

Long-Term Soil Productivity - The capability of soil to sustain inherent, natural growth potential of plants and plant communities over time.

Mass Movement - The downslope movement of earth caused by gravity. Includes but is not limited to landslides, rock falls, debris avalanches, and creep. It does not include surface erosion.

Matrix Lands - Federal land outside of reserves and special management areas that will be available for timber harvest at varying levels. Consists of both Connectivity (CONN) and General Forest Management Area (GFMA) lands.

Mature Seral Stage - See Seral Stages.

Mining Claims - Portions of public lands claimed for possession of locatable mineral deposits, by locating and recording under established rules and pursuant to the 1872 Mining Law.

Mitigating Measures - Modifications of actions which:

- avoid impacts by not taking a certain action or parts of an action;
- minimize impacts by limiting the degree or magnitude of the action and its implementation;

. rectify impacts by repairing, rehabilitating or restoring the affected environment;
. reduce or eliminate impacts over time by preservation and maintenance operations during the life of the action; or
. compensate for impacts by replacing or providing substitute resources or environments.

Monitoring - The process of collecting information to evaluate if objectives and anticipated or assumed results of a management plan or action are being realized or if implementation is proceeding as planned.

Multilayered Canopy - Forest stands with two or more distinct tree layers in the canopy (also called multistoried stands.

Multiple Use - Management of the public lands and their various resource values so that they are utilized in the combination that will best meet the present and future needs of the American people; making the most judicious use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use to conform to changing needs and conditions. Multiple use can include the use of some land for less than all of the resources and a combination of balanced and diverse resource uses that takes into account the long-term needs of future generations for renewable and nonrenewable resources. Multiple use includes, but is not limited to, recreation, range, timber, minerals, watershed, wildlife and fish, and natural scenic, scientific, and historical values; and harmonious and coordinated management of these various resources without permanent impairment of the productivity of the land and the quality of the environment with consideration being given to the relative values of the resources and not necessarily to the combination of uses that will give the greatest economic return.

Non-forest Land - Land developed for non-timber (human) uses or non-forest types incapable of being 10 percent stocked with forest trees.

Nonpoint Source Pollution - Water pollution that does not result from a discharge at a specific, single location (such as a single pipe) but generally results from land runoff, precipitation, atmospheric deposition or percolation, and normally is associated with agricultural, silvicultural and urban runoff, runoff from construction activities, etc. Such pollution results in the human-made or human-induced alteration of the chemical, physical, biological, radiological integrity of water.

Noxious Plant or Weed - A plant specified by law as being especially undesirable, troublesome, and difficult to control.

Objectives - Expressions of what are the desired end results of management efforts.

Off-Highway Vehicle - Any motorized track or wheeled vehicle designed for cross country travel over natural terrain. The term “Off-Highway Vehicle” will be used in place of the term

"Off-Road Vehicle" to comply with the purposes of Executive Orders 11644 and 11989. The definition of both terms is the same.

Off-Highway Vehicle Designations:

. **Open**: Designated areas and trails where off-highway vehicles may be operated subject to operating regulations and vehicle standards set forth in BLM Manuals 8341 and 8343.

. **Limited**: Designated areas and trails where off-highway vehicles are subject to restrictions limiting the number or types of vehicles, date, and time of use; limited to existing or designated roads and trails.

. **Closed**: Areas and trails where the use of off-highway vehicles is permanently or temporarily prohibited. Emergency use is allowed.

Old-Growth Associated Species - An animal species so adapted that it is associated primarily with old-growth forests.

Old-Growth Conifer Stand - Older forests occurring on western hemlock, mixed conifer, or mixed evergreen sites which differ significantly from younger forests in structure, ecological function, and species composition. Old-growth characteristics begin to appear in unmanaged forests at 175 to 250 years of age. These characteristics include:
. a patchy, multilayered canopy with trees of several age classes;
. the presence of large living trees;
. the presence of large standing dead trees (snags) and down coarse woody debris; and
. the presence of species and functional processes which are representative of the potential natural community.

For purposes of inventory, old-growth stands on BLM-administered lands are only identified if they are at least 10 percent stocked with trees of 200 years or older and are ten acres or more in size. For purposes of habitat or biological diversity, the BLM uses the appropriate minimum and average definitions provided by Pacific Northwest Experiment Station publications 447 and GTR-285. This definition is summarized from the 1986 interim definitions of the Old-Growth Definitions Task Group.

Old-Growth Seral Stage - See Seral Stages.

Open Sapling/Brush Seral Stage - See Seral Stages.

Operations Inventory - An intensive, site-specific BLM forest inventory of forest stand location, size, silvicultural needs, and recommended treatment based on individual stand conditions and productivity.

Outstandingly Remarkable Values - Values among those listed in Section 1(b) of the Wild and Scenic Rivers Act: "scenic, recreational, geological, fish and wildlife, historical, cultural, or other similar values." Other similar values which may be considered include ecological, biological or botanical, paleontological, hydrological, scientific, or research.

Peak Flow - The highest amount of stream or river flow occurring in a year or from a single storm event or period of snow melt.

Perennial Stream - A stream that has running water on a year-round basis under normal climatic conditions.

Physiographic Province - A continuous geographic area wherein species composition, both plant and animal, is more homogeneous than between adjacent areas.

Plant Association - A plant community type based on land management potential, successional patterns, and species composition.

Plant Community - An association of plants of various species found growing together in different areas with similar site characteristics.

Pool/Riffle Ratio - The ratio of surface area or length of pools to the surface area or length of riffles in a given stream reach; frequently expressed as the relative percentage of each category. Used to describe fish habitat rearing quality.

Population - A group of individuals of a species living in a certain area. They have a common ancestry and are much more likely to mate with one another than with individuals from another area.

Precommercial Thinning - The practice of removing some of the trees less than merchantable size from a stand so that remaining trees will grow faster.

Proposed Threatened or Endangered Species - Plant or animal species proposed by the U.S. Fish and Wildlife Service to be biologically appropriate for listing as threatened or endangered, and published in the Federal Register. It is not a final designation.

Public Water System - A system providing piped water for public consumption. Such a system has at least fifteen service connections or regularly serves at least twenty-five individuals.

Rearing Habitat - Areas in rivers or streams where juvenile salmon and trout find food and shelter to live and grow.

Regeneration Harvest - Timber harvest conducted at the end of the rotation with the objective

of opening a forest stand to the point where favored tree species will be reestablished.

Relative Density (Curtis, 1982) - A measure that estimates stand density using stand basal area and tree diameters.

Resource Management Plan - A land use plan prepared by the BLM under current regulations in accordance with the Federal Land Policy and Management Act (FLPMA).

Restoration - The process of restoring site conditions as they were before a land disturbance.

Right-of-Way - A permit or an easement that authorizes the use of public lands for specified purposes, such as pipelines, roads, telephone lines, electric lines, reservoirs, and the lands covered by such an easement or permit.

Riparian Reserves - A Land Use Allocation which overlays the entire Federal land base as stream buffers. Riparian Reserves are to be managed to maintain and enhance riparian and late successional conditions to meet Aquatic Conservation Strategy Objectives.

Riparian Zone - Those terrestrial areas where the vegetation complex and microclimate conditions are products of the combined presence and influence of perennial and/or intermittent water, associated high water tables and soils which exhibit some wetness characteristics. Normally used to refer to the zone within which plants grow rooted in the water table of these rivers, streams, lakes, ponds, reservoirs, springs, marshes, seeps, bogs, and wet meadows.

River Basin - An area, defined by physical boundaries, in which all surface water flows to a common point. River basins are associated with large river systems and are typically 1000s of square miles in size.

Rotation - The planned number of years between establishment of a forest stand and its regeneration harvest. The management cycle.

Rural Interface Areas - Areas where BLM-administered lands are adjacent to or intermingled with privately owned lands zoned for 1 to 20-acre lots, or that already have residential development.

Sediment Yield - The quantity of soil, rock particles, organic matter, or other debris transported through a cross-section of stream in a given period of time. Measured in dry weight or by volume. Consists of suspended sediment and bedload.

Seral - A biotic community which is a developmental, transitory stage in an ecological succession.

Seral Stages - The series of relatively transitory plant communities which develop during forest

succession from bare ground to the climax stage. There are five stages:

Early Grass/Forb Seral Stage - The period in the life of a forest stand from disturbance to stand establishment with forest tree saplings. Grass, forbs and herbs, including annuals and perennials, dominate the site. Tree age class is generally from 0 through 10.

Open Sapling/Brush Seral Stage - The period in the life of a forest stand from stand establishment to crown closure. Usually occurs from ages 10 through 40, with tree diameters less than 10 inches DBH. Depending on stand density, brush dominates, with grass and forbs declining as the stand reaches crown closure.

Closed Sapling Seral Stage - The period in the life of a forest stand from first merchantability to culmination of mean annual increment. Much of the commercial thinning occurs during this stage, generally 40 to 80 years of age, with tree diameters typically ranging from 11 to 20 inches DBH. During this period, stand diversity is at its minimum, with grasses, forbs and brush often sparse due to high canopy closures.

Mature Seral Stage - The period in the life of a forest stand from culmination of mean annual increment to an old-growth stage or stand condition. Usually occurs from stand ages 80 to 200 years. Tree diameters of dominants and co-dominants typically range from 21 to 30 inches DBH. This is a time of gradually increasing stand diversity and differentiation, with increasing understory components, including a multilayered canopy, understory brush layers, grasses, forbs.

Old-Growth Seral Stage - This stage constitutes the potential or climax plant community capable of existing on a site, given the frequency of natural disturbance events. For forest communities, this stage exists from approximately age 200 until when stand replacement occurs and secondary succession begins again. Tree diameters of dominants and co-dominants are greater than 30 inches DBH. Depending on fire frequency and intensity, old-growth stands vary in their species composition, stocking levels, age class distributions, and amounts and sizes of snags and down coarse woody debris.

Short Term - The period of time during which the Resource Management Plan will be implemented; assumed to be ten years.

Site - An area described or defined by its biotic, climatic, and soil conditions as related to its capacity to produce vegetation; an area sufficiently uniform in biotic, climatic, and soil conditions to produce a particular climax vegetation.

Site Class - A measure of an area's relative capacity to producing timber or other vegetation.

Site Index - A measure of forest productivity expressed as the height of the tallest trees in a

stand at an index age.

Slope Failure - See Mass Movement.

Snag - Any standing dead, partially-dead, or defective (cull) tree at least 10 inches DBH and, at least, 6 feet tall. A hard snag is composed primarily of sound wood, generally merchantable. A soft snag is composed primarily of wood in advanced stages of decay and deterioration, generally not merchantable.

Snag Dependent Species - Birds and animals dependent on snags for nesting, roosting, or foraging habitat.

Soil Compaction - An increase in bulk density (weight per unit volume) and a decrease in soil porosity resulting from applied loads, vibration, or pressure.

Soil Displacement - The removal and horizontal movement of soil from one place to another by mechanical forces such as a blade.

Soil Productivity - Capacity or suitability of a soil for establishment and growth of a specified crop or plant species, primarily through nutrient availability.

Soil Series - A group of soils developed from a particular type of parent material; having naturally developed horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement of the profile.

Special Forest Products - Firewood, cedar shake bolts, mushrooms, ferns, floral greens, berries, mosses, bark, grasses, Christmas trees, etc., that could be harvested in accordance with the objectives and guidelines in the proposed resource management plan.

Special Habitat Features - Habitats of special importance due to their high ecological values. Examples include meadows, rock talus, cliffs and caves.

Special Recreation Management Area - An area where a commitment has been to provide specific recreation activity and experience opportunities. These areas usually require a high level of recreation investment and/or management. They include recreation sites, but recreation sites alone do not usually constitute special recreation management areas.

Special Status Species - Plant or animal species falling in any of the following categories (see separate glossary definitions for each):

- Threatened or Endangered Species
- Proposed Threatened or Endangered Species
- Candidate Species
- State-Listed Species

. Bureau Sensitive Species
. Bureau Assessment Species

Spotted Owl Capable Habitat - Forest habitat that is not currently classified or functioning as dispersal or suitable habitat for spotted owls, but has the capability to become suitable habitat over time. Capable habitat is in younger age classes, less than 40 years of age.

Spotted Owl Dispersal Habitat - Forest habitat that is classified as able to provide for enough of the basic life history requirements of spotted owls to enable movement across the landscape between areas of suitable habitat. Such stands generally lack the structure and characteristics to support nesting or resident spotted owls for long periods of time. Dispersal habitat is in the closed sapling seral stage 40 to 80 years of age, with crown closures over 40 percent and average diameters of 11 inches or more.

Spotted Owl Foraging, and Roosting Habitat - Forest habitat that is capable of supporting most of the life history requirements of resident spotted owls, but generally lack the structure required for nesting. These stands are usually in the mature seral stage, 80 to 120 years of age.

Spotted Owl Known Sites - Sites monitored by BLM for spotted owl occupancy during some or all of the years from 1985 to the present time, in accordance with U.S. Fish and Wildlife's spotted owl monitoring guidelines. These sites are known to have been occupied by spotted owls at some time during the last ten years.

Spotted Owl Nesting, Foraging, and Roosting (NFR) Habitat - Forest habitat that is capable of supporting all life history requirements of resident spotted owls, including nesting activities. These stands are generally in the mature and old-growth seral stages, over 120 years of age.

Spotted Owl Non-Capable Habitat - Non-forest habitat that is not classified as dispersal or suitable habitat for spotted owls, and does not have the capability to become suitable habitat over time. Non-capable habitat includes land developed for non-timber (human) uses and non-forest types incapable of being 10 percent stocked with forest trees.

Spotted Owl Suitable Habitat - Forest habitat that is capable of supporting resident spotted owls. Suitable habitat is comprised of both nesting, foraging, and roosting habitat, plus foraging and roosting habitat. These stands are generally in the mature and old-growth seral stages, over 80 years of age.

Stand (Tree Stand) - An aggregation of trees occupying a specific area and sufficiently uniform in composition, age, arrangement, and condition so that it is distinguishable from the forest in adjacent areas.

Stand Density - An expression of the number and size of trees on a forest site. My be expressed in terms of numbers of trees per acre, basal area, stand density index, or relative density index.

State-Listed Species - Plant or animal species listed by the state of Oregon as threatened or endangered pursuant to ORS 496.004, ORS 498.026, or ORS 564.040.

Statewide Comprehensive Outdoor Recreation Plan (SCORP) - A plan prepared by the state, which describes and analyzes the organization and function of the outdoor recreation system of the state. The plan provides an analysis of the roles and responsibilities of major outdoor recreation suppliers; an analysis of supply, demand, and needs; issue discussions; an action program to address the issues; and a project selection process.

Stocked/Stocking - A measure of the number and spacing of trees in a forest stand.

Stream Class - A system of stream classification established in the Oregon Forest Practices Act. Class I streams are those which are significant for (1) domestic use; (2) angling; (3) water dependent recreation; and (4) spawning, rearing or migration of anadromous or game fish. All other streams are class II. Class II special protection streams (class II SP) are class II streams which have a significant summertime cooling influence on downstream class I waters which are at or near a temperature at which production of anadromous or game fish is limited.

Stream Order - A hydrologic system of stream classification based on stream branching. Each small unbranched tributary is a first order stream. Two first order streams join to make a second order stream. Two second order streams join to form a third order stream and so forth, with the main stream being always of the highest order.

Stream Reach - An individual first order stream or a segment of another stream that has beginning and ending points at stream confluence. Reach end points are normally designated where a tributary confluence changes the channel character or order. Although reaches identified by BLM are variable in length, they normally have a range of one-half to one and one-half miles in length unless channel character, confluence distribution, or management considerations require variance.

Structural Diversity - Variety in a forest stand that results from layering or tiering of the canopy and the die-back, death and ultimate decay of trees. Structural diversity is measured in terms of the amount, sizes and condition of forest canopy layers, snags, and down coarse woody debris.

Sub-Watershed - A sub-division of the watershed into sub-basins in order to allow tracking of various watershed functions on a more localized (site-specific) basis. For the Quartzville Creek watershed analysis, there are seven sub-watersheds (6^{th} field watersheds), which are: Canal Creek, Lone Star, Moose Creek, Packers Gulch, South Green Peter, Upper Quartzville, and Whitcomb Creek.

Succession - A series of dynamic changes by which one group of organisms succeeds another through stages leading to potential natural community or climax. An example is the development of series of plant communities (called seral stages) following a major disturbance.

Surface Erosion - The detachment and transport of soil particles by wind, water, or gravity. Surface erosion can occur as the loss of soil in a uniform layer (sheet erosion), in many rills, or by dry ravel.

Suspended Sediment - Sediment suspended in a fluid by the upward components of turbulent currents or by colloidal suspension.

Terrestrial - Living primarily on land rather than in water.

Terrestrial Ecosystem - An interacting system of soil, geology, topography with plant and animal communities.

Texture (soil) - The relative proportion of sand, silt, and clay in a soil; grouped into standard classes and subclasses in the U.S. Department of Agriculture *Soil Survey Manual.*

Threatened Species - Any species listed through the Endangered Species Act as likely to become endangered within the foreseeable future throughout all or a significant portion of its range and published in the Federal Register.

Timber Production Capability Classification (TPCC) - The BLM process of partitioning forest land into major classes indicating relative suitability to produce timber on a sustained yield basis.

Transient Snow Zone - The elevation range within a watershed where snowfall is transitory in nature and rain-on-snow events occur several times during winter months.

Transportation System - Network of roads used to manage BLM-administered lands. Includes BLM-controlled roads and some privately controlled roads. Does not include Oregon Department of Transportation, county, and municipal roads.

Understocked - The condition when a plantation of trees fails to meet the minimum requirements for number of well-spaced trees per acre.

Viewshed - The landscape that can be directly seen from a viewpoint or along a transportation corridor.

Visual Resources - The visible physical features of a landscape.

Visual Resource Management - The inventory and planning actions taken to identify visual values, establish visual management objectives, and the management actions needed to achieve those objectives.

Visual Resource Management Classes - Categories assigned to public lands based on scenic quality, sensitivity level, and distance zones. There are four classes. Each class has an objective that prescribes the amount of modification allowed in the landscape.

Water Quality - The chemical, physical, and biological characteristics of water.

Watershed - A region or area bounded peripherally by a water parting feature and draining ultimately to a particular watercourse or body of water. There are many watersheds within a river basin. Watershed area range from 20 to 200 square miles in size.

Watershed Analysis - Development and documentation of a scientifically based understanding of the processes and interactions occurring within a watershed in order to make more sound management decisions.

Water Yield - The quantity of water derived from a unit area of watershed.

Western Oregon Digital Data Base (WODDB) - A very high resolution (1 inch = 400 feet) geographic digital (computer) data base derived from aerial photography for BLM-administered lands in Western Oregon.

Wetlands or Wetland Habitat - Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for living in saturated soil conditions. Wetlands generally include, but are not limited to, swamps, marshes, bogs, and similar areas.

Wet Meadows - Wetland areas where grasses predominate. Normally waterlogged within a few inches of the ground surface.

Wild and Scenic Rivers System - A national system of rivers or river segments that have been designated by Congress and the President as part of the National Wild and Scenic Rivers System (Public Law 90-542, 1968). Each designated river is classified as one of the following:

> **Wild Classification** - A river or section of a river free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. Designated wild as part of the National Wild and Scenic Rivers System.
>
> **Scenic Classification** - A river or section of a river free of impoundments, with shorelines or watersheds still largely primitive and undeveloped but accessible in places by roads. Designated scenic as part of the National Wild and Scenic Rivers System.
>
> **Recreational Classification** - A river or section of a river readily accessible by road or

railroad, that may have some development along its shorelines, and that may have undergone some impoundment or diversion in the past. Designated recreational as part of the National Wild and Scenic Rivers System.

FOI	Forest Operations Inventory
FPA	Forest Practices Act (State of Oregon)
GFMA	General Forest Management Area
GIS	Geographic Inventory System
GLO	Government Land Office
HJA	H.J. Andrews Experimental Forest
IDT	Interdisciplinary team
KOS	Known (spotted) Owl Site
LCFPA	Linn County Forest Protection Association
LEA	Law Enforcement Agreement
LHU	Lynx Habitat Unit
LSR	Late Successional Reserve
LSRA	Late Successional Reserve Assessment
LUA	Land Use Allocation
LWD	Large Woody Debris
MFRI	Mean Fire Return Interval
NEPA	National Environmental Protection Act
NFP	Northwest Forest Plan
NMFS	National Marine Fisheries Service
ODEQ	Oregon Department of Environmental Quality
ODF	Oregon Department of Forestry
ODFW	Oregon Department of Fish and Wildlife

OFPA	Oregon Forest Practices Act
OHV	Off Highway Vehicle
ONA	Outstanding Natural Area
ONHP	Oregon Natural History Program
OI	BLM Operations Inventory: Forest Cover Stand Condition and Management History
PCT	Precommercial Thinning
RD	Relative Density
REAP	Regional Ecological Analysis
RIA	Rural Interface Area
RMP	Salem District Resource Management Plan
RM	River Miles
RN	Roaded Natural
RNA	Research Natural Area
RNV	Range of Natural Variation
ROD	Record of Decision
ROS	Recreation Opportunity Spectrum
RR	Riparian Reserve
SCORP	Statewide Comprehensive Outdoor Recreation Plan
SCS	Soil Conservation Service
SEIS	Supplemental Environmental Impact Statement
SFP	Special Forest Products

SNC	Swiss Needle Cast
SRMA	Special Recreation Management Area
SSS	Special Status Species
SSSA	Special Status Special Attention Species
SWB	Sub-Watershed Basin
TMO	Transportation Management Objective
TMP	Transportation Management Plan
TPCC	Timber Production Capability Classification
TSZ	Transient Snow Zone
USDA	U.S. Department of Agriculture
USDC	U.S. Department of Commerce
USDI	U.S. Department of Interior
USGS	U.S. Geological Survey
USFS	U.S. Forest Service
USFWS	U.S. Fish & Wildlife Service
VRM	Visual Resource Management
WA	Watershed Analysis
WAA	Watershed Analysis Area
WAR	Water Available for Runoff
WFPB	Washington Forest Practices Board
WOBS	Wildlife Observations
WODIP	Western Oregon Digital Imagery Project

WQRP Water Quality Restoration Plan

WRB Willamette River Basin

WRD Water Resources Department

WRIS Water Rights Information System

Appendix C

Public Scoping and Comments on Quartzville Watershed Issues and Concerns

The issue identification and scoping process are a two-phased approach. The first step involved scoping through the IDT of scientists and resource professionals. Primary team members were staff from within the Bureau of Land Management (BLM) Cascades Resource Area. During the spring of 2000, an informational scoping letter containing a questionnaire was sent out to watershed landowners, other local, county, and state agencies, and other interested individuals and organizations. These individuals, groups, and organizations were encouraged to complete the questionnaire and return it to our office. In addition, notification regarding ongoing watershed analyses was published in the Salem District Project Update, with contact names, email addresses and phone numbers. Contained within this appendix are a summary of comments, issues and concerns received on the Quartzville Watershed, **Notice of Crabtree and Quartzville Watershed Analysis, Watershed Analysis: Questions and Answers**, and a summary of the questionnaire that was sent out to the public.

Summary of Public Comments on Quartzville Watershed Analysis Issues and Concerns

Most Important Issues

Need more areas to ride Off-Highway Vehicles

Keep motorized access open to recreational areas in the watershed

Lack of rest rooms where overnight camping is allowed

Clearcutting has resulted in a great increase in water runoff and landslides

Pollution of creeks and streams

Increased stream sedimentation

Loss of private property due to flooding

Declining fishery resource

Not replanting trees after harvest

Support Law Enforcement efforts

How Would You Like to See Federal Lands Managed in the Quartzville Watershed?

Positive management of the motorcycle riding area

Give all interest groups equal preference in how the lands are managed

No harassment of landowners; enforce rules already in place

For timber protection, creating a more natural range of forest conditions

No clearcutting

Manage lands for wildlife benefit

Streambank stabilization

Plant more trees on harvested land

More dams to control flooding

Keep roads and lands open to the public for recreational uses

Remove diseased spike tops and do more thinning

Maintain roads for fire control access using Legacy Road Maintenance Standards under the Oregon Salmon Plan

Maintain the Church Creek closure to control ORV activity and damage and to lessen the threat from fire

What Kind of Watershed Restoration Work Would You Like to See Planned in the Watershed?

Maintain motorcycle trails to eliminate erosion problems

Replant more trees in harvested areas

Keep streams at appropriate safe flow volumes

Spray the maple tree stumps

Other Comments, Issues, or Concerns

Disappointed with the level of funding and support the BLM contributes to the Forest Security Program through Linn Forest Protection Association and the Linn County Sheriff's Office. BLM should pay an equal share like the private landowners do.

Law enforcement is essential in maintaining and protecting a watershed; need more officers out there patrolling the watershed.

Waterways need to be better maintained and kept unplugged

Not enough money for enforcement of laws regarding vandalism, illegal ORV use etc.

Restrict access to the watershed during summer fire season

Dear Citizen:

The Bureau of Land Management(BLM), Cascades Resource Area, is currently analyzing the Crabtree and Quartzville Watersheds (see enclosed map). The Quartzville Watershed analysis is being conducted in cooperation with the U.S. Forest Service, Sweet Home Ranger District. You or your organization was identified as being potentially interested in the watershed analysis process for one or both of these watersheds. We are interested in any issues and comments that pertain to the management of these watersheds. Enclosed is additional information about the watershed analysis process and a questionnaire to help capture your input. Your involvement in this analysis process will be very helpful for future federal land management planning activities in these watersheds. Analysis of both watersheds will occur over the next several months and we hope to have them completed by June of 2000.

The Crabtree Watershed is located approximately 16 miles east of Albany and is just over 100,000 acres in size. The upper portion of the Crabtree Watershed includes private, state and BLM-administered lands in Crabtree Valley and the Snow Peak area. The lower portion of the watershed includes private agricultural/rural lands and the communities of Lacomb and Crabtree. **For more information about the Crabtree Watershed Analysis contact Jim England at (503) 315-5913 or at Jim_England@blm.gov**.

The Quartzville Watershed is located approximately five miles northeast of Sweet Home and is 95,500 acres in size. The watershed begins at Green Peter Dam and continues up the northern arm of Green Peter Reservoir and ends at the headwaters of Quartzville Creek. The watershed includes land managed by the BLM, the U.S. Forest Service and the U.S. Army Corps of Engineers, as well as state, county, and private lands. **For more information about the Quartzville Watershed Analysis contact Laura Graves at (503) 315-5908 or Laura_Graves@blm.gov.**

Please return the questionnaire or contact the individuals listed above by April 30th if you wish to remain on or add additional contacts to our mailing list. In an effort to reduce unwanted mailings, if you do not notify us of your continued interest in this project, your name will be removed from the mailing list. Thank you for your interest and assistance in this effort.

Sincerely yours,

Cascades Resource Area Manager

Watershed Analysis: Questions and Answers

What is a watershed analysis?

Watershed analysis simply tells the story of a particular watershed. It examines how major ecological processes are working together in the watershed. It is one of the principal assessment tools that will be used to meet the ecosystem management objectives of the BLM Salem District's Resource Management Plan standards and guidelines. It is not a planning or decision document. Watershed analysis will focus on collecting and compiling information about trends and conditions of the watershed that is essential for making sound management decisions. The findings and recommendations resulting from the watershed analysis process will provide guidance for future federal land uses and activities in the watershed. It will serve as a basis for developing project specific proposals and determining monitoring and restoration needs. It will not establish direction or regulations for state, tribal or private lands within the watershed.

How will a watershed analysis be used?

It will provide important baseline resource information to help federal resource specialists and land managers develop project-specific proposals for forest management, recreation, fisheries and wildlife habitat improvements, restoration and other activities and actions within the watershed. It will also help identify information gaps, monitoring and restoration needs for the watershed.

Is this a one time process?

Watershed analysis is an ongoing process. The analysis document, maps and files will be updated and expanded as new information is gathered and watershed conditions change.

Are non-federal lands analyzed and how are they affected?

The analysis will consider resource conditions of the entire watershed, regardless of land ownership or jurisdictional boundaries. **However, the watershed analysis process is not intended to be used to determine or direct management of non-federally owned lands.** The watershed analysis process can help encourage more coordination between landowners and other public land management agencies that have lands or jurisdiction within the watershed. It is our ultimate goal to work collaboratively with those sharing the watershed to ensure the continued health of the forest ecosystem, maintain water quality and meet resource management objectives.

Why spend money to do a watershed analysis in a drainage where the BLM and FS do not actually manage most of the land?

Federal lands account for over 18,000 acres in the Crabtree watershed and the majority of the land in the Quartzville Watershed. A watershed consists of many interacting ecosystems. To best manage public lands we need a clear and accurate picture of the condition of the entire watershed, not just specific locations or habitats.

How will the watershed analysis address water quality?

Available water quality will be analyzed, problem areas/sources and new data needs will be identified. As a result, opportunities for improving water quality conditions or changing certain management activities will be recommended for federal lands. Opportunities for improving water quality in cooperation with private land owners may also be identified.

How can I be involved?

The question is, how do you *wish* to be involved? Since the Watershed Analysis is not a formal decision process but an analytical tool, there are no requirements set forth for public involvement. However, input from the public is desired and encouraged. Many of you are familiar with the resource and know the watershed well. Your information and participation can help us paint a more accurate and detailed picture of the watershed and be more responsive to key issues and concerns. You could help us by filling out the attached questionnaire to ensure that we are addressing issues that are important to you.

Quartzville Watershed Questionnaire

Issue and information response sheet (modified from the original)

1. Yes, I want to be involved in the watershed analysis process and continue to receive mailings and information:

Name: _____ Date: _____

Address: _____

_____

Telephone: _____

Organization: _____

2. What do you see as the most important issues in this watershed? What do you think needs to be done to resolve these issues?

3. Are there any specific locations within this watershed of particular concern to you? What are those areas and what are your concerns?

4. How would you like to see federal lands managed in the Quartzville Watershed?

5. What kind of watershed restoration work would you like to see planned and specifically where would that work be?

6. How would you like to be involved in the watershed analysis currently underway in the Quartzville Watershed, and to what extent?

7. Other comments, issues or concerns?

Appendix D

Botanical Species of Concern
Special Status Plants to Search for in the Quartzville Watershed

SPECIES & STATUS	HABI TAT	ELEVATION (FT)	BEST I.D. SEASON
FEDERAL ENDANGERED (FE)			
LOMATIUM BRADSHAWII (Rose) Math. & Const. Bradshaw's lomatium	WV, Linn, Marion WET MEADOWS GRAVELLY STREAMBEDS	<750	APRIL-MAY
FEDERAL THREATENED (FT)			
HOWELLIA AQUATILLIS A. Gray howellia	VW, Clack, Marion, Mult. SHALLOW PONDS & MARSHES	<200	MAY
SIDALCEA NELSONIANA Piper Nelson's sidalcea	WV, Linn, Marion	<2000	JUNE-JULY
FEDERAL PROPOSED THREATENED (PT)			
CASTILLEJA LEVISECTA Greenm. Golden paintbrush	WV, Linn, Marion, Mult. WET OR VERNALLY WET MEADOWS	<1000	JUNE-EARLY JULY
FEDERAL CATEGORY 1 CANDIDATES (FC1)			
DELPHINIUM PAVONACEUM Ewan peacock larkspur	WV, Clack, Marion, Mult.	<1500	MAY-JUNE
ERIGERON DECUMBENS Nutt. VAR. *DECUMBENS* Willamette daisy	WV, Clack, Linn, Marion GRASSLANDS	<1000	JUNE-EARLY JULY
BUREAU SENSITIVE (BS)			
ASTER CURTUS Cronq. white-topped aster	WV, Clack, Linn, Marion, Mult.		
ASTER GORMANII (Piper) Blake Gorman's Aster	WC, Clack, Linn, Marion OPEN OR SPARSLEY TIMBERED, ROCKY RIDGETOPS & MEADOWS	>3500	LATE JULY-AUGUST
BRIDGEOPORUS NOBILISSIMUS W.B. Cooke giant polypore fungus, fuzzy sandozi	WC, Clack, Linn OLD GROWTH NOBLE FIR		
CIMICIFUGA ELATA Nutt. tall bugbane	WV, WC, Clack, Linn, Marion, Mult. MOIST WOODS	<2000	JUNE-MID JULY

SPECIES & STATUS	HABI TAT	ELEVATION (FT)	BEST I.D. SEASON
CORYDALIS AQUAE-GELIDAE Peck & Wilson cold-water corydalis	WC, Clack, Linn, Marion, Mult. COLD SPRINGS & STREAMS	>1000	MID JUNE-JULY
DELPHINIUM LEUCAPHAEUM Greene white rock larkspur	WV, Clack, Marion, Mult.	<1000	MAY-EARLY JUNE
HORKELIA CONGESTA Douglas ssp. *CONGESTA* shaggy horkelia	WV, Linn OPEN SANDY OR ROCKY FLATS TO OPEN WOODS	LOW	APRIL-JUNE
LUPINUS SULPHUREUS Douglas ssp. KINKAIDII (Smith) Phillips Kincaid's lupine	WV, Linn, Marion WILLAMETTE VALLEY	<1500	MAY-JULY
MONTIA HOWELLII S. Watson Howell's montia	WV, WC, Clack, Linn, Mult. ROCKY RIVER BANKS ESP. IN DISTURBED SITES	<2500	APRIL-EARLY MAY

Noxious Weeds to Search for in the Quartzville Watershed

Plant Scientific Name	Plant Common Name	OR State List[1]	Life Span[2]	Flowering
Priority I – Potential New Invaders				
Acroptilon repens	Russian knapweed	B		
Aliaria petiolata	Garlic mustard			
Buddleia davidii	Butterfly bush			
Buddleia alternifolia	Butterfly bush			
Brachypodium sylvaticum	False-brome			
Cardaria chalapensis	Lens-podded white top	B		
Cardaria draba	whitetop	B		
Carthamus lanatus	Wooly distaff thistle	A, T	A	Jul-Aug
Carthamus baeticus	Smooth distaff thistle	A		
Carduus nutans	Musk thistle	B		
Cardaria pubescens	Hairy white top	B		
Carduus pycnocephalus	Italian thistle	B	A, B	May-Jun
Carduus tenuiflorus	Slender flowered thistle	B	P, A	May-Jun
Centaurea calcitrapa	Purple starthistle	A, T		
Centaurea iberica	Iberian starthistle	A, T		
Centaurea macrocephala	Big-headed knapweed	A		
Centaurea solstitialis	Yellow starthistle	B, T	A, B	Jul-Sep
Centaurea triumfetti	Squarrose knapweed	T	P	
Chondrilla juncea	Rush skeletonweed	B, T	P	mid-Jul-frost
Cyperus esculentus	Yellow nutsedge	B		
Cynoglossum officinale	Houndstongue	B		
Cytisus striatus	Portugese broom	B	P	
Euphorbia esula	Leafy spurge	B	P	May-Jul
Genista monspessulana	French broom	B	P	Mar-Apr
Heracleum mantegazzianum	Giant hogweed	A		
Hieracium aurantiacum	Orange hawkweed	A		
Hieracium caespitosum	Meadow hawkweed	A		
Hieracium pilosella	Mouse-eared hawkweed	A		
Hydrilla verticillata	Hydrilla	A	P	
Iris pesudoacorus	Yellow iris			
Lepidium latifolium	Perennial pepperweed	B		
Linaria dalmatica	Dalmation toadflax	B		
Linaria vulgaris	Yellow toadflax	B	P	Jun-Sep
Lythrum salicaria	Purple loosestrife	B	P	Aug-Sep
Onopordum acanthium	Scotch thistle	B	B	Jul
Phalaris aquatica	Harding grass			
Potentilla recta	Sulfur cinquefoil	B	P	May-Jul

Pueraria montana var lobata	Kudzu	A		
Purnus avium	Sweet cherry			
Sorghum halepense	Johnsongrass	B		
Spartinum junceum	Spanish broom	B	P	
Taeniatherum caput-medusa	Medusahead rye	B	A	May-Jun
Tribulus terrestris	puncturevine	B		
Trifolium lappaceum	Burdock			
Xanthium spinosum	Spiny cocklebur	B	A	
	Pampass grass			
Priority II – Eradication of New Invaders				
Centaurea maculosa	Spotted knapweed	B, T	B, P	Jun-Oct
Centaurea debeauxii	Meadow knapweed	B	P	Jul-Oct
Centaurea diffusa	Diffuse knapweed	B	A, B, P	Jul-Sep
Clematis vitalba	Travelers-joy			
Crataegeous monogyna	Hawthorne			
Impatiens glandulifera	Policeman's helmet			
Lathyrus latifolius	Everlasting peavine			
Polygonum cuspidatum	Japanese knotweed	B	P	Jul-Oct
Polygonum polystachyum	Himalayan knotweed	B		
Polygonum sachalinense	Giant knotweed	B	P	
Silybum marianum	Milk thistle	B	A, B	Apr-Jul
Ulex europaeus	Gorse	B, T	P	Apr-May

Priority III – Established Infestations				
Cirsium arvense	Canada thistle	B	P	Jun-Sep
Cirsium vulgare	Bull thistle	B	B, P	Jul-Sep
Convolvulus arvensis	Field bindweed	B	P	Jun-fall frost
Cytisus scoparius	Scotch broom	B	P	May-Jun
Geranium robertianum	Stinky Bob			
Hedera helix	English ivy	B	P	
Hypericum perforatum	St. Johnswort	B	P	Jun-Jul
Ilex aquifolium	English ivy			
Phalaris arundinacea	Reed canary grass			
Rubus discolor	Himalayan blackberry	other	P	
Rubus lasciniatus	Evergreen blackberry			
Senecio jacobaea	Tansy ragwort	B, T	B, P	Jul-Sep
Taraxacum officinale	Dandelion			
Taraxacum laevigatum	Dandelion			

[1] ODA Noxious Weed Rating System

- "A" - a weed of known economic importance which occurs in the state in small enough infestations to make eradication/containment possible; or is not know to occur, but its presence in neighboring states make future occurrence in Oregon seem imminent.
- "B" - a weed pf economic importance which is regionally abundant, but which may have limited distribution in some counties. Where implementation of a fully-integrated statewide management plan is feasible, biological control shall be the main control approach.
- "T" - a priority noxious weed designated by the Oregon State Weed Board as a target weed species on which the Department will implement a statewide management plan.

[2] B = biennial, P = perennial, A = annual

Survey & Manage and Protection Buffer Species in the Cascades Resource Area

The species listed below are included in the survey and manage and the protection buffer species portion of the Northwest Forest Plan. The species included on this list and their respective survey strategies could change in the future.

** Known sites of these species are the Crabtree and/or Quartzville Watershed Analysis area*

Bryophytes (Category)

Racomitrium aquaticum	*(B)*

Fungi

Asterophora lycoperdoides	*(B)*
**Bridgeoporus nobilissiuus*	*(A)*
**Clavariadelphus pistillaris (occidentalis)*	*(B)*
Cudonia monticola	*(B)*
Hypomyces luteovirens	*(B)*
**Leucogaster citrinus*	*(B)*
**Mycena overholtsii*	*(D)*
**Neournula pouchetii*	*(B)*
Otidea leporina	*(D)*
**Phaeocollybia californica*	*(B)*
**Phaeocollybia kauffmanii*	*(D)*
**Ramaria araiospora*	*(B)*
**Ramaria stuntzii*	*(B)*
**Sparassis crispa*	*(D)*
**Sowerbyella rhenana*	*(B)*

Lichens

Calicium viride	*(F)*
Cetrelia cetrariodes	*(E)*
Chaenotheca chrysocephala	*(B)*
Chaenotheca ferruginea	*(B)*
**Nephroma bellum*	*(E)*
** Pannaria saubinetii*	*(F)*
** Peltigera pacifica*	*(E)*
** Platismatia lacunosa*	*(C)*
** Pseudocyphellaria sp*	*(B)*
**Pseudocyphellaria rainierensis*	*(A)*
Ramalina thrausta	*(A)*
**Usnea longissima*	*(F)*

Appendix E

E.1. Vertebrate Wildlife List

The following is a list of vertebrate species for the Quartzville watershed. This list includes species that could occur, or are extirpated, as well as species which are known or suspected to occur. Occurrence codes for are based on Wildlife Observation Databases, Oregon Natural Heritage Program (ONHP) and on extrapolation from literature specific to the Pacific Northwest region. Federal, State Forest Service and Bureau statuses are based on ONHP, Forest Service Sensitive Species and BLM Special Status Species Lists.

HABITAT & OCCURRENCE KEY:

V=Willamette Valley & Cascades Foothills
H=High Elevation Habitats
I=Introduced, L=local, B=Breeding (Birds), NB=Non-breeding (Birds),
BU= Breeding Status Uncertain(Birds), OU=Occurrence Uncertain, E=Extirpated

FEDERAL/STATE STATUS:

LE=Federal Endangered, SE=State Endangered,
LT=Federal Threatened, ST=State Threatened,
FP= Federal Proposed, FC=Federal Candidates,
SC=State Critical, SV=State Vulnerable, SU=State Undertermined Status,
SP=State Peripheral, FS=Forest Service Sensitive, BS=Bureau Sensitive,
BA=Bureau Assessment, BT=Bureau Tracking,
SM=ROD Survey and Manage, B=ROD Buffer or Extra Protection Species

QUARTZVILLE WATERSHED - WILDLIFE LIST - HERPETOFAUNA

SPECIES	SPCODE	FEDERAL	STATE	BLM/FS	SA-ROD	OCC
Northwestern salamander	AMGR					
Pacific giant salamander	DIEN					
Cascade torrent salamander	RHCA		SV	BT/FS		L
Clouded salamander	ANFE		SU	BT		L
Oregon slender salamander	BAWR		SU	BT/FS		
Ensantina	ENES					
Dunn's salamander	PLDU					
Western redback salamander	PLVE					OU
Roughskin newt	TAGR					
Pacific tree frog	HYRE					
Tailed frog	ASTR		SV	BT		L
Red-legged frog	RAAU		SV	BT		
Foothill yellow-legged frog	RABO		SV	BT/FS		OU
Cascade frog	RACA		SV	BT		H
Bullfrog	RACAT					V-I,OU
Northwestern pond turle	CLMA		SC	BS/FS		V-OU
Northern alligator lizard	ELCO					
Western fence lizard	SCOC					L
Western skink	EUSK					L
Rubber boa	CHBO					L
Racer	COLCO					L
Ringneck snake	DIPU					L
Northwestern garter snake	THOR					
Common garter snake	THSI					

QUARTZVILLE WATERSHED - WILDLIFE LIST - BIRDS

SPECIES	SPCODE	FEDERAL	STATE	BLM/FS	SA-ROD	OCC
Common loon	GAIM			BA		NB
Pied-billed grebe	POPO					BU
Eared grebe	PODNI					NB
Western grebe	AEOC					NB
Great blue heron	ARHE					B
Green-backed heron	BUST					NB
Canada goose	BRCA					B
Wood duck	AISP					B
Green-winged teal	ANCR					NB
Mallard	ANPL					B
Northern pintail	ANAC					NB
Cinnamon teal	ANCY					OU
Blue-wingedTeal	ANDI					OU
Northern shoveler	ANCL					NB
Gadwall	ANST					NB
American wigeon	ANAAM					NB
Ring-necked duck	AYCO					NB
Lesser scaup	AYAF					NB
Harlequin duck	HIHI		SU	BS/FS		B
Common goldeneye	BUCL					NB
Barrow's goldeneye	BUIS		SU	BT		NB
Bufflehead	BUAL		SU	BA/FS		NB
Hooded merganser	LOCUC					B
Common merganser	MERME					B
Ruddy duck	OXJA					NB
Turkey vulture	CAAU					B
Osprey	PAHA					B
Bald eagle	HALE	LT	ST	LT		B
Northern harrier	CICY					NB
Sharp-shinned hawk	ACST					B
Cooper's hawk	ACCO					B
Northern goshawk	ACGE		SC	BS		B
Red-tailed hawk	BUJA					B

SPECIES	SPCODE	FEDERAL	STATE	BLM/FS	SA-ROD	OCC
Rough-legged hawk	BULA					NB
Golden eagle	AQCH					BU
American kestrel	FASP					B
Merlin	FACO			BA		NB
Peregrine falcon	FAPE		SE	BS/FS		B
Blue grouse	DEOB					H-B
Ruffed grouse	BOUM					B
Mountain quail	ORPI					B
Virginia rail	RALI					B
American coot	FUAM					NB
Sandhill Crane	GRCATA		SV	BT		NB
Killdeer	CHVO					NB
Spotted sandpiper	ACMA					B
Western sandpiper	CAMAU					NB
Least sandpiper	CAMI					NB
Dunlin	CAALP					NB
Common snipe	GAGA					NB
Ring-billed gull	LADE					NB
California gull	LACAL					NB
Herring gull	LAAR					NB
Rock dove	COLI					NB
Band-tailed pigeon	COFA					B
Mourning dove	ZEMA					NB
Western screech-owl	OTKE					B
Great horned owl	BUVI					B
Northern pygmy-owl	GLGN					B
Northern spotted owl	STOC	LT	ST	LT		B
Great gray owl	STNE		SV	BT	B	OU
Barred owl	STVA					B
Short-eared owl	ASFL					NB
Northern saw-whet owl	AEAC					B
Common poorwill	PHNU					NB
Common nighthawk	CHMI		SC	BS		B
Vaux's swift	CHVA					B

SPECIES	SPCODE	FEDERAL	STATE	BLM/FS	SA-ROD	OCC
Rufous hummingbird	SERUF					B
Belted kingfisher	CEAL					B
Red-breasted sapsucker	SPRU					B
Downy woodpecker	PIPU					B
Hairy woodpecker	PIVI					B
Black-backed woodpecker	PIAR		SC	BS	B	H-OU
Northern flicker	COAU					B
Pileated woodpecker	DRPI		SV	BT		B
Olive-sided flycatcher	COBO		SV	BT		B
Western wood-pewee	COSO					B
Willow flycatcher	EMTR		SV	BT		B
Hammond's flycatcher	EMHA					B
Dusky flycatcher	EMDU					H-BU
Pacific-slope flycatcher	EMDI					B
Tree swallow	TABI					B
Violet-green swallow	TATH					B
N.rough-winged swallow	STSE					BU
Cliff swallow	HIPY					BU
Barn swallow	HIRU					BU
Gray jay	PECA					B
Steller's jay	CYST					B
Clarke's nutcracker	NUCO					H-NB
American crow	COBR					NB
Common raven	CORCO					B
Black-capped chickadee	PAAT					BU
Chestnut-backed chickadee	PARU					B
Red-breasted nuthatch	SITCA					B
Brown creeper	CEAM					B
Bewick's wren	THBE					OU
House wren	TRAE					B
Rock wren	SAOB					H-B
Winter wren	TRTR					B
American dipper	CIME					B
Golden-crowned kinglet	RESA					B

SPECIES	SPCODE	FEDERAL	STATE	BLM/FS	SA-ROD	OCC
Ruby-crowned kinglet	RECA					NB
Western bluebird	SIME		SV	BT		B
Mountain bluebird	SICU					H-BU
Townsend's solitaire	MYTO					B
Swainson's thrush	CAUS					B
Hermit thrush	CAGU					B
American robin	TUMI					B
Varied thrush	IXNA					B
Cedar waxwing	BOCE					B
American pipit	ANSP					NB
European starling	STVU					I-BU
Solitary vireo	VISO					BU
Hutton's vireo	VIHU					B
Warbling vireo	VIGI					B
Orange-crowned warbler	VECE					B
Nashville warbler	VERU					NB
Yellow warbler	DEPE					BU
Yellow-rumped warbler	DENCO					H-BU NB
Black-throated gray warbler	DENI					B
Townsend's warbler	DETO					NB
Hermit warbler	DEOC					B
MacGillivray's warbler	OPTO					B
Common yellowthroat	GETR					B
Wilson's warbler	WIPU					B
Western tananger	PILU					B
Black-headed grosbeak	PHME					B
Lazuli bunting	PAAMO					NB
Rufous-sided towhee	PIER					B
Chipping sparrow	SPPA					B
Fox sparrow	PAIL					BU
Song sparrow	MELME					B
Lincoln's sparrow	MELI					H-B
Golden-crowned sparrow	ZOAT					NB

SPECIES	SPCODE	FEDERAL	STATE	BLM/FS	SA-ROD	OCC
White-crowned sparrow	ZOLE					B
Dark-eyed junco	JUHY					B
Red-winged blackbird	AGPH					BU
Western meadowlark	STUNE		SC	BS		NB
Brewer's blackbird	EUCY					BU
Brown-headed cowbird	MOAT					NB
Northern oriole	ICGA					NB
Purple finch	CARPU					B
Cassin's finch	CARCA					H-OU
Red Crossbill	LOCU					H-B
Pine siskin	CAPI					B
American goldfinch	CATR					NB
Evening grosbeak	COVE					B

QUARTZVILLE WATERSHED- WILDLIFE LIST - MAMMALS

SPECIES	SPCODE	FEDERAL	STATE	BLM/FS	SA-ROD	OCC
Baird's shrew	SOBA			FS		
Pacific water shrew	SOBE					
Pacific shrew	SOPAC			FS		
Water shrew	SOPAL					OU
Trowbridge's shrew	SOTRO					
Vagrant shrew	SOVA					
Shrew-mole	NEGI					
Big brown bat	EPFU					
Silver-haired bat	LANO				B	
Hoary bat	LACI					
California myotis	MYOCA					
Long-eared myotis	MYEV		SU	BT	B	
Little brown myotis	MYLU					
Long-legged myotis	MYVO		SU	BT	B	
Yuma myotis	MYYU			BT		
Townsend's big-eared bat	COTO		SC	BS	B	L
Coyote	CALAT					
Gray Wolf	CALU	LE	SE	LE		E
Gray fox	URCI					
Black bear	URAM					
Raccoon	PRLO					
California Wolverine	GUGU		ST	BS/FS		H-OU
River otter	LUCA					
Pine Marten	MAAM		SV	BT		H
Fisher	MAPE		SC	BS/FS		H
Ermine	MUER					
Long-tailed weasel	MUFR					
Mink	MUVI					
Spotted skunk	SPPU					
Mountain lion	FECO					
Lynx	LYCA	FT		FT	SM	OU
Bobcat	LYRU					
Elk	CEEL					
Black-tailed deer	ODHE					

SPECIES	SPCODE	FEDERAL	STATE	BLM/FS	SA-ROD	OCC
Mountain beaver	APRU					
Northern flying squirrel	GLSA					
Golden-manteled ground squirrel	SPLA					H
Townsend's chipmunk	TATO					
Douglas squirrel	TADO					
Western pocket gopher	THMA					H
Beaver	CASCAN					
Bushy-tailed woodrat	NECI					
Deer mouse	PEMA					
Red tree vole	ARLO			BS	SM	
Western red-backed vole	CLCA					
Gray-tailed vole	MICAN					
Long-tailed vole	MILO					
Creeping vole	MIOR					
Water vole	MIRI					H
Pacific jumping mouse	ZATR					
Porcupine	ERDO					
Pika	OCPR					H
Snowshoe hare	LEAM					H

E.2. Special Status/Special Attention Invertebrate Species that are documented or suspected to occur in the Quartzville Watershed.

SPECIES	SPCODE	BLM/FS STATUS	ONHP LIST	GEOGRAPHIC RANGE or HABITAT NEEDS
MOLLUSKS Oregon megomphix	MEHE	SM/BS	4	CR,WV,WC: Conifer/hardwood forest with bigleaf maple, duff/litter at low/mid elevations. Common along Willamette Valley floor/Cascades foothills.
INSECTS American boreostolus bug	BOAM	BT	3	KM,WC: Under rocks and in sandy substrates of streams
Mulsant's small water strider	MEMU	BT	3	CR,WV,WC,BR: Floating vegetation and water surface of ponds. Wide ranging.
Cascades apatanian caddisfly	APTA	BT	4	WC,EC,BM: Found in small streams on coarse gravel and cobble in areas of low current at mid/high elevations
Mt. Hood brachycentrid caddisfly	EOGE	BT	4	WC: Cold spring fed streams at mid/high elevations, generally subalpine
Tombstone Prairie farulan caddisfly	FARE	BT	4	WC: Small spring fed streams with moderate to fast currents on coble and wood at high elevations
Tombstone Prairie oligophlebodes caddisfly	OLMO	BT	3	WC: Small to large streams at high elevations
One-spot rhyacophilan caddisfly	RHUN	BT	3	WC,EC: Clear streams at high elevations

KEY:
WV=Western Valleys **WC**=Western Cascades **EC**=Eastern Cascades **CR**=Coast Range **KM**=Klamath Mtns **BR**=Harney Basin **BM**=Blue Mtns.
BS = Bureau Sensitive
BT=Bureau Tracking
SM=ROD Survey and Manage

E.3. Special Status/Special Attention Wildlife Species Known& Suspected - Quartzville

	SPECIES & STATUS	HABITAT DESCRIPTION
	INVERTEBRATES	
D	MEGOMPHIX HEMPHILLI **SM/BS** Oregon megomphix (snail)	Conifer/hardwood forest floor, in association with bigleaf maple, duff /litter at low/mid elevations. Common along Willamette Valley floor/Cascades foothills.
	HERPETOFAUNA	
D	RHYACOTRITON CASCADAE **BT/FS/SV** Cascade torrent salamander	Prefers small cold streams and springs with water seeping through moss-covered gravel. Most common in mature and old-growth conifer forests below 4000 feet.
D	ANEIDES FERREUS **BT/SU** clouded salamander	Prefers the spaces between loose bark on down logs in forests, forest edges, and clearings created by fire.
D	BATRACHOSEPS WRIGHTI **BT/FS/SU** Oregon slender salamander	West slope of Cascades. Prefers down logs and woody material in more advanced stages of decay. Most common in mature and old-growth conifer forests.
D	ASCAPHUS TRUEI **BT/SV** tailed frog	Cold, fast-flowing permanent springs and streams in forested areas. Has a very narrow temperature tolerance.
D	RANA AURORA **BT/SU/SV** red-legged frog (Willamette Valley)	Common in marshes, ponds, and streams with little or no flow, from the valley floor to about 3000 feet in the Cascades. Populations in the Willamette Valley are of greater concern (SV) than Cascades populations (SU).
S	RANA CASCADAE **BT/SV** Cascades frog	Highly likely to occur in Quartzville to the east at higher elevations. Found in higher elevation bogs, ponds and stream edges associated with moist meadows.
	BIRDS	
D	GAVIA IMMER **BA** common loon	Breeding populations are of concern. Occurs only as a non breeder on Green Peter Reservoir at the lower end of the Quartzville Watershed.
D	HISTRIONICUS HISTRIONICUS **BS/FS/SU** harlequin duck	Breeds on Quartzville creek and its tributaries where its a common summer resident. Found in whitewater mountain rivers and streams during nesting season. Winters on rocky coasts.
D	BUCEPHALA ISLANDICA **BT/SU** Barrow's goldeneye	Breeding population s are of concern. Occurs in Quartzville only as a migrant and winter visitor. Has been observed on Green Peter Reservoir.

D	BUCEPHALA ALBEOLA **BA/FS/SU** bufflehead	Breeding population s are of concern. Occurs in Quartzville only as a rare migrant and winter visitor. Has been observed on Green Peter Reservoir.
D	HALIAEETUS LEUCOCEPHALUS **LT/ST** bald eagle	Documented to occur in Quartzville year round. There are two nests sites in the Green Peter area. The pairs tend to be resident, but some movement to the Willamette Valley occurs during winter. For nesting and perching, prefers large old-growth trees near major bodies of water and rivers.
D	ACCIPITER GENTILIS **BS/SC** northern goshawk	Has been observed and is known to breed in Quartzville Watershed. Rare Summer resident in Cascades. Prefers mature or old-growth forests with dense canopy cover at higher elevations. Winters at lower elevations.
S	FALCO COLUMBARIUS **BA** merlin	Breeding populations are of concern. Likely to occur in Quartzville only during migration and winter. Fields, open areas and edges.
D	FALCO PEREGRINUS **BS/FS/SE** peregrine falcon	Known to breed in the Green Peter area. Suitable cliff habitat for nesting is present in Quartzville. Likely to occur as a transient/migrant and winter visitor. Found in a variety of open habitats near cliffs or mountains. Prefers areas near larger bodies of water and rivers.
S	GRUS CANADENSIS **BT/SV** sandhill crane	Breeding populations are of concern. Suspected as a rare spring/fall overhead migrant.
S	TRINGA MELANOLEUCA **BA** greater yellowlegs	Breeding populations are of concern. Likely to occur as an rare transient and winter visitor in Quartzville. Wetlands, flooded fields, and mud flats.
S	TRINGA SOLITARIA **BT** solitary sandpiper	Breeding populations are of concern. Likely to occur only as a rare spring/fall migrant and transient. Wetlands, flooded fields, and small water bodies.
D	STRIX OCCIDENTALIS CAURINA **LT/ST** northern spotted owl	Permanent resident in Quartzville, where 35 sites were known from the early 1990s. Prefers mature and old-growth conifer forests with large down logs, standing snags in various stages of decay, high canopy closure and a high degree of vertical stand structure.
D	CHORDEILES MINOR **BS/SC** common nighthawk (Willamette Valley)	Open habitats from the valley floor to high elevation clearcuts. Breeding populations of are concern, especially in the Willamette Valley.
D	DRYOCOPUS PILEATUS **BT/SV** pileated woodpecker	Common permanent resident in Quartzville Watershed. Prefers to nest in old-growth and mature forests. Also forages in younger forests containing mature or old-growth remnants. Requires larger snags and down wood.
D	CONTOPUS COOPERI **BT/SV** olive-sided flycatcher	Uncommon summer resident in more open coniferous forest and edge with prominent tall snags or trees that serve as foraging and singing perches.
D	EMPIDONAX TRAILLII BRESTERI little willow flycatcher **BT/SV**	Summer resident in Quartzville Watershed. Riparian forests, valley brushlands, clearcuts and early seral forests.
D	SIALIA MEXICANA **BT/SV** western bluebird	Uncommon permanent resident in Willamette Valley and adjacent foothills. Open areas with standing snags, or small farms with diversified agriculture. Nests in natural woodpecker cavities or artificial nest boxes.

D	STRUNELLA NEGLECTA **BS/SC** western meadowlark (Willamette Valley)	Occurs as an uncommon transient and winter visitor in lower end of Quartzville Watershed. Found in grassy open habitat.
	MAMMALS	
S	SOREX BAIRDII PERMILIENSIS **FS** Baird's shrew	Moist forests with coarse woody debris. Endemic to Oregon.
S	SOREX PACIFICUS CASCADENSIS **FS** Pacific shrew	Moist wooded areas with fallen decaying logs and brushy vegetation. Endemic to Oregon.
S	LASIONYCTERIS NOCTIVAGANS **BT/B/SU** silver-haired bat	Highly likely to occur in the Quartzville Watershed. Associated with cliff/cave and snag habitat. Forages in a variety of forest habitats and riparian areas.
S	MYOTIS EVOTIS **BT/B/SU** long-eared myotis	Highly likely to occur in the Quartzville Watershed. Associated with snags and cave habitat. Prefers older forests. Forages over water and riparian areas.
S	MYOTIS VOLANS **BT/B/SU** long-legged myotis	Highly likely to occur in the Quartzville Watershed. Associated with cliff/cave and snag habitat. Prefers older forests. Forages over water and riparian areas.
S	MYOTIS YUMANENSIS **BT** yuma myotis	Highly likely to occur in the Quartzville Watershed. Associated with cliff/cave and snag habitat. More closely associated with riparian areas than the other myotis. Prefers older forests. Forages over water and riparian areas.
S	CORYNORHINUS TOWNSENDII **BS/B/SC** Townsend's big-eared bat	Highly likely to occur in the Quartzville Watershed. Feeds on flying insects in a variety of habitats in forested areas. Primary habitat is caves, rock outcrops, buildings and abandoned mines.
S	MARTES AMERICANA **BT/SV** pine marten	Highly likely to occur in the QuartzvilleWatershed. Mature and old-growth forests containing large quantities of standing snags and downed logs, in the upper end of LNS. Prefers wetter forests, often near streams.
D	MARTES PENNANTI **BS/FS/SC** fisher	There are two sightings in the Quartzville Watershed. Prefers mature and old-growth forests and riparian areas containing large quantities of dead and down wood.
S	ARBORIMUS LONGICAUDUS **SM** red tree vole	Suspected to occur in the Quartzville Watershed. This arboreal vole prefers mid to late seral forests with closed canopies.

KEY

Occurrence:
S = Suspected
D = Documented

Status:
LE = Federal endangered
LT = Federal Threatened
ST = State Threatened
SE = State Endangered

BS = Bureau Sensitive
BA = Bureau Assessment
BT = Bureau Tracking
FS = Forest Service Sensitive
SM=ROD Survey and Manage
B=ROD Buffer or extra protection species

SC = State Critical
SV = State Vulnerable
SU = State Uncertain
SP = State Peripherial

E.4. Special Status/Special Attention Wildlife Species Data Gaps - Quartzville

	SPECIES & STATUS	DATA NEEDS/HABITAT DESCRIPTION
	INVERTEBRATES	
D	MEGOMPHIX HEMPHILLI **SM/BS** Oregon megomphix (snail)	Based on surveys performed to date, known to be common along Willamette Valley floor/Cascades foothills at low/mid elevations. Good distributional data is Lacking, especially in LSR where no surveys have been conducted.
	HERPETOFAUNA	
OU	RANA BOYLEI **BT/FS/SV** foothill yellow-legged frog	Permanent streams and vicinity, with rocky, gravelly and sandy substrates. Quartzville Creek is a good candidate stream.
OU	CLEMMYS MARMORATA **BS/FS/SC** western pond turtle	Marshes, ponds, lakes, slow rivers and streams, usually with an abundance of aquatic vegetation and emergent logs or boulders for basking. Associated with Willamette Valley. Not likely to occur in Quartzville Watershed.
	BIRDS	
D	AQUILA CHRYSAETOS golden eagle	Has been observed in the Boulder Creek and Packer's areas of the Quartzville Watershed. Nesting status is unknown. Known to nest in an adjacent watershed.
D	ACCIPITER GENTILIS **BS/SC** northern goshawk	Has been observed in Quartzville Watershed, but breeding status is unknown. Rare Summer resident in Cascades. Surveys should target Whitcomb, Green Peter and Elk Creek areas.
D	FALCO PEREGRINUS **BS/FS/SE** peregrine falcon	Known to nest in the Green Peter area. There could be additional sites in Quartzville. Surveys should target suitable cliff habitat.
D	STRIX OCCIDENTALIS CAURINA **LT/ST** northern spotted owl	Permanent resident in Quartzville, where 35 sites were known from the early 1990s. Many of these sites have not been surveyed to protocol since then.
OU	STRIX NEBULOSA **BT/B/SV** great gray owl	Primarily an east side species. On the west side, associated with natural and manmade openings, mostly at higher elevations.
OU	PICOIDES ARCTICUS **BS/B/SC** black-backed woodpecker	Suspected to occur in the upper end of Quartzville Watershed. Primarily an eastside species. On the westside, it's found in mature/older forests with abundant snags at higher elevations.

	MAMMALS	
S	SOREX BAIRDII PERMILIENSIS **FS** Baird's shrew	Nothing is know about occurrence of this species in the Quartzville Watershed.
S	SOREX PACIFICUS CASCADENSIS **FS** Pacific shrew	Nothing is know about occurrence of this species in the Quartzville Watershed.
S	LASIONYCTERIS NOCTIVAGANS **BT/B/SU** silver-haired bat	Highly likely to occur in the Quartzville Watershed. Associated with cliff/cave and snag habitat. Forages in a variety of forest habitats and riparian areas. Little information exists on bat species occurrence in the Quartzville Watershed.
S	MYOTIS EVOTIS **BT/B/SU** long-eared myotis	Highly likely to occur in the Quartzville Watershed. Associated with snags and cave habitat. Prefers older forests. Forages over water and riparian areas. Little information exists on bat species occurrence in the Watershed.
S	MYOTIS VOLANS **BT/B/SU** long-legged myotis	Highly likely to occur in the Quartzville Watershed. Associated with cliff/cave and snag habitat. Prefers older forests. Forages over water and riparian areas. Little information exists on bat species occurrence in the Watershed.
S	MYOTIS YUMANENSIS **BT** yuma myotis	Highly likely to occur in the Quartzville Watershed. Associated with cliff/cave and snag habitat. More closely associated with riparian areas than the other myotis. Prefers older forests. Forages over water and riparian areas. Little information exists on bat species occurrence in the Watershed.
S	CORYNORHINUS TOWNSENDII **BS/B/SC** Townsend's big-eared bat	Highly likely to occur in the Quartzville Watershed. Feeds on flying insects in a variety of habitats in forested areas. Primary habitat is caves, rock outcrops, buildings and abandoned mines. Little information exists on bat species occurrence in the Watershed.
OU	GULO GULO **BS/FS/ST** wolverine	Found in higher elevation mountainous and isolated coniferous forests.
D	MARTES PENNANTI **BS/FS/SC** fisher	There are two sightings in the Quartzville Watershed. Prefers mature and old-growth forests and riparian areas containing large quantities of dead and down wood.
OU	LYNX CANADENSIS **FT** lynx	Higher elevations in true fir types with snowpacks. Based on analysis of existing and potential habitat, unlikely to occur in the Quartzville watershed.
S	ARBORIMUS LONGICAUDUS **SM** red tree vole	Likely to occur in the Quartzville Watershed. This arboreal vole prefers mid to late seral forests with closed canopies. Good distributional data is Lacking, especially in LSR where no surveys have been conducted.

KEY

Occurrence:
OU=Occurrence Uncertain
S = Suspected
D = Documented
E=Extirpated

Status:

LE = Federal endangered
LT = Federal Threatened
BS = Bureau Sensitive
BA = Bureau Assessment
BT = Bureau Tracking
SM=ROD Survey and Manage
B=ROD Buffer or extra protection species

SE = State Endangered
ST = State Threatened
SC = State Critical
SV = State Vulnerable
SU = State Uncertain
SP = State Peripherial

Appendix F

Riparian Management Areas and Riparian Reserves

Oregon Forest Practices Act: Riparian Management Areas for Private Lands (1

Size (flow)	Type F (fish bearing)	Type D (domestic use)	Type N (all others)
Large(>10 cfs)	100 feet - Basal area target, minimum 40 conifers	70 feet - Basal area target, minimum 30 conifers	70 feet - Basal area target, minimum 30 conifers
Medium(2-10 cfs)	70 feet - Basal area target, minimum 30 conifers	50 feet - Basal area target, minimum 10 conifers	50 feet - Basal area target, minimum 10 conifers
Small (<2 cfs)	50 feet - Basal area target	20 feet - Basal area target	0 to 10 feet - non-merch conifers, understory vegetation

(1 Within specified riparian widths, there are basal area retention requirements that are based on harvest type and geographic region.

Northwest Oregon State Management Plan: Riparian Management Areas for State of Oregon Lands

Size (flow)	Type F (fish bearing)	Type N (all others)
Large(>10 cfs)	0 to 25 feet - No harvest 25 to 100 feet - Manage for mature forest condition 100 to170 feet - Retain 10 to 45 conifers/acre	0 to 25 feet - No harvest 25 to 100 feet - Manage for mature forest condition 100 to170 feet - Retain at least 10 conifers per acre
Medium(2-10 cfs)		
Small (<2 cfs)		(75% of reach): 0 to 25 feet - No harvest/maintain channel integrity 25 to 100 feet - retain 10 to 25 conifers/acre 100 to170 feet - Retain 0 to10 conifers/acre

Northwest Forest Plan: Riparian Reserves for Federal Lands

Size (flow)	Type F (fish bearing)	Type N (all others)
Large(>10 cfs)	Two site potential tree widths (320 to 360 feet slope distance was modeled) Manage for Late Seral Conditions and Aquatic Conservation Strategy Objectives	One site potential tree width (160 to 180 feet slope distance was modeled) Manage for Late Seral Conditions and Aquatic Conservation Strategy Objectives
Medium(2-10 cfs)		
Small (<2 cfs)		

Appendix G

Riparian Reserve Function and Role of Vegetation

Riparian Vegetation Function	Requirements for Proper Function
Shade • regulates instream temperatures for fish/amphibians/invertebrates • regulates terrestrial microclimate	• large trees and other vegetation with high % canopy closure
Allochthonous input • food resource for invertebrates/microbes (99% in 1st order streams)	• diverse species of trees and other vegetation
LWD source • provides habitat for fish, amphibians, invertebrates, and beaver • Helps frame stream geomorphology	• mature conifers in abundant supply
Nutrient/sediment filter • maintains high water quality	• connectivity of flood plain and stream(promotes denitrification) • trees and other vegetation to trap sediment
Bank stability • lowers erosion potential • maintains high water quality	• trees and other vegetation with good root strength
Habitat/Dispersal corridors • provides cover, forage, water • provides connectivity to dispersal areas	• mature to late-successional forest characteristics
Energy dissipation • lowers erosion potential • builds flood plains • maintains high water quality	• trees and other vegetation • connectivity of stream and flood plain
Regulate stream base flows • higher summer low flows/lower winter peak flows	• proper species composition

Appendix H

Transportation Management

1. U. S. Forest Service

Roads in the watershed were built using construction methods common at the time of construction. As a result, the majority were constructed using side cast fill placement, and minimal or substandard drainage facilities by today's standards, and are located near or in riparian reserves. Design and construction standards in the past provided little consideration of existing fisheries. These roads are continually in need of maintenance and reconstruction in order to minimize sedimentation from the cut slopes, fill slopes, surface erosion, and roadway failures. These maintenance and reconstruction activities are becoming increasingly difficult to fund, making it impossible to continue maintaining the large network of roads to a standard that will minimize resource problems and provide for public safety. As a result, maintenance work has been prioritized and maintenance of the roads that serve the most users are highest priority. Other roads that have very little use or that cause resource problems are being decommissioned or closed. Many roads are revegetating and will close naturally over time. A variety of uses and demands makes management of the federal transportation system a complex task. On Forest Service lands, a forest wide road closure policy has been developed.

2. Bureau of Land Management

Overview of the Western Oregon Transportation Management Plan

Both the *Northwest Forest Plan* (NFP) and each Western Oregon District's Resource Management Plan (RMP) direct each district to develop a road management plan. The NFP and the Salem RMP offer general guidance on road management and items to consider in the development of a transportation plan. This guidance was incorporated into the *Western Oregon Transportation Management Plan* (TMP) to provide consistency throughout the Western Oregon Districts and to communicate a common road management philosophy to other federal, state, or interested entities. The Western Oregon TMP, encompassing all the western Oregon districts, was completed in June 1996 and updated April 2000. The plan was not intended to be specific on a road by road basis. This level of detail was intended to be developed by each district, and would consider specifics unique to each district.

Road management in Western Oregon is complicated by BLM's checkerboard land ownership pattern and legal access agreements. The BLM has acquired access easements across adjacent lands, and has entered into numerous reciprocal right-of-way agreements. These agreements enable the BLM to use private roads and lands to access BLM lands, and in turn, allow private land owners to access their lands through BLM roads and ownership. As a result, the

transportation system utilized to manage forested lands is formed by a combination of BLM, county, private, state and other federal roads. The rights of adjacent land owners to access their lands is often a prime consideration in transportation management.

Objectives of the Strategy for Implementing the Transportation Management Plan

The objectives of the strategy for implementing the TMP on the Salem District are to:

1. Detail how the Western Oregon TMP is to be implemented on the Salem District.

2. Meet Endangered Species Act (ESA) requirements for all federally listed or proposed aquatic and terrestrial species.

3. Meet Aquatic Conservation Strategy objectives (ACSO) in conducting road related activities and addresses specific items identified in the standards and guides of the NFP.

4. Explain the implementation strategy to the District's employees and external interested parties.

5. Ensure that roads are maintained efficiently and effectively.

The TMP outlines goals and objectives for transportation management with respect to various resource values, common definitions for maintenance levels and road closures, and key components for its implementation. Implementation of the TMP consists of three main components: transportation management objectives, an annual road maintenance operation plan, and monitoring of road related activities. The TMP and the process of how the various components relate to each other can best be illustrated by Figure 1.

Transportation Management Objectives (TMOs)

Criteria:

All resource areas have developed Transportation Management Objectives (TMOs) by assigning each road in the resource area a TMO classification. TMOs are specific management objectives considering multiple resources for both the short and long term access needs for each road under BLM management. The TMO itself is a recommendation which does not initiate an action, but is carried forth into a decision making process as part of project implementation. TMOs are developed and reviewed in conjunction with the watershed analysis process. TMOs may be updated/refined as additional information becomes available, such as collaboration with adjacent land owners and road managers. Figure 2 best illustrates the TMO process.

Compliance with the Aquatic Conservation Strategy (ACS) warrants a reduction of roads in some watersheds. In addition, each Districts' RMP recommends a reduction in the miles of road open

to vehicles. The primary objectives are to reduce sedimentation, to restore hydrological processes, and to reduce impacts to wildlife, botanical resources, or special areas from a large, open road system. Roads controlled by BLM will be managed in varying states of accessibility. Many local or resource roads may be in a continual state of flux from open to closed to regulate motorized access.

Key items which the interdisciplinary team considers in making recommendations to upgrade, close or decommission roads include:

1. Closing or upgrading roads which pose substantial risk to riparian conditions in terms of landslide susceptibility and flood effects.

2. Closing or upgrading roads in order to minimize sediment delivery to streams from roads and reduce the need for routine maintenance. This can include seasonal restriction of use to reduce sedimentation from winter haul traffic.

3. Removing (road closure) or upgrading culverts to provide or maintain fish passage.

4. Closing or upgrading roads in order to minimize disruption of hydrologic flow paths. Examples include increasing the number of relief culverts and avoiding diversion of streamflow down road ditches.

5. The needs to upgrade or stabilize roads in sensitive soils or unstable areas.

6. Access for resource management in the short-term (<5yrs) and long-term (5-25 yrs). This may have an effect on the type and duration of a road closure.

7. The current/future use and constraints of each road, including the rights of adjacent land owners to access their lands. Access to adjacent private ownership and/or roads under reciprocal right-of-ways have constraints subject to review by the affected parties.

8. Road density criteria established by the RMP and the Biological Opinions between the BLM, USFS, and/or NMFS concerning anadromous fish species (NMFS, March 1997).

9. Reducing road densities according to the Salem District RMP and/or to reduce disturbance to big game and other wildlife species.

10. Closing roads to reduce disturbance sensitive areas and special habitats, including botanical resources.

11. Reasonable and prudent measures, terms and conditions, and conservation measures as addressed in the current Biological Opinions received from USFWS and NMFS to protect

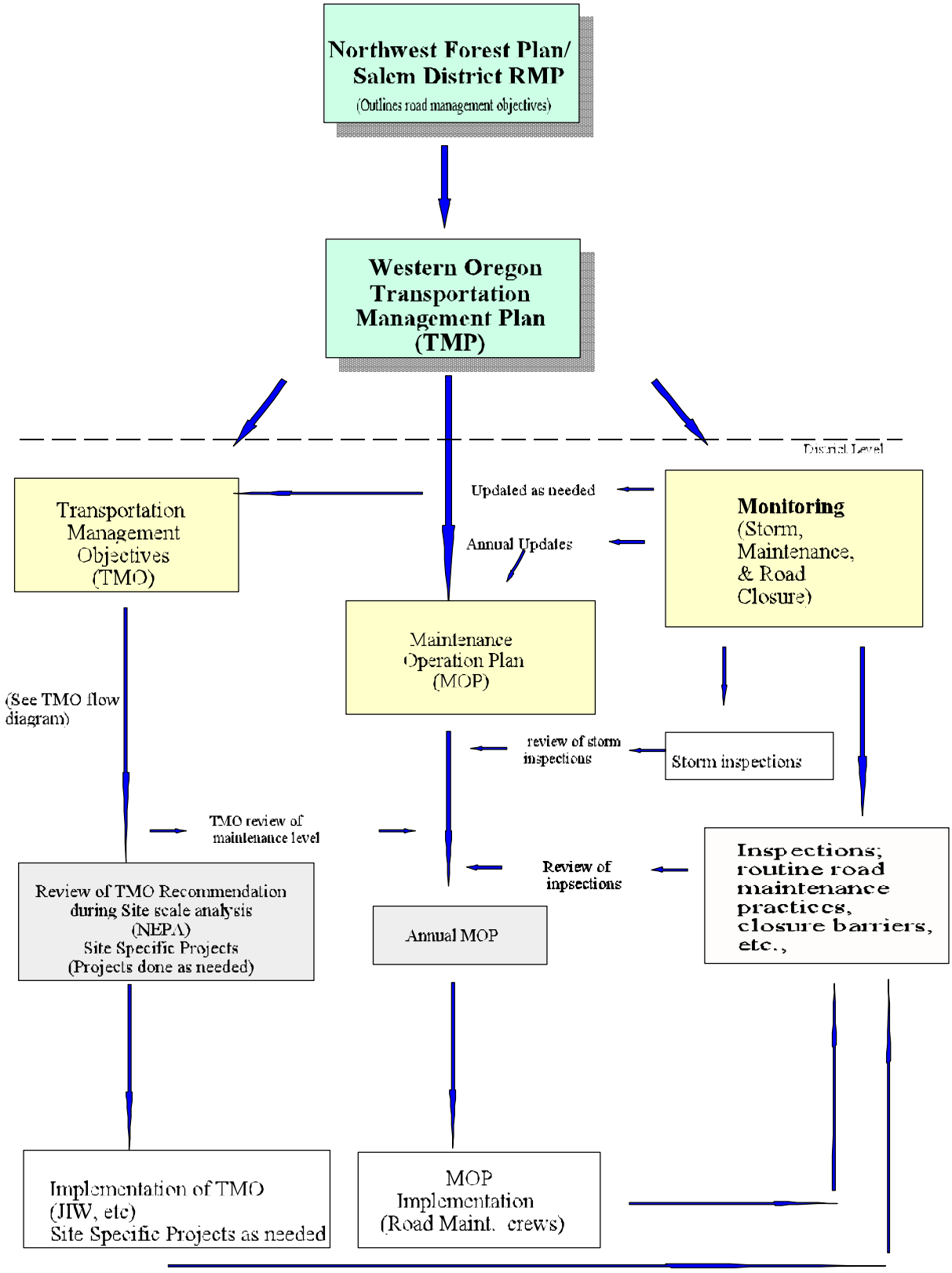
proposed, threatened or endangered species.

On a project by project basis, budget and funding limitations have to be weighed against the risk of resource damage, long term and short term effects and viability of projects. More inexpensive methods may be employed to mitigate risks, address the greatest risk situations and maximize the efficient use of funding across project areas.

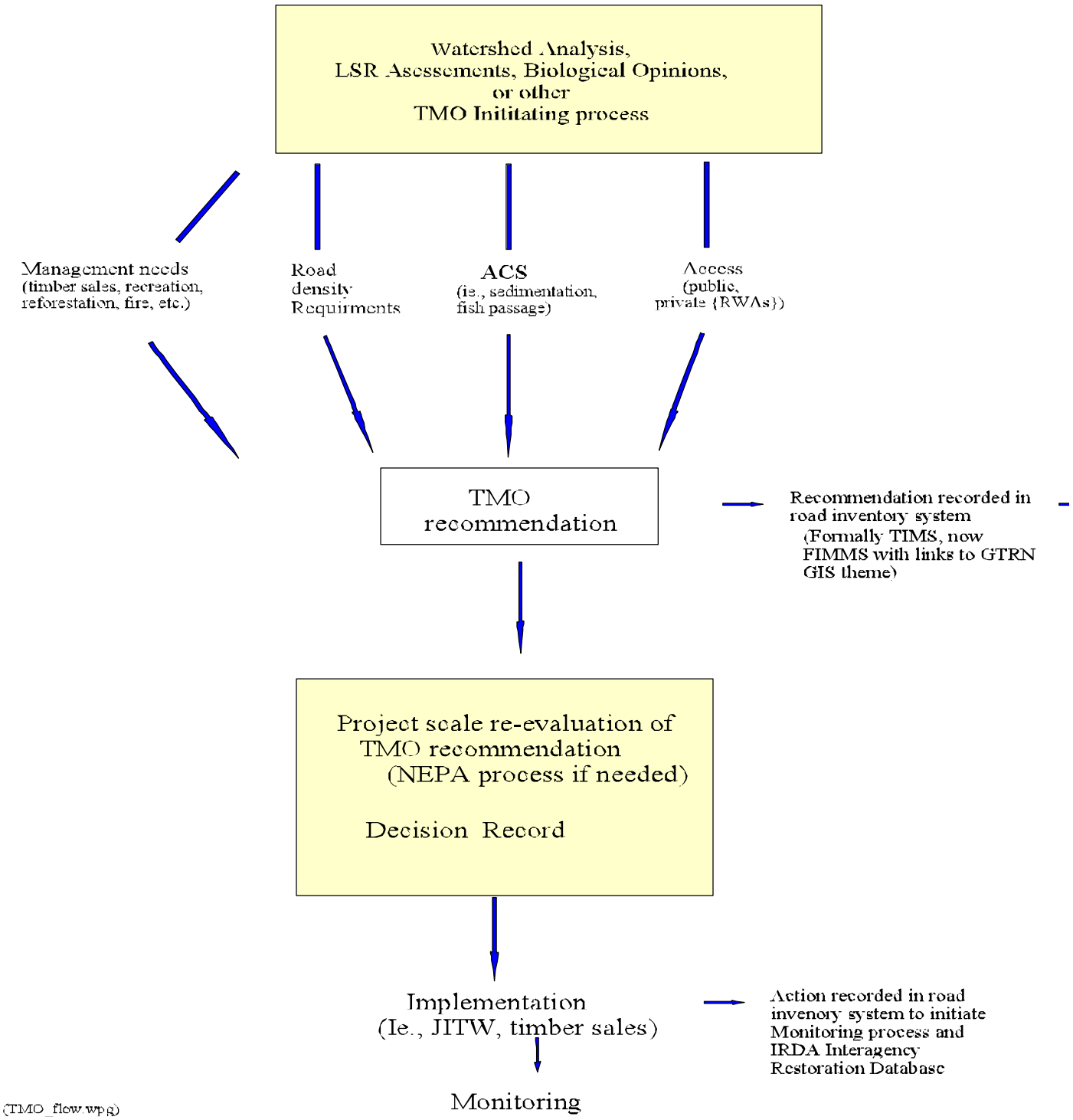
Figure 1. Flow Chart Describing Implementation of the Western Oregon Transportation Plan.

Figure 2. Flow Chart Describing the TMO Development Process.

(Following pages)


Northwest Forest Plan/
Salem District RMP
(Outlines road management objectives)
Western Oregon
Transportation
Management Plan
(TMP)
District Level
Transportation
Management
Objectives
(TMO)
Updated as needed
Annual Updates
Monitoring
(Storm,
Maintenance,
& Road
Closure)
Maintenance
Operation Plan
(MOP)
(See TMO flow
diagram)
review of storm
inspections
Storm inspections
TMO review of
maintenance level
Review of
inpsections
Inspections;
routine road
maintenance
practices,
closure barriers,
etc.,
Review of TMO Recommendation
during Site scale analysis
(NEPA)
Site Specific Projects
(Projects done as needed)
Annual MOP
Implementation of TMO
(JIW, etc)
Site Specific Projects as needed
MOP
Implementation
(Road Maint. crews)

Transportation Management Objectives



(TMO_flow.wpg)

Potential Road Restoration Areas

The following list of roads and road segments in the Quartzville Watershed are planned for decommissioning or closure based on the Western Oregon TMP, the strategy for implementation of the TMP on the Salem District and the Quartzville Watershed Analysis. Most of these roads have been assigned a TMO of 8, which are roads that are no longer needed for the overall transportation system.

Road #	Route Name	Miles	Sub basin
11-2E-14.1	K Line	1.49	Packers Gulch
11-3E-1.1	Packers Gulch to 6000 Line	0.55	Packers Gulch
11-3E-1.5	Toms Try II P-Line	0.24	Packers Gulch
11-3E-2.4	Harry South Side Ext	0.58	Packers Gulch
11-3E-10	Livingston Fire Road	0.44	Packers Gulch
11-3E-10.1	Cougar Camp Spur	0.12	Packers Gulch
11-3E-11	Harry South Side East	0.25	Packers Gulch
11-3E-11.1	Harry South Side West	0.37	Packers Gulch
11-3E-11.2	Dr Livingston Road	0.36	Packers Gulch
11-3E-11.3	Dr Livingston I	0.15	Packers Gulch
11-3E-11.4	Dr Livingston II	0.13	Packers Gulch
11-3E-12	Packers Road System	0.48	Packers Gulch
11-3E-12.1	11-3E-12.1	0.34	Packers Gulch
11-3E-12.2	Ham and Cheese	0.22	Packers Gulch
11-3E-12.3	Packers Gulch Skyline	0.13	Packers Gulch
11-3E-12.4	Red Rock	0.07	Packers Gulch
11-3E-13.3	West Fork Packers Spur	2.25	Packers Gulch
11-3E-14	11-3E-14	0.33	Packers Gulch
11-3E-14.1	11-3E-14.1	0.79	Packers Gulch
11-3E-14.2	Packers Divide	2.08	Packers Gulch
11-3E-14.3	11-3E-14.3	0.54	Packers Gulch
11-3E-14.4	11-3E-14.4	0.17	Packers Gulch
11-3E-15.1	11-3E-15.1	0.23	Packers Gulch
11-3E-16	11-3E-16B	0.34	Packers Gulch
11-3E-22	Yellowstone Loop SPU	0.24	Packers Gulch
11-3E-22.2	Yellowstone Loop Spur 2	0.11	Packers Gulch
11-3E-22.3	Yellowstone Loop Spur 3	0.46	Packers Gulch
11-3E-22.4	Upper Virgin Flats	0.07	Packers Gulch
11-3E-22.5	Virgin Spur 1	0.14	Packers Gulch
11-3E-22.7	Stadeli's Revenge	0.43	Packers Gulch
11-3E-22.8	Crabtree Cherry Road	0.54	Packers Gulch
11-3E-22.9	Crabtree Cherry Spur	0.12	Packers Gulch
11-3E-23	Size 34 Disposal	0.42	Packers Gulch
11-3E-23.1	Virgin Flats Mainline	1.15	Packers Gulch
11-3E-24	Simpsons High Road	0.08	Packers Gulch

Road #	Route Name	Miles	Sub basin
11-3E-24.4	Simpson Road Spur 1	0.19	Packers Gulch
11-3E-26.2	Yellowstone Road C2	0.33	Packers Gulch
11-3E-26.4	Yellowstone Loop Road	0.49	Packers Gulch
11-3E-26.5	Size 34	0.22	Packers Gulch
11-3E-26.7	Purring Kitten	0.14	Packers Gulch
11-3E-28	Longbench	1.64	Packers Gulch
11-3E-28.1	Longbench Spur 1	0.15	Packers Gulch
11-3E-28.2	Longbench Spur 2	0.08	Packers Gulch
11-3E-29.1	Yellowstone Mountain System	0.33	Packers Gulch
11-3E-29.3	The Bank	0.60	Packers Gulch
11-3E-29.4	The Bank Spur	0.15	Packers Gulch
11-3E-32	Yellowstone Mountain System	0.95	Packers Gulch
11-3E-32.2	Repeater Spur	0.32	Packers Gulch
11-3E-32.4	Yellowstone Mountain Sale	0.06	Packers Gulch
11-3E-32.5	Yellowstone Mountain P/1	0.06	Packers Gulch
11-3E-32.6	Yellowstone Mountain P/2	0.03	Packers Gulch
11-3E-33.1	Lonely Buck East	0.16	Moose Creek
11-3E-33.2	Lonely Buck West	0.11	Packers Gulch
11-3E-33.3	Good Old Boy	0.17	Packers Gulch
11-3E-34	50 Cent Spur	0.73	Moose/Packers
11-3E-34.1	4 Bit Adverse Spur	1.09	Packers Gulch
11-3E-34.1	Yellow Eye Spur 11	0.24	Packers Gulch
11-3E-34.2	E. Pluribus Unum	1.01	Moose Creek
11-3E-34.3	Yellow Eye	0.04	Packers Gulch
11-3E-35	Simpson Spur Boulder	0.65	Moose/Packers
11-3E-35.4	11-3E-35.4	0.83	Packers Gulch
11-3E-36	Lower Boulder	2.40	Packers/Moose
11-3E-36.1	Lower Boulder Spur	0.56	Packers Gulch
11-4E-4	Lower Pat Creek Road	0.47	Canal Creek
11-4E-4.1	Pat Creek Spur	0.07	Canal Creek
11-4E-4.2	Upper Pat Creek Spur	0.25	Canal Creek
11-4E-5.4	Flat Top East	0.33	Canal Creek
11-4E-6	Thomas Ridge Spur	0.16	Packers Gulch
11-4E-6.1	Toms Try II P/1 Spur	0.18	Packers Gulch
11-4E-8.1	Backside Road (Packers)	1.19	Packers Gulch
11-4E-16.5	South Pat Creek Ridge	0.21	Canal Creek
11-4E-16.6	Pat Creek Spur 1 Road	0.10	Canal Creek
11-4E-17.3	11-4E-17.3	0.29	Packers Gulch
11-4E-17	Old E F Longline Road	1.64	Packers Gulch
11-4E-17.2	Johnsons Road	0.65	Canal Creek
11-4E-19.1	Yellowbottom Spur 1	0.66	Packers Gulch
11-4E-19.2	Yellowbottom Spur 2	0.44	Packers Gulch
11-4E-19.3	Yellowbottom A	1.21	Canal Creek
11-4E-20	Ceanothus Heaven	0.84	Packers Gulch

Road #	Route Name	Miles	Sub basin
11-4E-20.1	Prone Tree Road	0.35	Packers Gulch
11-4E-21	Yellowbottom A Spur	0.21	Canal Creek
11-4E-31.1	Tyler Spur	0.50	Packers Gulch
11-4E-31.2	Boulder Creek System	0.47	Packers Gulch
11-4E-31.3	Screaming Cat Spur	0.17	Packers Gulch
12-2E-11	12-2E-11 Spur	0.35	Whitcomb Creek
12-2E-11.2	H G Sale Road	0.16	Whitcomb Creek
12-2E-11.3	White Wall Spur	0.08	Whitcomb Creek
12-2E-12.1	12-2E-12.1 Spur	0.41	Whitcomb Creek
12-2E-12.2	12-2E-12.2	0.16	Whitcomb Creek
12-2E-13	O & C 1 (End Section)	1.25	Whitcomb Creek
12-2E-14	Whitcomb Creek System	0.67	Whitcomb Creek
12-2E-14.1	Whitcomb 14.1	0.10	Whitcomb Creek
12-2E-14.2	Whitcomb 14.2	0.91	Whitcomb Creek
12-2E-14.3	E. F. Whitcomb 14.3	0.66	Whitcomb Creek
12-2E-14.4	E. F. Whitcomb P 1	0.06	Whitcomb Creek
12-2E-14.5	White Wall Road	0.26	Whitcomb Creek
12-2E-15	Whitcomb Creek 2 One	0.05	Whitcomb Creek
12-2E-15.1	Whitcomb Creek 2 Two	0.49	Whitcomb Creek
12-2E-15.2	Whitcomb Creek 2 Three	0.06	Whitcomb Creek
12-2E-21.1	Bald Peter Spur 5	0.26	Whitcomb Creek
12-2E-21.3	Bald Peter Spur 6	0.21	Whitcomb Creek
12-2E-23.1	Lower Thistle Spur	0.33	Whitcomb Creek
12-2E-26	Genesis Salvage Road E	0.66	Whitcomb Creek
12-2E-35	Thistle Creek	1.40	Whitcomb Creek
12-3E-1	Upper Boulder	0.89	Moose Creek
12-3E-1.1	Upper Boulder 1.1	1.26	Moose Creek
12-3E-1.2	Upper Boulder 1.2	0.36	Moose Creek
12-3E-2	Upper Boulder 2	0.04	Moose Creek
12-3E-3.1	Lower Dogwood	0.75	Moose Creek
12-3E-3.2	One Eyed Fish	0.06	Moose Creek
12-3E-4	Upper Dogwood	1.30	Moose Creek
12-3E-9.1	One Eyed Fish	0.25	Moose Creek
12-3E-9.2	One Eyed Fish	0.06	Moose Creek
12-3E-9.3	One Eyed Fish	0.15	Moose Creek
12-3E-9.4	One Eyed Fish	0.06	Moose Creek
12-3E-10	Rocky Top 10	0.30	Moose Creek
12-3E-10.1	Rocky III	0.44	Moose Creek
12-3E-11	Rocky Top 11	0.40	Moose Creek
12-3E-11.1	Rocky Top 11.1	0.34	Moose Creek
12-3E-11.2	Sturgeon Falls	0.09	Moose Creek
12-3E-12	Galena Ridge Fire Spur	0.09	Moose Creek
12-3E-15	Rocky Top Spur 1	0.63	Moose Creek

Road #	Route Name	Miles	Sub basin
12-3E-15.1	Rocky Top Spur 2	0.11	Moose Creek
12-3E-15.3	Lower Rocky Top Extension	1.17	Moose Creek
12-3E-15.4	Infantile Rivalry	0.27	Moose Creek
12-3E-16	Rocky Top	0.70	Moose Creek
12-3E-16.1	Simpsons Yellowstone	1.59	Moose/Packers
12-3E-17	Moose Creek Spur 1	0.25	Moose Creek
12-3E-17.2	Moose Creek Spur 2	0.19	Moose Creek
12-3E-17.4	Moose 17.4	0.04	Moose Creek
12-3E-18	Bull Moose Spur	0.04	Moose Creek
12-3E-19.1	Section 19 Spur 1	0.37	Moose Creek
12-3E-19.2	Pre-Coot Spur	0.38	Moose Creek
12-3E-19.3	Coot Spur	0.13	Moose Creek
12-3E-19.4	Section 19 Spur 4	0.12	Moose Creek
12-3E-19.5	Bull Moose P1 Extension	0.19	Moose Creek
12-3E-19.6	Bull Moose 19.6 D	0.19	Whitcomb Creek
12-3E-19.7	Moose 19.7 Road	0.20	Moose/Whitcomb
12-3E-19.8	Bull Moose Main	0.47	Moose Creek
12-3E-20	Thomas Creek Coot Extension	0.09	Moose Creek
12-3E-30.1	Lower M & M Thinning Spur	0.16	Moose Creek
12-3E-30.2	Lower M & M Thinning Spur	0.11	Moose Creek
	TOTAL	**63.30**	

Appendix I

Recreation Opportunity Spectrum (ROS)

The Recreation Opportunity Spectrum (ROS) is the planning framework that was used to inventory both private and public lands in the Quartzville Watershed. Three major components that affect visitor use and preference are setting, activity, and desired experience. Visitors participating in the same activity may be seeking different settings and experiences. For example, one camper may desire a wilderness setting to experience solitude and challenge. Another camper may want highly developed facilities that offer more comfort and social opportunities. To meet these different needs, ROS is a system that is divided into seven major classes that provide a spectrum of opportunities, ranging from more primitive to more developed.

Primitive: Characterized by an unmodified natural environment of fairly large size where evidence of humans and human-induced restrictions and controls is essentially absent and motorized access is not permitted. Very low social interaction.

Semi-Primitive / Non-Motorized: Characterized by a predominantly natural environment of moderate to large size where evidence of humans and human controls is present but low. Motorized use is not permitted. Social interaction is low.

Semi-Primitive / Motorized: This class is similar to the previous one, however, motorized use is allowed.

Roaded Natural: Characterized with a predominantly natural environment with moderate evidence of human modification and control, that are in harmony with a natural setting. Moderate social interaction

Roaded Modified: Forest or other natural environment, with obvious modifications such as logging or mining, etc., road access and limited facility development, within an open space context. Moderate social interaction.

Rural: Characterized by an environment that is culturally modified to the point that it is dominant feature. Cultural modifications are usually associated with agricultural activities, residential activities, and utility corridors. Moderate social interaction.

Urban: This class is similar to rural however facility development is intensified and the environment though natural appearing is often landscaped. Modifications are designed to enhance specific recreational activities.

Appendix J

Quartzville Creek Wild and Scenic River Management Actions

This appendix outlines the key Management Actions from the Quartzville Creek Wild and Scenic River Management Plan (November, 1992).

Resource Management Guidance and Actions

The planning cycle for most plans of this nature are 10 to 15 years; however, its effects could be evident for the next 50 years or longer. In developing the plan, management objectives and a desired future condition were developed for each resource to help provide short-term and long-term guidance in the management of Quartzville Creek.

Recreation

Management Objectives

* To provide a wide range of recreation opportunities managed in a fashion that prevents the degradation of the outstandingly remarkable values.

* To provide facilities, river access and administrative control that support resource protection, visitor safety, health, and enjoyment.

* To provide recreation users with education, information, and interpretation designed to encourage stewardship and minimize user impacts and conflicts.

Desired Future Condition

The outstanding recreation opportunities that Quartzville Creek offers for activities, such as swimming, camping, fishing, recreational mining, whitewater boating, and nature study, will continue to attract visitors to the corridor. Additional facilities would be developed to meet growing recreational demands and provide short-term and long-term protection of the river's resources and outstandingly remarkable values. However retaining the natural and undeveloped character of the river corridor would be emphasized.

Facilities: New overnight facilities would vary in size and level of development depending on

their location in the corridor. Providing resource protection and barrier-free access would be emphasized. The area around the upper portion of the designated segment would be the priority for resource development. Facility design would attempt to minimize impacts to scenic values and other resources within the corridor.

River Access and Trail Development: Some improvements in river access would occur in the river corridor in places where needed and where parking is adequate. Efforts would be made to provide barrier-free access where possible. Trail development opportunities, within and extending outside of the river corridor would be pursued. Connectivity to potential trails on Green Peter Peninsula, Crabtree Lake, and the Willamette National Forest, would be emphasized.

Land Acquisition: The lands in the corridor which have the greatest concentration of overnight use and the highest potential for recreation development are currently under private ownership. These lands would be acquired on a willing-seller-basis to provide potential sites for facility development and support more consistent recreation management in the corridor.

Administration: The level of administrative presence would increase through patrolling, education and interpretation. Visitor safety and resource protection would be emphasized. Recreation use patterns and preferences would continue to be monitored, helping managers to track recreation use levels, trends, and to anticipate potential use conflicts. Standards for recreational use impacts would be developed along with management actions designed to reduce unacceptable impacts. The least restrictive actions would be selected, as long as standards for unacceptable impacts are not exceeded.

Currently boating activity on Quartzville Creek is minimal, consisting primarily of kayaking, when flows are high enough. The need for a use-allocation system for recreational boating is not expected in the near future.

Increases in recreation use along the Green Peter Reservoir may affect the level and type of use within the corridor. These connections make coordination between neighboring management agencies a key component of managing recreational use both within and outside the boundary limits. Any increase in agency presence would be coordinated, when possible, with neighboring agencies in an effort to provide greater coverage and consistent management.

Undeveloped Camping: This plan would attempt to maintain undeveloped camping opportunities, however, management of undeveloped use would increase and long-term resource protection would be emphasized. Visitor education would be increased to encourage low impact use habits and minimize undesirable conditions such as multiple fire rings, litter, loss of vegetation, tree damage and improper disposal of human waste. Undeveloped sites continuing to exhibit these undesirable impacts would be temporarily or permanently closed.

Recreational Mining: Recreational mining, an outstandingly remarkable value, would continue as an important recreation opportunity within the river corridor. Regulations governing the

management of recreational mining will be consistent with requirements of the Division of State Lands (DSL) and the Oregon Department of Environmental Quality (ODEQ) (see Appendix C). This plan would seek to enhance the recreational mining experience through interpretation information about the mining history of the Quartzville drainage. Education about minimizing the impacts of recreational mining and reducing conflicts with other river users would also be provided.

Interpretation: Interpretation of prehistoric and historic values, along with the importance of river resources and resource protection would be key themes. Another important component would provide adequate orientation information to visitors about recreation facilities and opportunities available within the corridor.

Management Actions

Facility Development

1. Prepare a facility development plan which would include:

* Constructing up to four overnight recreation facilities of varying size and levels of development. (The estimated costs below do not show maintenance costs for any new facilities being developed.)

Schedule: Planning will begin in 1993 and construction will occur as funding allows.
Estimated Cost: $350,000 for the larger facility (similar to Yellowbottom Recreation Site) and $100,000 for each smaller facility.

* Identifying and providing for interim facility needs such as portable restrooms.

Schedule: Attempt to provide in 1993, or as soon as funding allows.
Estimated Cost: $6,000 for six units over five months.

* Evaluating the feasibility of expanding Dogwood Recreation Site to include overnight walk-in tent camping.

Schedule: Begin planning in 1993 with construction occurring as funding allows.
Estimated Cost: $15,000-20,000 for planning and to provide a water source and overnight tent sites.

* Converting a 3.2-acre parcel of BLM land acquired from the General Services Administration into a group-use recreation site.

Schedule: Begin planning in 1993 with construction occurring as funding allows.
Estimated Costs: $75,000 for planning and construction.

* Identifying key areas for developing permanent restroom facilities outside of developed recreation sites.

Schedule: Identify sites in 1993 with construction occurring as funding allows.
Estimated Costs: $2,000 for planning and $10,000 per one-person unit.

* Providing an RV dump station within or in close proximity to the river corridor.

Schedule: Identify site in 1993 with construction occurring as funding allows.
Estimated Cost: $10,000-15,000 for planning and construction.

River Access and Trail Development

1. Improve river access in four to six locations and provide barrier-free access where possible.

Schedule: Begin in 1994 with construction occurring as funding allows.
Estimated Cost: $4,000 to $6,000 for planning and construction, with varying maintenance costs.

2. Construct up to two barrier-free fishing platforms along Quartzville Creek.

Schedule: Begin planning in 1994, with construction occurring as funding allows.
Estimated Cost: $10,000 to $15,000 for the planning and construction of each platform.

3. Prepare a trail development plan including trails within and extending out of the river corridor and connecting with trails on the Willamette National Forest when possible. Connections to Crabtree Lake and Green Peter Peninsula would also be considered.

Schedule: Attempt to complete plan by 1994, construction would be begin as funding allows.
Estimated Cost: $7,000 for planning. Construction costs will vary depending on the types and lengths of trails.

Land Acquisition

1. Pursue the acquisition (on a willing seller basis) of approximately 1,200 acres of private land through purchase or exchange. In the case of an exchange, the use of public domain

lands rather than O and C lands would be emphasized in an effort to minimize impacts on county timber receipts.

Schedule: Ongoing.
Estimated Cost: $6,000 to $8,000 to complete the administrative portion of the exchange. $20,000 to $30,000 will be needed to staff botanical, wildlife, and cultural resource clearances on both the private and BLM parcels.

2. Pursue an MOU with private landowners in the corridor for the management of recreation on private lands, on an interim basis, until acquisition is completed.

Schedule: Attempt to establish in 1993.
Estimated Cost: $1,000 for staffing.

Administration

1. Work cooperatively and develop a Memorandum of Understanding (MOU) with the USFS, Sweet Home Ranger District, U.S. Army Corps of Engineers, Linn County and the State Marine Board to manage recreation along the entire Quartzville drainage and Green Peter Reservoir.

Schedule: Attempt to complete during 1993.
Estimated Cost: $1,000 per year for staffing.

2. Develop standards for user impacts, conflicts and crowding.

* Informally monitor through visitor contact on a yearly basis.

* An intensive study would be completed every five years or as needed. Information on use levels, patterns, conflicts, and user preferences would be gathered.

Schedule: First five year study completed in 1991, next one to occur in 1996.
Estimated Cost: $1,000 a year for staffing and approximately $7,000 to $10,000 dollars every five years, depending on the extent of the study.

3. Develop interim recreational use guidelines for the corridor. (see Appendix C)

Schedule: Finalize guidelines by 1993 and revise as necessary.
Estimated Cost: $1,000 for staffing.

4. Provide a seasonal recreation staff during peak-use period. Attempt to coordinate with

neighboring agencies for providing additional coverage.

Schedule: Attempt to begin in 1994 as funding allows.
Estimated Cost: $14,000 per year.

5. Install and maintain limited signing as well as publications informing visitors of use regulations encouraging low-impact use practices and directing them to public river access, recreation sites.

Schedule: Begin installation in 1994 and maintain as needed.
Estimated Cost: $3,000 to $5,000 initially with maintenance costs as needed.

Undeveloped Camping

1. Inventory undeveloped campsites within the corridor.

Schedule: Attempt to complete in 1993 and update every five years.
Estimated Cost: $3,500 every five years for staffing.

2. Develop criteria for identifying sites unsuitable for undeveloped camping and close those sites permanently. Also develop criteria for those sites which are suitable but have unacceptable use impacts and need to be temporarily closed and rehabilitated.

Schedule: Develop criteria in 1993, finalize in 1994 and update every five years or as needed.
Estimated Cost: $3,500 for staffing.

3. Develop signing and interpretive materials that encourage low impact camping practices.

Schedule: As funding allows.
Estimated Cost: See Administration actions.

Recreational Mining

1. Develop interim guidelines for managing recreational mining using ODEQ and DSL requirements. (See Appendix D)

Schedule: Attempt to finalize in 1993 and update as necessary.
Estimated Cost: $1,800 for staffing, with minor costs for updating.

2. Develop recreation mining brochure which has historical mining information, mining guidelines and encourages low-impact mining practices.

Schedule: Attempt to complete by 1994.
Estimated Cost: $5,000 for design, layout and one year of printing.

Interpretation

1. Develop an interpretative master plan for the entire river corridor that would provide guidance in enhancing visitor experiences and supporting resource protection.

Schedule: Begin planning in 1994, with implementation occurring as funding allows.
Estimated Cost: $7,000 for planning with construction costs varying with interpretive projects selected.

2. Develop an MOU with neighboring private, state and federal entities to coordinate efforts, promote linkage, and prevent duplication of interpretive messages and materials.

Schedule: Would be incorporated into 1993 recreation MOU.
Estimated Cost: See Administration actions.

Road Management

Management Objectives

* To provide scenic driving opportunities and promote road safety along Quartzville Access Road.

Desired Future Condition

The Quartzville Access Road would be managed for recreational and commercial traffic. The BLM-administered segment of the Quartzville Access Road would be dedicated as a part of the BLM's Back Country Byway program. An Oregon State Scenic Byway dedication would also be pursued. A road design and feasibility study would be sought to evaluate the Quartzville Access Road's ability to safely accommodate current and future levels and types of traffic. Coordination and cooperation on the management and maintenance of the entire length of the Quartzville Access Road would be sought.

Management Actions

1. Pursue a road design and feasibility study for the BLM-administered segment of the Quartzville Access Road. Where possible attempt to implement the recommendations of the study.

Schedule: Attempt to fund in 1994, will be completed as funding allows.
Estimated Costs: $200,000 for study and varying implementation costs depending upon recommendations made.

2. Until a feasibility study is completed, continue to meet safety requirements for a single-lane road with turnouts.

Schedule: Ongoing.
Estimated Cost: $34,000 annually.

3. Dedicate the Quartzville Access Road as a BLM Back Country Byway.

Schedule: Begin dedication submission process in 1993.
Estimated Cost: $5,000 for planning and Back Country Byway Kiosk.

4. Pursue having the Quartzville Access Road nominated and dedicated an Oregon State Scenic Byway.

Schedule: Begin nomination process in 1993.
Estimated Cost: Unable to estimate at this time.

5. Coordinate with the USFS Sweet Home Ranger District in road management and maintenance.

Schedule: Ongoing.
Estimated Cost: $500 per year for staffing.

6. Install signing encouraging traffic safety and warning drivers of oncoming commercial log truck traffic.

Schedule: As funding allows.
Estimated Costs: $3,000 initially, with additional funding required for replacement as needed.

Water Quality

Management Objectives

* To protect and enhance water quality. Strive to maintain acceptable water temperatures and levels of turbidity, oxygen, suspended sediment, chemicals, and bacteria.

* Seek to restore natural ecological and hydrological functioning along Quartzville Creek.

Desired Future Condition

Water quality is specifically addressed in the National Wild and Scenic Rivers Act. The intent of the Act is to maintain the character of the river and protect or enhance specific resource values. Maintaining water quality on Quartzville Creek is important because it directly relates to the health and condition of the river's outstandingly remarkable values, such as scenery (including cascading white water and water clarity) and recreation (recreational mining and white water boating). Water quality is also important to other significant values such as fisheries. Maintaining and improving water quality while enhancing the rivers outstanding scenic and recreational values will require a monitoring program to collect baseline data, develop water quality standards, assess trends, and identify pollution sources and potential mitigating measures.

The BLM is obligated by a number of federal laws to concern itself with water quality. Chief among these laws are the National Environmental Policy Act of 1969, the Federal Land Policy and Management Act of 1976, and the Clean Water Act of 1977 amended 1987. The Clean Water Act lists the State of Oregon as ultimately responsible for the protection of the quality of all waters contained in the state. However, the Oregon Department of Environmental Quality (ODEQ) has identified the BLM as a designated water management agency responsible for protecting water quality as part of its land management planning and implementation. Taken together, these laws require BLM to comply with all federal, state, and local water quality protection measures.

Guidelines for water quality have been defined by ODEQ for the Willamette River Basin, which contains Quartzville Creek. These guidelines include maximum allowable changes in the physical, chemical, and microbiological quality of the creek depending on natural or background levels. The 1988 ODEQ publication entitled "Oregon Statewide Assessment of Non-point Sources of Water Pollution" lists Quartzville Creek as moderately impacted for nutrients, sediment, and stream structure caused by landslides, erosion, changes in flow patterns, road runoff, riparian disturbance, elimination of thermal cover, and removal of vegetation from the watershed.

Once baseline data is collected and the natural variation in the river's water quality is established, standards will be developed to characterize existing water quality. These standards will enable hydrologists to detect changes in water quality and identify potential sources. If negative impacts are identified, point or non-point sources will be isolated and appropriate state and federal authorities notified to take enforcement actions as prescribed by existing laws. All human activities that can affect water quality will be reviewed. Specific projects such as recreation trails and facilities will be reviewed for adverse impacts to water quality.

Management Actions

1. Recommend to the United States Geological Survey (USGS) to maintain operation of the

stream gage on Quartzville Creek at Panther Creek.

* Recommend the USGS maintain the gage on Quartzville Creek. If the agency considers closure, then consider cooperative funding if possible.

Schedule: As needed.
Estimated Costs: Up to $5,000 a year for cooperative funding.

2. Develop water quality standards for Quartzville Creek using state guidelines and baseline data currently being collected.

* After three years of baseline data have been collected, interim guidelines will be established using the Limits of Acceptable Change (LAC) process (see Appendix E).

* Interim guidelines will be tested for applicability and effectiveness for two years, then finalized.

* Notify ODEQ of the parameters.

Schedule: Establish interim parameters (natural variation) by 1995 and final parameters by 1997.
Estimated Costs: One time costs are $5,000 for planning and staffing.

3. Develop a long-term monitoring program for water quantity and quality.

* BLM will conduct monitoring and testing at three locations on the river, one site near the upper end of the designated segment, one between, and one near the lower end of the segment.

* The locations will be tested for a range of chemical, biological, and physical indicators, and stream discharge on a monthly basis for three years, and bi-monthly or quarterly thereafter.

Schedule: Begin monitoring immediately.
Estimated Costs: Annual costs are $5,000 per year for staffing, equipment and water testing.

4. Establish an action plan outlining notification procedures and specific actions if pollution levels are exceeded.

* BLM will develop an action plan to isolate pollution sources if a problem develops.

* BLM will develop notification procedures to follow if pollution is detected.

Schedule: Attempt to have completed by 1995.
Estimated Costs: One time costs are $4,000 for planning and staffing.

5. Notify ODEQ of any water quality problems originating outside BLM jurisdiction.

* ODEQ will be notified and a request made to locate and mitigate problems which develop outside BLM jurisdiction.

Schedule: As needed.
Estimated Costs: $500 a year for staffing.

6. Dispersed campsites in and adjacent to riparian areas would be evaluated for adverse impacts to water quality. Areas found to have unacceptable impacts would be permanently closed or temporarily close and rehabilitated.

Schedule: Attempt to complete by 1994.
Estimated Costs: One time costs are $2,000 for planning and staffing. Rehabilitation costs will depend on the number of sites selected and the type or rehabilitation needed.

7. If the need develops, coordinate water quality monitoring with the USFS.

* Coordinate water quality monitoring with the USFS to identify non-point pollution sources if problems arise on forest service lands.

Schedule: Ongoing.
Estimated Costs: $500 a year for staffing.

8. Identify watershed enhancement opportunities on BLM lands which would meaningfully reduce non-point source pollution on Quartzville Creek.

* Identify and implement projects such as, riparian area rehabilitation, landslide rehabilitation, erosion reduction projects on roads, campgrounds, and trails.

Schedule: Ongoing.
Estimated Costs: $2,000 per year for staffing and materials.

9. Initiate cooperative watershed enhancement opportunities on neighboring private and public lands, if necessary, to reduce non-point pollution.

* Identify and work with neighboring landowners if necessary to reduce non-point pollution sources.

Schedule: Ongoing.
Estimated Costs: $1,000 a year for staff and planning.

Botanical/Ecological

Management Objectives

* To provide plant and animal community diversity and maintain and/or enhance healthy functioning ecosystems as the foundation to sustain long-term productivity.

* To protect any special status species identified in the corridor.

Desired Future Condition

The desired future condition is to perpetuate and conserve naturally functioning ecosystems within the river corridor. Some aspects of ecosystem conservation will include: nutrient cycles, plant and animal habitat, number of species, abundance and density of species, spatial arrangement and geological and successional processes. Conservation practices would seek to maintain native plant communities and their habitats and protect rare, sensitive, threatened and endangered species administered by federal and state agencies and the Oregon Natural Heritage Program. Facility development and any other management activities would take into consideration and mitigate the impacts to these resources. Revegetation, where necessary, would be done with native species when possible.

Management Actions

1. Comply with existing BLM policy, federal and state laws and regulations governing the management of special status species should any be identified in the corridor.

Schedule: Ongoing.
Estimated Cost: Will vary depending on situation and species identified.

2. Complete botanical surveys on specific locations where planned management actions such as access routes to streams, access road modifications, sanitation and dump station sites, waste disposal sites, interpretive trails and timber harvest would occur.

Schedule: As needed.
Estimated Cost: $500 per clearance (may vary with size of project area).

3. Cooperate with the Department of Agriculture on the removal of any noxious weeds identified within the corridor or in close proximity to the corridor boundary.

Schedule: As needed.
Estimated Cost: Will vary with type and extent of invasion, and method of eradication.

Riparian Areas

Management Objectives

* Seek to restore proper functioning condition of riparian areas. Proper functioning condition exists when adequate vegetation and large woody debris are present to dissipate stream energy associated with high water flows, stabilize streambanks, develop diverse channel characteristics, and support greater biodiversity.

* Maintain a spectrum of seral stages throughout the riparian corridor driven primarily by natural disturbances.

* Manage for native species.

Desired Future Condition

Healthy riparian areas provide values and benefits far in excess of the small percentage of area they occupy. When a riparian area is healthy and functioning properly, its lush vegetation contributes to improved water quality, rebuilds flood plains, reduces erosion, helps store floodgates, and regulates flows. A healthy riparian also encourages vegetative growth for a more productive animal community and are of critical importance to fish, birds, and other wildlife. It supports a large diversity of insects, mollusks, and crustacean species that are key resources in the food chain. Riparian areas provide shelter, nesting, and traveling corridors for a diversity of wildlife species.

The BLM national policy goal guiding future riparian management is to maintain, restore, or enhance riparian-wetland values to achieve a healthy and properly functioning condition for maximum long-term benefit. Four major goals and strategies for achieving the riparian management policy are outlined in the BLM publication "The Riparian-Wetland Initiative for the 1990s". These general goals are: (1) maintain and restore riparian areas, (2) protect riparian areas and associated uplands, (3) provide information and education, and (4) improve coordination between land owners.

Management Actions

1. Comply with BLM policy, federal, and state laws and regulations governing the management of riparian areas.

Schedule: Ongoing.
Estimated Costs: Will vary with situation.

2. Allow no timber harvesting within 200 feet of Quartzville Creek on BLM- administered lands.

* Exceptions to this action would be harvesting for recreational development or improvements, scenic enhancement, and hazard tree removal. Such activities would require an interdisciplinary review for approval.

Schedule: As needed.
Estimated Costs: No cost expenditures necessary.

3. Seek watershed and riparian enhancement opportunities and provide technical assistance and funding for enhancement projects. Pursue cooperative and voluntary opportunities for rehabilitation projects.

Schedule: As needed beginning in 1993.
Estimated Cost: $1,000 annually for supplies and $1,800 annually for staffing.

4. Close sensitive or excessive river access routes and trail networks within riparian zone.

Schedule: Initiate after plan implementation.
Estimated Costs: $300 annually for supplies and $900 annually for staffing.

Wildlife

Management Objectives

* To comply with existing BLM policy, federal and state laws and regulations, governing the management of special status species and other wildlife.

* To protect, restore and/or enhance wildlife habitat in and adjacent to the corridor.

* To coordinate with other agencies and organizations to better manage wildlife habitat.

Desired Future Condition

Management of wildlife habitat would stress protection of critical habitats such as wetlands, riparian areas, deer and elk winter range, and old-growth forests. Management would attempt to minimized or mitigate impacts from human activities to the extent that natural processes are allowed to continue.

Selected wildlife species and habitats within the corridor would be inventoried to establish baseline data for the development of a future habitat monitoring program and to better evaluate impacts of future actions. Wildlife species inventories would stress those species listed by the U.S. Fish and Wildlife Service and the State of Oregon as threatened, endangered, sensitive, or of special concern.

Coordination and cooperation with other agencies and interested parties would be important for the consistent management of the wildlife resource. This includes opening negotiations for the acquisition of private land within and adjacent to the corridor to better facilitate management of the wildlife resource.

Habitat restoration and/or enhancement would be pursued in order to restore previously impacted areas or improve existing habitats.

Management Actions

1. Inventory and monitor selected wildlife species and habitat to establish baseline data on species presence, habitat condition and trends.

* Species inventory would place emphasis on determining occurrence and relative abundance of species listed as threatened, endangered, sensitive, or of special concern. A site specific wildlife observation file would be compiled and maintained. Baseline data would be used to better evaluate impacts of future actions and develop a wildlife habitat monitoring program. Monitoring efforts would be directed toward wildlife habitat. Wildlife habitat inventory and monitoring would focus on critical habitats such as wetlands, riparian areas, deer and elk winter range, and old-growth forests.

Schedule: Attempt to begin inventory in 1994.
Estimated Costs: $9,000 annually for two years until the inventory is completed. The cost of the monitoring program will vary depending on the level of monitoring necessary.

2. Dispersed campsites in and adjacent to riparian areas would be evaluated for adverse impacts to wildlife. Close and rehabilitate areas found to have unacceptable impacts. Other habitat protection, restoration and enhancement opportunities would be identified based on habitat inventories and monitoring.

Schedule: Same as wildlife inventory.
Estimated Costs: Costs included in species inventory estimate.

3. Pursue negotiations for the acquisition of private land within and adjacent to the corridor to better facilitate management of the wildlife resource.

* Critical habitat areas on private lands in and adjacent to the corridor would be identified. Land values would be investigated and parcels identified and ranked in importance from a wildlife perspective. Continue negotiations with private landowners

for the acquisition of parcels.

Schedule: Begin in 1993 and continue until completed.
Estimated Costs: See Land Acquisition section.

4. Recommend the Quartzville Creek Corridor be designated a Watchable Wildlife Area.

* Quartzville Creek provides the opportunity for observing several osprey and osprey nests along the corridor. Bald eagle activity is also common around Green Peter Reservoir, directly below the designated river segment.

Schedule: Begin in 1993.
Estimated Costs: $900 for staffing and up to $2,500-3,500 for an interpretive signing.

Fisheries

Management Objectives

* Maintain/improve the current condition of fish habitat, to preserve the quality of the recreational rainbow trout fishery and the wild cutthroat trout fishery.

* Minimize impacts on fish habitat from facility development, unregulated recreation use and road construction.

* Maintain/improve the current habitat conditions, such that reintroduction of anadromous fish to Quartzville Creek is feasible, in the event that Oregon Department of Fish and Wildlife makes a decision to do so.

Desired Future Condition

Existing fish resting, rearing and spawning habitat will not be further degraded as a result of human activities. Habitat quality will gradually improve in Quartzville Creek and its tributaries as previously disturbed riparian areas revegetate, and as new land management practices afford better protection for these areas in the future. Fish habitat restoration measures will help speed this process.

Management Actions

1. Conduct a habitat and species inventory for Quartzville Creek and one of its main tributaries.

Schedule: Will be completed by September, 1993.
Estimated costs: One-time costs of $4,650 for habitat inventory and $1,500 for staffing for species inventory work.

2. Develop a habitat monitoring program for Quartzville Creek and that same tributary.

* Habitat inventories are generally conducted at ten-year intervals. If habitat improvement structures are constructed, intervals of five years are recommended.

Schedule: Program will be developed after the initial inventory is completed.
Estimated Costs: Unless habitat improvement structures are implemented, annual monitoring costs will be $465 for staffing.

3. Leave fallen trees along and in Quartzville Creek to provide large woody debris in the stream channel.

Schedule: Ongoing.
Estimated costs: None.

4. Enhance riparian conditions where possible.

* Planting of cedar, willow and alder in impacted riparian zones.

* Possible installation of structures to divert water away from areas of human-caused bank erosion.

* Closure of riparian areas impacted by heavy recreational use.

Schedule: Ongoing.
Estimated costs: Annual costs of $1,000 for materials and $1,000 for staffing.

Visual Resources

Management Objectives

* To comply with Visual Resource Management (VRM) guidelines (see Appendix E) for public lands within the river corridor.

* To protect and maintain the visual resources within the river corridor.

Desired Future Condition

Scenic driving was identified as one of the outstandingly remarkable values for which Quartzville Creek was designated. This plan would seek to maintain the undeveloped character of the river as well as protecting the key visual components within the river corridor.

Some of the key visual components within the river corridor are old-growth stands, views of Quartzville Creek (waterfalls and white water riffles), wildlife (osprey nests), color and texture contrasts provided by younger stands and hardwoods and rocky outcroppings.

Directed by VRM guidelines (see Appendix E), those lands with a Class 2 rating would be managed such that, "changes in any basic element caused by a management activity should not be evident in the characteristic landscape." Those lands with a Class 3 rating require that," while contrasts to the basic elements caused by management activity may be evident and may attract attention in the characteristic landscape, changes should remain subordinate to the existing landscape.

Some vegetation manipulation may be allowed for enhancement of scenic qualities. (i.e. removing vegetation to open up view of water falls, revegetation where needed, etc.
Any management activities such as facility development or timber harvest would be subject to modification, and screening of any development would be used whenever possible to preserve scenic values within the corridor.

Scenic values on private lands within the corridor will improve as disturbances become less observable as vegetation regrowth continues. Should any of these lands be acquired through purchase or exchange, they would be inventoried, classified and managed under the same guidance as other public lands in the corridor.

Management Actions

1. Inventory and map viewshed along Quartzville Creek from Quartzville Road, and identify key viewpoints to be protected or enhanced.

* After initial inventory and map has been completed, monitor visual resources every five years, and update as necessary.

Schedule: Complete by 1995.
Estimated Cost: $2,000 for initial inventory and mapping.

2. Monitor compliance with VRM guidelines for any proposed management action and make necessary modifications on proposed actions for the protection of visual resources.

Schedule: As needed.
Estimated Cost: Will vary depending on extent and type of proposed action.

3. Work with private landowners in minimizing the visual impacts of timber harvest and other activities on private lands.

Schedule: As needed.
Estimated Cost: Will vary, depending on level and type of involvement.

4. Open negotiations on a willing-seller basis for the acquisition of private land within the river boundary.

Schedule: See land acquisition.
Estimated Cost: See land acquisition.

Cultural Resources

Management Objectives

* Identify historic and prehistoric cultural resource sites and protect and stabilize significant sites.

* Emphasize providing users with education, information, and interpretation designed to minimize user impacts and to encourage appreciation of cultural resources.

Desired Future Condition

This plan will seek to protect prehistoric and historic cultural resources within the river corridor. Significant cultural sites will remain stable and where necessary, stabilization measures will be taken to prevent deterioration resulting from natural or human-induced processes. Sites will be available for scientific research purposes if the site can contribute significant information to broad research questions. Conservation of sites for future use will be emphasized for all significant sites. Interpretation of cultural resource themes relevant to the Quartzville Corridor will be undertaken to enhance recreational visitors experience and to promote site protection and positive stewardship values in the public. Interpretation efforts may take a variety of forms, including publications, but would not typically occur on the cultural resource site locations themselves. Interpretive materials may take a variety of forms, including publications, and would be made available typically at developed recreation sites or interpretive facilities.

The presence of specific prehistoric sites is not known at this time. Historic activities and sites have been identified. The National Historic Preservation Act and other laws mandate certain requirements for identification, evaluation and protection of cultural resource values. The intent of this plan is to identify and protect significant cultural resources and to enhance recreational experiences of visitors through a variety of means including interpreting the local history and prehistory of the Quartzville Creek Corridor. This will be done by conducting inventories of lands and recorded sources and may also include collecting oral histories, when possible. Evaluations of identified sites will occur in accordance with federal law and Bureau policy.

Management Actions

1. Conduct a cultural resource inventory within the Quartzville Wild and Scenic corridor boundary.

Schedule: Complete by 1995.
Estimated costs: $35,000 for a one-time cost.

2. Evaluate and determine eligibility of all sites for the National Register of Historic Places.

Schedule: Following inventory, or as needed.
Estimated costs: $5,000 to $20,000 per site.

3. Manage suitable cultural resources for scientific use, socio-cultural use, public use or conserve for future use according to the use categories in BLM Manual 8111.21.

Schedule: Ongoing.
Estimated costs: $5,000 annually.

4. Interpret cultural resource information, emphasizing prehistoric and historic themes pertinent to the corridor and the importance of resource protection. Interpretation efforts would focus on minimal on-site construction in developed recreation sites.

Schedule: Following inventory, with the majority of work in the two years immediately thereafter. Ongoing and updating interpretation would continue to occur in the years following the initial work.

Estimated costs: $10,000 annually for the first two years after initiation of interpretation efforts, $3,000 annually in succeeding years.

5. Monitor cultural resources in the corridor.

Schedule: Following inventory, ongoing.
Estimated costs: $3,000 annually.

Timber and Special Forest Products

Management Objectives

* To provide timber and special forest products management that is consistent with National Wild and Scenic Rivers Act and other BLM land use plan allocations and guidelines.

Desired Future Condition

Timber management and special forest products collecting would be allowed to occur within the corridor as long as they are consistent with other resource management objectives and broader land use plans for the Salem District. Management actions associated with these resources would be analyzed for potential adverse impacts to the outstandingly remarkable values or other

significant river-related values. Actions resulting in impacts will require modification or mitigation to eliminate or reduce such adverse impacts.

Management Actions

1. Timber management activities and the collection of special forest products will be allowed as long as they are consistent with other resource management objectives and guidelines for the corridor.

Schedule: As needed.
Estimated Cost: Will vary, depending on extent and type of activity.

Implementation Priority

The full implementation of this plan will require a significant investment. Some of the costs associated with staffing for monitoring purposes may be partially covered with existing personnel. However, additional funding will be necessary for facility planning and construction and program development. Where possible, partnerships will be sought to help provide additional funding.

The priority in implementing this plan will emphasize public health, safety and resource protection. Of immediate concern is the lack of sanitation facilities and agency presence within the corridor. Another important concern is the high level of undeveloped recreation use and user impacts occurring on private land in the corridor.

The feasibility study for the Quartzville Access Road is also a priority, because the capacity of the road should be established before any major facility development occurs which might increase traffic in the area.

As impacts associated with high concentrations of undeveloped camping continue to increase, the need for more developed sites will intensify. This makes implementing the facility development portion of this plan a key activity.

To aid in tracking the implementation process, a brief summary report will be prepared on an annual basis discussing accomplishments, monitoring activities, and unmet needs.

Appendix K

Quartzville Cultural Resource Sites

The following sites are affiliated with historic mining and settlement within the Quartzville Mining District. All of the sites are located in the BLM's (U.S.D.I., n.d.; Stumpf, 1979) Quartzville Creek Wild and Scenic River corridor:

Note: ownership of the site is shown in parentheses following the site description.

SHS 638 - A cabin site designated "Miners Cabin" on the 1897 GLO survey map in an area that was heavily mined. (Private Land)

SHS 640 - The George Ross cabin, shown on the 1897 GLO survey map. Prior to 1897, Ross built a water ditch from Boulder Creek to Quartzville Creek, apparently for mining purposes. The land on which the cabin stood was purchased in 1906 and now belongs to BLM. (BLM)

SHS 642 - A cabin and small power plant built in the 1940's by four men from Albany, this site was destroyed by construction of the Yellowstone Road. (BLM)

SHS 657 - The W.B. Stevens cabin, shown on the 1907 GLO survey map. (BLM)

SHS 658 - The H.H. Stevens cabin, shown on the 1907 GLO survey map. (BLM)

SHS 659 - A cabin designated "Old Cabin" on the GLO survey map of 1907, this cabin site may date to the gold rush of the 1860's. (BLM)

SHS 662 - The Crutch field cabin, shown on the 1907 GLO survey map. (BLM)

SHS 663 - The Nat Needham cabin, shown on the 1907 GLO survey map. (BLM)

SHS 667 - A cabin designated "Hunter's Cabin" on the 1907 GLO survey map. (BLM)

SHS 670 - The Elizabeth Cox cabin, shown on the 1907 GLO survey map. (Private Land)

SHS 671 - The C.B. Chandler cabin, shown on the 1907 GLO survey map. (Private Land)

SHS 820 - Quartzville Access Road. An 1879 GLO survey map shows a trail running from Foster to the Quartzville Mining District along the west and north sides of Quartzville Creek. Portions of the trail were improved into road at various times. In the 1930's, the CCC improved the entire road from Foster to Quartzville. Originally, the trail

was used by early miners and settlers to carry supplies from Sweet Home to Quartzville. After 1911, the Linn County Fire Patrol Association used the trail grade for a string of telephone lines connecting fire lookouts at High Deck, Green Peter and Yellowstone Mountain to their Lebanon main station. Today, the road is incorporated into the major Quartzville county access route. (Private and BLM)

SHS 821 - A short trail branching from the Quartzville Wagon Road at Bryant City and extending south along Canal Creek to join the Quartzville Access road. This trail was in use prior to the 1900's. (BLM)

SHS 828 - Dogwood Park was the location of intensive placer mining form the 1890's through the 1930's. (BLM)

SHS 876 - The A.J. and Robert Babb's cabin on the Maple Leaf placer claim, dates to 1955. The claim was declared void in 1965. (BLM)

SHS 877 - August Kroop cabin on the Big Bend Placer Mining claim dates to 1934. The claim may actually have been made to get the timber. (BLM)

The sites of the town of Quartzville and the town of Bryant City, the Mining District's entertainment center, are outside the Wild and Scenic River corridor on private land. No structures remain on either site.

With the exception of SHS 642 and SHS 820, the condition of these mining-related cultural resources along Quartzville Creek is unknown.

Nearly all the BLM managed lands along Quartzville Creek are originally those unhomesteaded lands granted by Congress to the Oregon and California Railroad Company (O&C company) between 1866 and 1869 for the purpose of raising money to pay for the construction of a railroad which would start in Portland and go through the Willamette Valley, south to California. the O&C Company was required to sell these lands to settlers, but in many cases, as with this area, the land was heavily timbered, steeply dissected, slopes with forest-type soils, and so unsuitable for farming. In 1916, unsold O&C lands were revested to the Federal Government due to numerous violations in the terms of the original grant, and these Quartzville Creek lands returned to be managed as timber lands by the GLO and ultimately, its successor, the Bureau of Land Management. The first timber sales on these lands occurred in the early 1950's.

Other historic sites in the corridor include:

Yellowstone Guard Station, which was built in 1936 by the Linn County Fire Patrol Association (Linn County Fire Patrol Association, 1962) for fire patrol and suppression purposes.

Quartzville Guard Station/Work Center (11-4-29-1h), built in the 1930's at Rabbit Camp on the Willamette National Forest as part of a CCC camp, and moved before 1956 to its present location on BLM land. The two buildings at the site have never been used in their current location and have been found ineligible for the National Register of Historic Places. (U.S.D.I., n.d.)

At this time, the Quartzville Guard Station/Work Center is the only site in the corridor to have been evaluated for National Register eligibility.

Findings: The identified existing historic sites within the Quartzville Creek Wild and Scenic River corridor are not associated with rare, unusual or one-of-a-kind events or cultural activities in the region. Scattered gold mining districts of small production in the western Cascades dating to the same era include the North Santiam District in Clackamas and Marion Counties (1872 to 1947), the Blue River District in Linn and Lane Counties (1887 to 1913), Fall Creek District in Lane County (1901 to 1931) and the bohemia district in Lane County (1858 to recent) (Brooks and Ramp, 1968). None of the Quartzville historic sites are currently listed on or determined eligible for the National Register of Historic Places, although this may be due to the fact that these sites have not been systematically inventories and evaluated. The current information on historic resources in the Quartzville Creek corridor is incomplete and does not support a finding of outstandingly remarkable value. However, additional inventory and evaluation should be conducted in the future to accurately assess these historic resources' values.

Appendix L

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