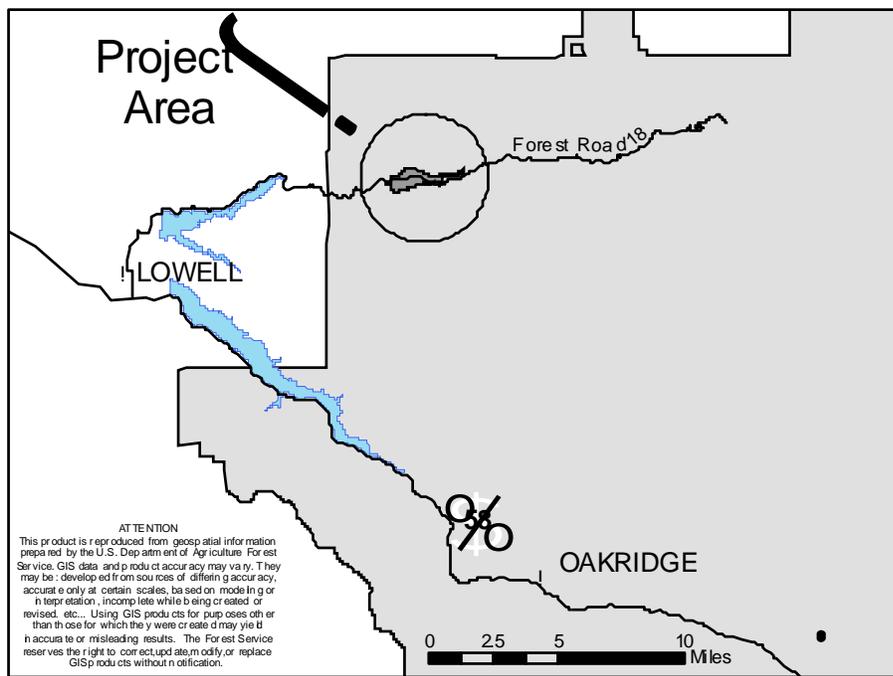
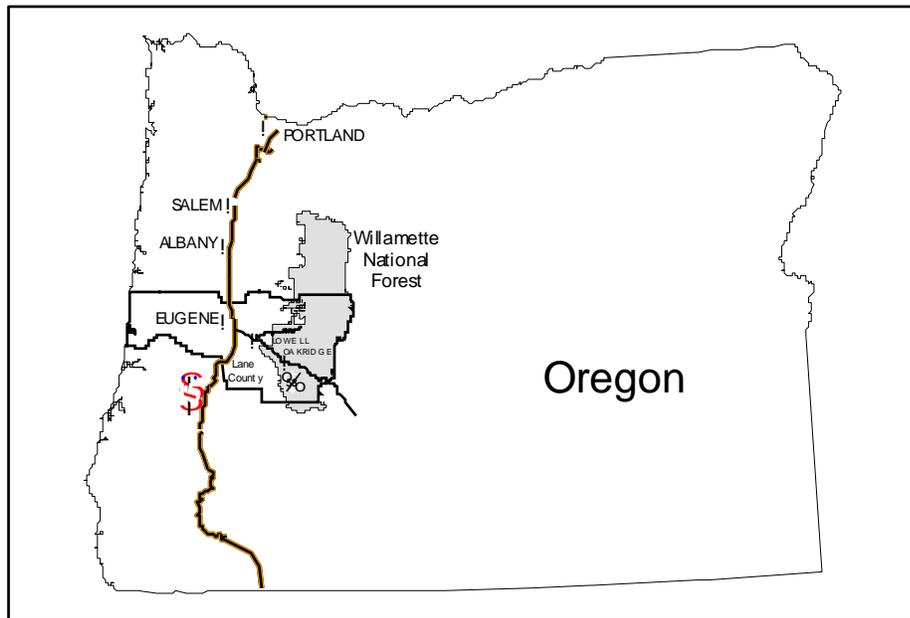


Fall Creek Special Interest Area Fire Recovery Project Environmental Assessment



January 2005

The Vicinity Maps of the Project Area



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Fall Creek Special Interest Area Fire Recovery Project Environmental Assessment

Willamette National Forest
Middle Fork Ranger District
Lane County
Lowell, Oregon

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January 2005

Abbreviations or Acronyms used in the document

Ac - Acres
ACS - Aquatic Conservation Strategy
ARP - Aggregate Recovery Percent
BA-Biological Assessment
BAER – Burned Area Emergency Rehabilitation
BE - Biological Evaluation
BGEA- Big Game Emphasis Areas
BLM - Bureau of Land Management
BMP - Best Management Practices
BO – Biological Opinion
C-30 - Refers to page number in the Northwest Forest Plan where a particular standard and guideline is located.
CCF – Hundreds of Cubic Feet
CHU – Critical Habitat Unit
CVS – Current Vegetation Survey
CWD- Coarse woody Debris
CFR - Code of Federal Regulations
DBH - Diameter Breast Height
DEQ - Department of Environmental Quality
EA - Environmental Assessment
EFH – Essential Fish Habitat
ESA - Endangered Species Act
ESU – Evolutionary Significant Unit
FS – Forest Service
FEIS - Final Environmental Impact Statement
FSM – Forest Service Manual
FW-084 - Refers to Forest-wide standards and guidelines in the Willamette Forest Plan
HEI – Habitat Effectiveness Index
IDT - Interdisciplinary Team
INFMS – Integrated Fuels Management Strategy
KV - Knutson Vandenberg
LSR - Late Successional Reserve
LSRA – Late Successional Reserve Assessment
14A - Refer to Management Areas or land allocations designated in the Willamette Forest Plan
MI. - Mile
MIIH- May Impact Individuals or Habitat
MIS – Management Indicator Species
MMBF - Million Board Feet
MA, NLAA – May Affect, Not Likely to Adversely Affect
NEPA - National Environmental Policy Act
NFMA - National Forest Management Act
NI – No Impact
NOAA – National Oceanic and Atmospheric Agency
NRF - Nesting, roosting, and foraging owl habitat
NTMB – Neotropical Migratory Birds
NTU – Nephelometric Turbidity Units
NWFP – Northwest Forest Plan
OSHA - Occupational, Safety and Health Administration

Pages IV -128 - Refers to page number in the Willamette Forest Plan where a particular standard and guideline is located.
PNV- Present Net Value
PSQ - Probable Sale Quantity
PSUB – Planning Subdrainage
R2E - Range 2 East
RAP – Willamette National Forest Road Analysis Report
ROD - Record of Decision
SIA – Special Interest Area
SOPA - Schedule of Proposed Actions
SRI - Soil Resource Inventory
T-12 – Best Management Practices reference number
T20S - Township 20 South
TE&S - Threatened, Endangered and Sensitive
VQO - Visual Quality Objectives
USDA - United States Department of Agriculture
USDC – United States Department of Commerce
USDI – United States Department of Interior
USFS - United States Forest Service
USF&WS - United States Fish and Wildlife Service
WA – Watershed Analysis
WNFP – Willamette National Forest Plan

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CHAPTER 1 - PURPOSE AND NEED

Introduction

The Forest Service has prepared this Environmental Assessment (EA) for the proposed hazard tree reduction for public safety, forest restoration, fuels management, and salvage of fire-killed timber in the Fall Creek Special Interest Area burned by the Clark Fire in 2003. The EA addresses the Proposed Action and 4 alternatives, including No Action, and the major issues associated with the proposal. It also addresses the direct, indirect, and cumulative effects of implementation of any of the alternatives.

The project area is located in the Fall Creek watershed approximately 12 miles northeast of the community of Lowell, Oregon. The legal description of the area is T18S, R2E, Sections 26, 27 and 28 of the Willamette Meridian, Lane County, Oregon.

Document Organization

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

Chapter 1 - Purpose and Need: The section includes information on the background of the project proposal, the Proposed Action, the purpose of and need for the project, planning framework, management direction, scope of the project decision, tiered documents and local assessments. This section also details how the Forest Service informed the public of the proposal, a summary of public comments, and the issues addressed in the environmental assessment.

Chapter 2 - Alternatives, including the Proposed Action: This section provides a detailed description of the agency's Proposed Action as well as alternative methods for achieving the stated purpose. The alternatives were developed to respond to significant issues raised by the public and other agencies. This section also includes mitigation measures associated with the action alternatives and a discussion of the alternatives considered but eliminated from detailed analysis. Finally, this section provides a summary table of the environmental consequences associated with each alternative.

Chapter 3 - Environmental Consequences: This section describes the environmental effects of implementing the Proposed Action and other alternatives. This analysis is organized by resource area and the associated issues. Within each section, the issue is stated first, and then the existing conditions are summarized, followed by the management direction pertinent to the resource or issue, and then the effects of the alternatives, starting with the no action alternative providing a baseline for evaluation, and finally the discussion and comparison of the action alternatives.

Chapter 4 – Coordination, Consultation and Public Contacts: This section provides a list of the interdisciplinary team who coordinated and prepared the document, agencies and tribes consulted, and individuals and organizations that were contacted or commented during the development of the environmental assessment.

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

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

Clark Fire Background

The Clark Fire started on July 13, 2003 on the south side of Fall Creek near the Clark Creek Organization Camp. The fire was determined to be human-caused and started near a dispersed recreation site. The fire weather conditions were moderate with temperatures in the mid 70's, relative humidity's 30-40 percent, and winds out of the west, 5-15 mph. The fire behavior was described as a rolling crown fire, with the fire climbing through the understory vegetation into the crowns of the trees, carrying from tree crown to tree crown, then dropping back down to the ground, and then starting the fire spread sequence over again. One of the contributing factors to the spread of the fire was the amount of lichens and mosses covering the understory vegetation, hanging from the lower tree branches, and extending into the crowns of the dominant trees. Given the mid-summer conditions, these lichens and mosses were dried out and provided the fine fuels that influenced the spread of the fire. The westerly winds spread the fire to the east up along the Fall Creek corridor and burned approximately 500 acres the first day. The initial attack fire crews assisted in the evacuation of the recreationalists camping in Clark Creek Organization Camp, the dispersed sites along Fall Creek, and the Bedrock Campground. The private property owner to the east was also notified about the fire. State and county fire protection engines and crews were called in to assist with fire suppression around the private property. The fire crossed over to the north side of Fall Creek and spread in the un-roaded Bedrock/Slick Creek area. The fire grew to over 2,000 acres in the first week and had over 1,000 federal and state firefighters assigned to the fire. Due to the steep terrain, fuel types, lack of road access, and fire behavior, an indirect approach to the fire suppression was required to protect fire fighter safety. Firefighters did not have escape routes, nor safety zones, which caused poor egress from the mid-slope areas of the fire. The indirect approach required establishing the fire line on the roads that surrounded the perimeter of the Bedrock/Slick Creek area and the use of back-burning to stop the advancement of the fire. The Clark Fire was contained on July 27th, 2003 and declared controlled on December 1, 2003, after the fall and early winter rains.

The Clark Fire burned an area of about 5,000 acres, including about 3 miles along the river corridor of the Fall Creek Special Interest Area and the Bedrock/Slick Creek drainages of the Late Successional Reserve #RO-219. The 3,300 acre Fall Creek Special Interest Area is a popular recreation use area. The characteristics that draw the public to visit this area are the campgrounds and trail network set in an old-growth forest setting along the scenic Fall Creek with its numerous pools attractive for fishing and swimming. The fire destroyed the Johnny Creek Nature Trail, which was located in the Johnny Creek Old-Growth Grove. The fire burned through the Bedrock Campground and portions of Fall Creek National Recreation Trail, Clark Butte Trail, Jones Trail and numerous dispersed campsites. Over 90 percent of the fire area is in the Late Successional Reserve. The 66,000 acre Late Successional Reserve covers the upper 2/3 of the Fall Creek watershed. The Late Successional Reserves were designed to maintain and enhance late successional forest as a network of forest reserves throughout the Pacific Northwest Region and to provide habitat for populations of species associated with old-growth forest ecosystems.

Aerial photographs taken of the fire area in the fall 2003 were used to determine fire intensity based on crown mortality. About 1,746 acres (35%) of the Clark Fire were in the high to severe categories, resulting in a fire intensity enough to kill a majority (>60%) of the trees. The areas affected by these high to severe fire intensities include the Johnny Creek Nature Trail area, the riparian area along Fall

Creek up to Bedrock Campground, and the mid-to-upper slopes of the Slick and Bedrock drainages. The high intensity burn covers most of the broad central portions of the Special Interest Area, shown in Map #7 on page 67, with very little left unburned. Areas around the perimeter of the Special Interest Area experienced more mixed intensities.



Photo 1: Fire-killed trees around junction of Road 1821 with Road #1800



Photo 2: Fire-killed trees along Road #1800 looking east

The fire area was forested with mixed conifer stands comprised of Douglas-fir overstories with western hemlock and western red cedar as co-dominant and in the understory. The age classes of the stands are 100-150 years with a scattered over-story of old-growth trees approximately 250-400 years old. Common associates include incense cedar, grand fir, Pacific yew, sugar pine and western white pine. Hardwood species includes bigleaf maple, red alder, vine maple, Oregon white oak, cottonwood, mountain ash, chinquapin, and madrone. The shrub layer includes: Dwarf Oregon grape, salal, rhododendron, red huckleberry, dogwood, hazelnut, and ninebark. Herb layers consist of a variety of moist-site indicating species including Oregon oxalis, coolwort foamflower, inside-out-flower, vanilla leaf, sword fern, twinflower, and redwood violet.

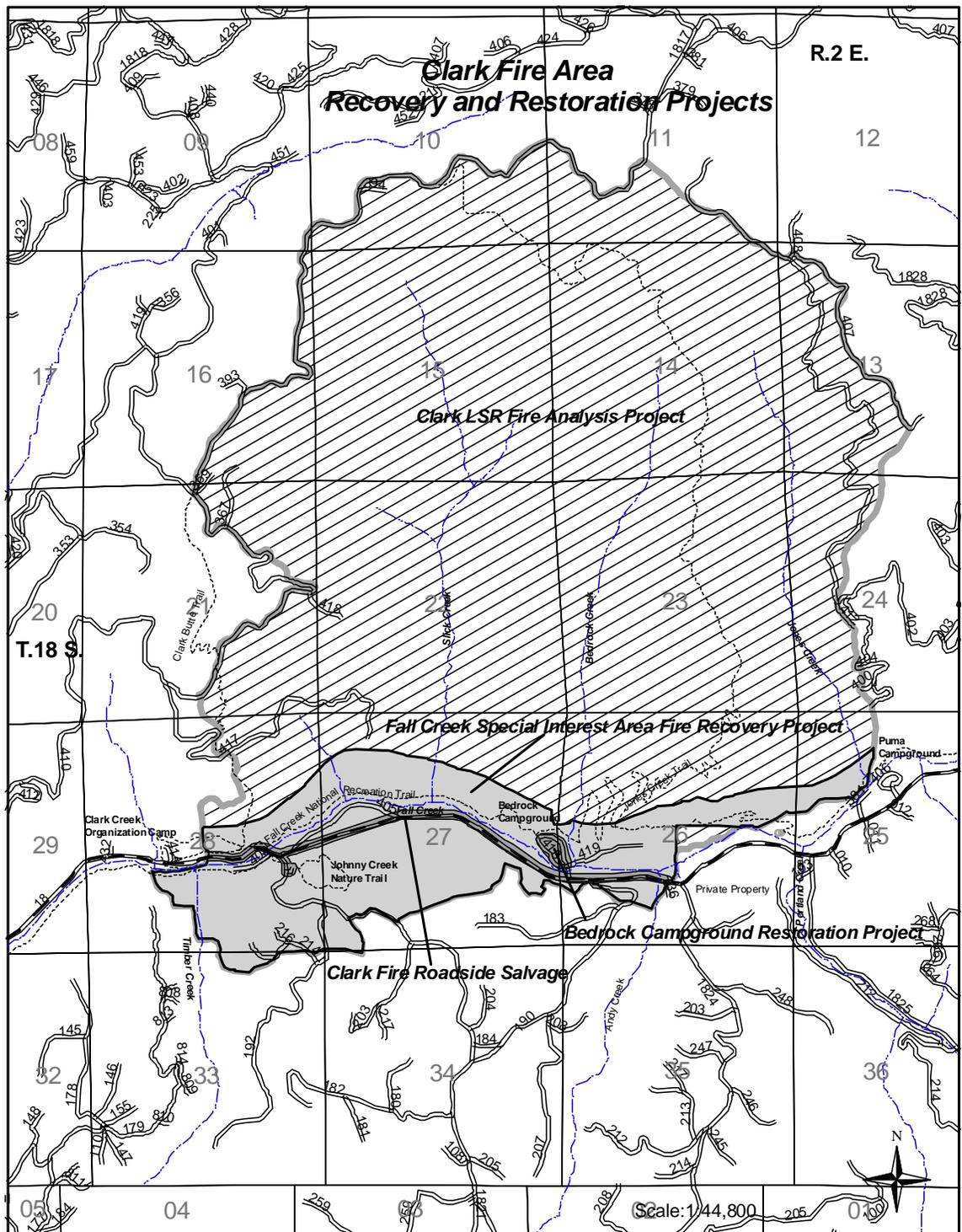
The fire burned about 4,526 acres of native forest and about 447 acres in young plantations. The predominate vegetation management objectives for the fire area, in both the Late Successional Reserve and the Special Interest Area, is to maintain or enhance the late-successional and old-growth forest conditions. Since the fire has destroyed these conditions, the recovery and restoration of these conditions is appropriate. The young plantations were generally scattered around the perimeter of the fire. Depending on the management area, the plantations were either being managed for timber

production or for late successional forest conditions. Other past vegetation management activities, which has occurred within the Fall Creek Special Interest Area corridor, includes hazard tree management and noxious weed control.

Post Fire Planning

The post-fire planning for fire recovery and restoration activities has been divided into four projects. The four projects include:

- 1) Clark Fire Roadside Salvage - This project addressed the immediate concerns over the fire-killed trees adjacent to the roads. Hazard trees that were felled as part of the fire suppression and standing dead trees that have been identified as an “imminent hazard” to public safety along the roads were removed by this project. These standing dead trees had branches overhanging the roadway or were within a distance where there was a high probability of either dead branches or dead treetops falling down and hitting the road. This project salvaged downed trees and hazard trees on about 31 acres within about 50 feet of the Forest Service Road #18. A Decision Memo (USDA, 2003a) was signed December 12, 2003 and used Category #13 (Salvage of Dead and Dying Trees) of the Category Exclusions.
- 2) Bedrock Campground Restoration Project – This project addressed the fire-killed trees in the Bedrock Campground. The project salvaged the fire-killed trees felled as hazard trees during fire suppression activities and additional dead trees identified as hazardous within the developed recreation facilities. Again, these standing dead trees had branches overhanging campsites or were within a distance where there was a high probability of either dead branches, treetops, or, whole dead trees falling in the campground. The dead trees were removed from the campground to prevent the inevitable accident, to keep fuel loadings low, and to get the trees out of the way of people using the campground. The project also replaced the vault toilet buildings and picnic tables burned during the fire and other various campground improvement such tree planting, resurfacing the roads, establishing a new well site, and construction of a day use and trailhead parking areas. The Decision Notice and Finding of No Significant Impact was signed May 17, 2004 based on the Environmental Assessment (USDA, 2004a).
- 3) Clark Fire - Post-Fire Analysis of the Fall Creek Late Successional Reserve (USDA, 2004c) – As mentioned above, about 90% of the Clark Fire burned in the southwest corner of Late Successional Reserve RO219. This area was mostly un-roaded which limits access into the Bedrock/Slick Creek drainages. After a review of the management direction and standards and guidelines from Northwest Forest Plan and the Willamette’s Late Successional Reserve Assessments (USDA,USDI, 1998a), an evaluation of planning time and costs, analysis of coarse woody debris conditions and requirements, inventory of timber types and projections of volume deterioration, assessments of riparian reserves and suitable soils, feasibility studies and



Map 1: Clark Fire Planning Projects

logging system logistics, and predicted economic returns, it was management's decision not to salvage timber in the Late Successional Reserve. As stated in the Northwest Forest Plan "these reserves represent a network of existing old growth forest that are retained in their natural conditions with natural processes, such as fire, allowed to function to the extent possible (NWFP, B-4)." The National Environmental Policy Act (NEPA) decision process was not used for this analysis.

- 4) Fall Creek Special Interest Area Fire Recovery Project – The fourth project is the proposed action and environmental assessment that comprises this document. The project area is defined by the portion of the Fall Creek Special Interest Area burned during the Clark Fire (see Map 1). The project area consists of the Fall Creek corridor between Clark Creek Organization Camp on the west and Puma Campground on the east. The project area is about 764 acres in size. Elevation ranges between 1,000 to 1,600 feet. The project area includes the roaded area south of Fall Creek that is bisected by the paved Forest Service Road #1800. The Fall Creek National Recreation Trail runs the entire length of the project area. The project area includes a portion of the Special Interest Area on the north side of Fall Creek that includes the Fall Creek National Recreation Trail corridor. The area north of Fall Creek was re-designated as Late Successional Reserve by the Northwest Forest Plan that over-rides the Willamette Forest Plan's Special Interest Area Management Area. The area north of Fall Creek also lies adjacent to the Willamette Forest Plan's Bedrock/Slick Creek Dispersed Recreation Semi-primitive Non-Motorized Use Management Area that also has been re-designated as Late Successional Reserve.

Proposed Action

The Middle Fork Ranger District of the Willamette National Forest proposes to restore the area of the Fall Creek Special Interest Area burned by the Clark Fire in a manner that provides for public safety, ensures the re-establishment of the forest setting, restores the riparian habitat, and manages forest fuels and coarse woody debris, and provides an economic return.

The following activities are associated with this project:

1. Falling of hazard trees to eliminate the danger to public safety around the developed recreational site of Johnny Creek Day Use and Nature Trail area, around the numerous dispersed recreation sites along Fall Creek, along sections of the Clark Butte, Fall Creek, and Jones Trails, around trailheads, turnouts, existing and proposed parking areas along main Fall Creek Road #1800, and along Forest Service Roads #1800, #1821, and #1821-190 within the fire area;
2. Site preparation and reforestation activities to accelerate the re-establishment of the conifer forest setting;
3. Re-develop the Johnny Creek Day Use site into an fire ecology interpretive site to promote public education;
4. Re-locate or restore the trails, trail signing , trail structures, and trailhead parking areas to enhance the recreation;
5. Rehabilitate Fall Creek with stream bank stability projects, placement of woody debris structure to improve stream habitat, and riparian planting to restore riparian habitat;
6. Fuel hazard reduction activities to manage forest fuels to reduce resource impacts of future wildfires;
7. Removal of merchantable fire-killed timber volume that is excess to coarse woody debris habitat needs in the management of the future fuels loading and to recover the economic value;

8. Road maintenance activities such as ditch line maintenance and culvert replacement on Forest roads to reduce effects on water quality;
9. Traffic control log and boulder placement along the roadsides of Fall Creek Road #1800 to prevent off road driving.

These activities are expected to be implemented in fiscal year 2005-2007.

Purpose and Need for Action

The primary purpose of this initiative is to mitigate or eliminate the hazard trees in order to provide for public safety around the developed and dispersed recreational sites, and along Forest roads and trails. The secondary purpose and need of the action is to ensure the restoration of a forest setting within the Special Interest Area and along the Fall Creek riparian area, to reduce the resource impacts of fire by reducing the forest fuel accumulation, and recovery of the economic value of the fire-killed timber before it deteriorates in order to provide a source of funding for restoration activities. The project was initiated May 6, 2004 with the District Ranger's Project Initiation Letter (Scott, 2004a).

The purpose and need for the proposed action is directed by the Land and Resource Management Plan of the Willamette National Forest (Willamette Forest Plan or WNFP) (USDA, 1990a) as amended by the Record of Decision for Amendments to Forest Service And Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl and Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl (USDA,USDI, 1994) (Northwest Forest Plan or NWFP). These plans provide the direction based on designated Management Areas (MA) and associated standards and guidelines (S&G). The Willamette Forest Plan Management Areas for this project area are MA-5A – Special Interest Area, MA-12A - Developed Recreation Sites, MA-11C – Scenic Partial Retention, MA-14A- General Forest, and MA-7 – Old Growth Groves. The Northwest Forest Plan amended the Willamette Forest Plan with MA-16A - Late Successional Reserve on the north side of Fall Creek and MA-15 - Riparian Reserve along the streams.

Approximately half of the project area consists of the MA-5A- Special Interest Area which was designated along the river corridor of Fall Creek. The Willamette Forest Plan provides several management area specific standards and guidelines that pertain to this given situation in the Special Interest Area. Unregulated harvest for the purpose of salvaging mortality from catastrophic losses may be permitted in this Management Area with an environment analysis and appropriate documentation.

The other half of the project area is in MA-16A - Late-Successional Reserve. The Northwest Forest Plan outlines guidelines for salvage in Late Successional Reserves. The salvage guidelines are intended to prevent negative effects on late successional habitat, while permitting some commercial wood volume removal. The Northwest Forest Plan provides guidelines specific to roads, trails, and recreation sites in Late Successional Reserves: Removal of snags and logs may be necessary to reduce the hazard to humans along roads and trails, and in or adjacent to campgrounds. (NWFP, C-15)

The Willamette Forest Plan provides further direction in the Forest-wide (FW) Standards and Guidelines for situations when catastrophic events, such as wildfires, change the conditions of a management area. FW-199 states that when changed conditions occur, environmental analysis shall be conducted to determine the effects of the changed conditions on resource values, and to re-evaluate and consider modification of existing management area objectives. FW-200 states that the decision to salvage harvest for catastrophic losses after changed condition shall be based on an environmental analysis.

This action is needed, because:

- 1) The Clark Fire created hazard trees within and adjacent to developed and dispersed recreational sites and along the recreation trails and Forest roads. The public recreating in the fire-affected portion of Fall Creek could be injured or killed by falling dead trees or falling tops and branches of fire-killed trees. There is a need to mitigate or eliminate known hazard trees in areas of concentrated public use such as the Johnny Creek Day Use Area, the dispersed recreation sites, trails and trailhead parking areas, and along Forest roads and turnouts.

Direction for public safety in the operation and maintenance of recreation sites and Forest roads is outlined in several Forest Service Manuals (2332, 2330, 6703, 6730, and 7733) and Forest Service Handbook 7709. Willamette Forest Plan Standard and Guideline FW-014 re-iterates direction on public safety for developed recreation sites. Further direction and safety standards are provided by Oregon Occupational and Safety and Health Division for areas adjacent to Forest roads.

- 2) Trees killed by the Clark Fire and the falling of hazard trees will create fuel loadings over time (especially in 5-20 years) in excess of desired amount for a high use recreation area. There is a need to manage the fuel loadings over time at the appropriate levels around the given recreation facilities and roadways and to reduce the resource impacts of another fire in the Fall Creek Special Interest Area while providing for long term maintenance of coarse woody debris habitat.

The Willamette Forest Plan does not provide specific direction for fuel loadings after catastrophic events, such as wildfires. Standard and Guideline FW-252 provides direction for management activities-created fuels. Standards and Guidelines FW-212, FW-212a, FW-213, and FW-213a provide direction for the amount of coarse woody debris (CWD) to be prescribed for a site.

The Willamette Late Successional Reserve Assessment (LSRA) (USDA, USDI, 1998a) provides guidance for determining coarse woody debris levels in potential salvage situations in the Late Successional Reserves.

- 3) The fire-killed the riparian forest vegetation along about 2 miles of Fall Creek. Fall Creek provides habitat for and contains spring chinook salmon, a fish species listed as threatened. The loss of riparian vegetation may cause increases in sedimentation, stream bank instability, and stream temperature. There is a need to restore the forest conditions along the Fall Creek to control soil erosion, stabilize stream banks, and re-establish the forest structure to provide stream shading and future sources of large woody debris.

The Endangered Species Act of 1973 (as amended) provides the direction for the conservation of threatened and endangered species and their ecosystems and the consultation requirements between agencies on determination of effects of management projects.

Northwest Forest Plan's Aquatic Conservation Strategy (ACS) provides the direction to manage the riparian-dependent resources to maintain the existing conditions or implement actions to restore conditions (NWFP, B-10).

Several Northwest Forest Plan's standards and guidelines for Riparian Reserves direct where catastrophic events such as fire, flooding, volcanic, wind, or insect damage result in degraded riparian conditions, allow salvage and fuel wood cutting (TM-1a, C-32) if required to attain ACS objectives at fifth-field watershed scale. Additional standards and guidelines provide for the felling of trees which pose a safety risk (RA-2, C-37), salvaging trees in riparian reserves (TM-

1b, C-32), reestablishment of vegetation characteristics (TM-1c, C-32), fuel treatments (FM-1, C-35).

The Fall Creek Watershed Analysis (USDA, 1995) provides a listing of recommendations specific to Fall Creek for riparian vegetation and aquatic habitats restoration projects.

- 4) The Clark Fire has burned 50-100% of the trees along Fall Creek corridor, changed the scenic quality, and destroyed the late-successional and old-growth forest conditions. The forest setting along the river corridor has changed from a cool, shaded, closed canopy green forest to more open, warmer, sunny, fire-killed forest condition. The re-establishment of the conifer dominated forest is expected to be delayed due to the poor conifer seed crop in 2003 and post-fire shrub competition leading to negligible natural regeneration. There is a need to expedite and ensure the recovery of a conifer forest setting that would put the area on a trajectory toward re-establishing a forested condition and appropriate scenic quality.

The Willamette Forest Plan provides general management goals and objectives for MA-5A - Special Interest Areas (WNFP, pages 138-140) and MA-12A - Developed Recreation Sites (WNFP, pages 216-218). The Willamette Forest Plan does not provide specific directions about the vegetation recovery after wildfires in scenic and recreation areas except for the Forest-wide Standard and Guideline FW-199 which addresses Changed Environmental Condition.

Several Willamette Forest Plan Management Area Standards and Guidelines address scenic quality and recreation experience for Special Interest Areas (MA-5A-02, MA-5A-04, and MA-5A-06).

A draft Fall Creek Watershed Interpretive Plan (pending 2006) is being prepared which will address the fire ecology interpretive opportunities presented by the Clark Fire. The Johnny Creek Day Use Site has been recommended as a potential future interpretive site.

- 5) The forest stands in the Special Interest Area have sustained severe or complete mortality and currently have little value in term of scenic qualities or late-successional habitat. These fire-killed stands do have value as wood products. There is need to recover the economic value of the fire-killed trees before the wood quality deteriorates. The revenues from the sale of the fire-killed timber would provide a return to the government and provide employment and income to the local communities. The fire-killed timber would provide a domestic source of forest products and offset the cost of accomplishing the restoration activities such as conifer planting.

There are hierarchical goals, objectives, and policies for the National Forest that managers have to consider when proposing actions. Examples of these broad authorizations can be found in the following acts such as the Multiple-Use Sustained-Yield Act of 1960 (P.L. 86-517, 74 Stat. 215; 16 U.S.C 528-531), that authorizes and directs the Secretary of Agriculture "...to develop and administer the renewable surface resources of the national forests for multiple use and sustained yield of the several products and services obtained there from..." and the National Forest Management Act of 1976 (90 Stat. 2949; 16 U.S.C. 1600 (note)), that states "it is the policy of the Congress that all forested lands in the National Forest System be maintained in appropriate forest cover with species of trees, degree of stocking, rate of growth, and conditions of stand designed to secure the maximum benefits of multiple use sustained yield management in accordance with land management plans." The District Ranger is implementing these broad authorizations with the proposed action to recover the economic value of fire-killed timber while

meeting multiple-use goals and objectives for wildlife habitat, water quality, soil productivity, fuels management, and recreation safety.

The purpose and need of the proposed action is to move the existing post-fire conditions of these five resource topics toward the desired conditions as described in the Forest Plan's Management Areas and Standards and Guidelines.

Planning Framework

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

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

Forest Plan Management Direction

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

The project area consists of two dominant Management Areas. They are: 1) a Special Interest Area along the Fall Creek corridor; and 2) the Late Successional Reserves north of Fall Creek. There are also some smaller inclusions of Management Areas throughout the project area such as Developed Recreation Sites, Old Growth Groves, Scenic - Partial Retention Areas, and General Forest – Matrix. All of these Management Areas are overlaid with the Riparian Reserves system which protects and creates a corridor network along all streams.

Management goals, descriptions of each area, and applicable standards and guidelines are briefly summarized below. For more complete discussion on objectives, standards, and guidelines, refer to the Willamette Forest Plan, Chapter IV, and the Northwest Forest Plan, Attachment A to the Record of Decision. Map 2 displays the location of the Management Areas and Table 1 presents acreages and percentages of the Management Areas within the project area.

Special Interest Area (SIA) – Management Area 5A

Goals:

Preserve lands in Special Interest Area (SIA) that contain exceptional scenic, cultural, biological, geological or other unusual characteristics. Foster public use and enjoyment in selected special interest area through facility development

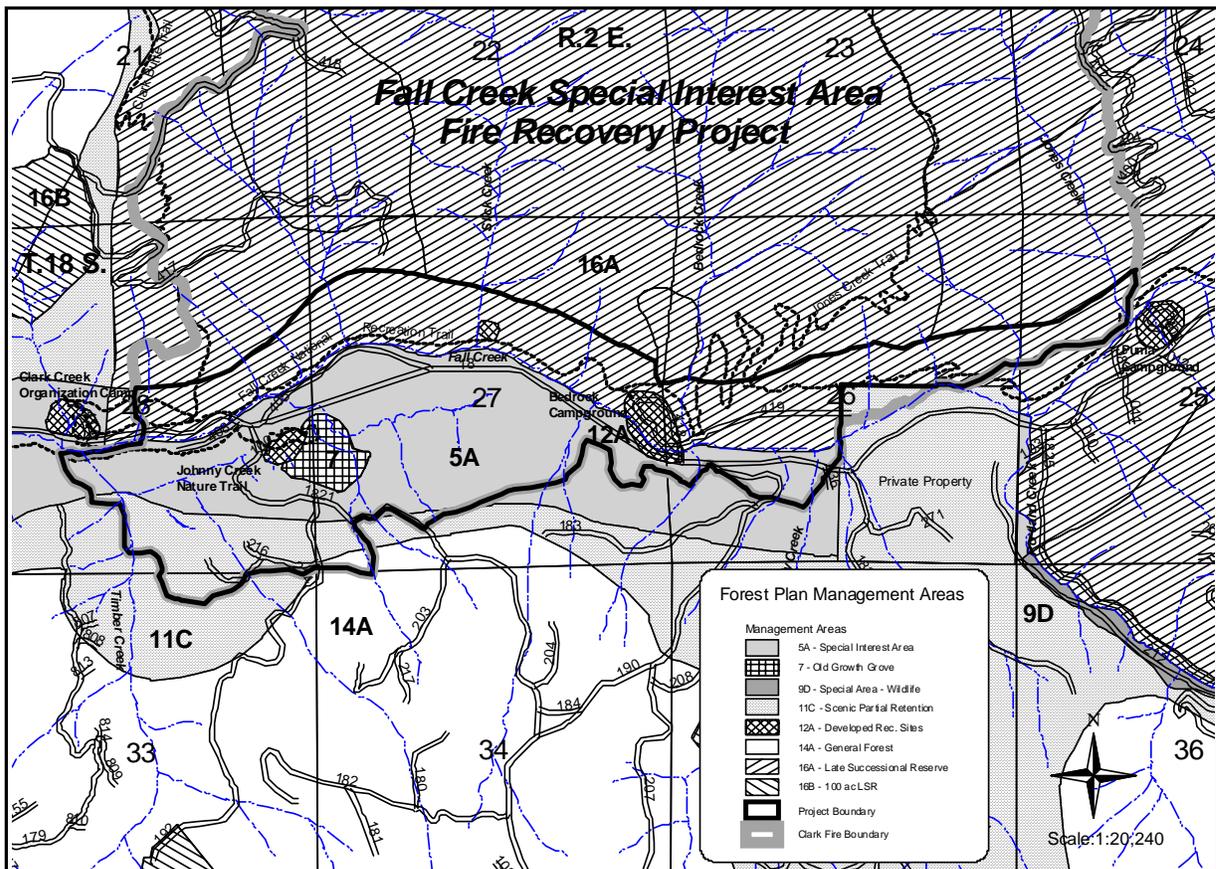
Description:

The Willamette Forest Plan has classified this SIA with an emphasis toward recreation. The Fall Creek SIA is popular recreation area due to its proximity to the urban areas of Springfield and Eugene. The

Table 1: Project Area - Forest Plan Management Areas

Management Areas	Management Area #	Acres	Percent
Special Interest Area	5A	329 ac	43%
Late Successional Reserve	16A	322 ac	42%
Old Growth Grove	7	21 ac	3%
Developed Recreation Sites	12A	8 ac	1%
Scenic Partial Retention	11C	79 ac	10%
General Forest/ Matrix	14A	5 ac	1%
Totals		764 ac	100%

* The Riparian Reserves overlays about 60% of the Project Area.



Map 2: Map of the Forest Plan Management Area in the Project Area.

characteristics that draw the public to visit this area are the campgrounds and trail network set in an old-growth forest setting along the scenic Fall Creek with its numerous pools attractive for fishing and swimming. This Management Area is classified as Administratively Withdrawn in the Northwest Forest Plan.

Forest-Wide Standards and Guidelines:

- **FW-199** - When changed conditions occur, environmental analysis shall be conducted to determine the effects of the changed conditions on resource values, and to re-evaluate and consider modification of existing management area objectives. Visual quality settings, wildlife habitat effectiveness, recreational experiences and timber harvest opportunities may be affected by unforeseen changes in environmental conditions. Changed conditions may result from events, such as catastrophic wind, fire, flood, and insects.
- **FW-200** - The decision to salvage harvest for catastrophic losses after changed conditions shall be based on an environmental analysis. The overall wildlife tree habitat conditions and coarse woody debris levels in the subdrainages shall be analyzed, particularly when scattered mortality harvests are considered.

Late-Successional Reserves (LSR) - Management Area 16A

Goals:

Maintain late-successional and old-growth habitat and ecosystems on federal lands. Maintain biological diversity associated with native species and ecosystems in accordance with laws and regulations on federal lands.

Description:

The LSRs are to be managed to protect and enhance conditions of late-successional and old-growth forest ecosystems, which serve as habitat for late-successional and old-growth related species. These reserves are designed to maintain functional, interacting, forest ecosystems. (C-11) The LSRs were designated to provide a distribution, quantity, and quality of late-successional forest habitat sufficient to avoid foreclosure of future options for the management of late-successional forest species (B-4, 5). The network of LSRs throughout the range of the northern spotted owl is assumed to provide the quality and quantity of habitat over time for viable populations of terrestrial plant and animal species that are associated with late-successional forests.

Standards and Guidelines:

Salvage guidelines are intended to prevent negative effects on late-successional habitat, while permitting some commercial wood removal. In some cases, salvage operations may actually facilitate habitat recovery. For example, excessive amounts of coarse woody debris may interfere with stand regeneration activities following some disturbances. In other cases, salvage may help reduce the risk of future stand replacing disturbances. While priority should be given to salvage in areas where it will have a positive effect on late successional forest habitat, salvage operations should not diminish habitat suitability now or in the future. (NWFP, C-13)

Removal of snags and logs may be necessary to reduce the hazard to humans along roads and trails, and in or adjacent to campgrounds. Where material must be removed from the site, as in a campground or on a road, a salvage sale is appropriate. In other areas, such as along roads, leaving material on site should be considered. Also material will be left where available coarse woody debris is inadequate. (NWFP, C-15)

Road maintenance may include felling of hazard trees along right-of-ways. Leaving material on site should be considered if available coarse woody debris is inadequate. Topping trees should be considered as an alternative to felling. (NWFP, C-16)

Existing developments in LSRs such as campgrounds, recreation residences, ski areas, utility corridors, and electronic sites are considered existing uses with respect to LSR objectives, and may remain, consistent with other standards and guidelines. Routine maintenance of existing facilities is expected to have less effect on current old growth conditions than development of new facilities. Maintenance activities may include felling hazard trees along utility right-of-ways, trails, and other developed areas. (NWFP, C-17)

Local Assessment:

The Willamette Late Successional Reserve Assessment (USDA, USDI, 1998a) re-iterates the Northwest Forest Plan direction by recognizing salvage as an acceptable management practice to avoid accumulation of excessive amounts of coarse woody debris or to reduce the risk of future stand replacing events. The priority is to salvage where it would help attain late-successional characteristics, e.g. to speed stand regeneration. The LSRA provides a process for determining coarse woody debris levels in potential salvage situations based on site-specific forest ecology and timber inventory plots.

Riparian Reserves - Management Area 15

Goals:

Protection and rehabilitation of aquatic and terrestrial habitat, maintenance and improvement of water quality while minimizing risks of downstream flooding, and management of riparian areas as corridors to provide dispersal habitat for plant and animal species by maintaining connectivity among mature and old-growth stands. Standards and guidelines prohibit and regulate activities in Riparian Reserves that retard or prevent attainment of the Aquatic Conservation Strategy (ACS) objectives (NWFP, B-9).

Description:

This allocation preserves and enhances the vegetation and lands adjacent to rivers, streams, and lakes, as well as other wetlands, for animal and plant species dependent on aquatic environments. Adjacent land is called the riparian area, where the stream or lake influences vegetation and microclimate and its associated water table. This riparian area provides shading and input of large and small organic material to streams. Riparian-dependent resources receive primary emphasis.

Standards and Guidelines:

Where catastrophic events such as fire, flooding, volcanic, wind, or insect damage result in degraded riparian conditions, allow salvage and fuel wood cutting if required to attain ACS objectives. (TM-1a, C-32)

Salvage trees only when watershed analysis determines that present and future coarse woody debris needs are met and other ACS objectives are not adversely affected. (TM-1b, C-32)

Apply silvicultural practices for Riparian Reserves to control stocking, re-establish and manage stands, and acquire desired vegetation characteristic needed to attain ACS objectives. (TM-1c, C-32)

For existing recreation facilities within Riparian Reserves, evaluate and mitigate impacts to ensure that these do not prevent, and to the extent practicable contribute to, attainment of ACS objectives. (RM-1, C-34)

Design fuel treatment and fire suppression strategies, practices, and activities to meet ACS objectives, and to minimize disturbance of riparian ground cover and vegetation. Strategies should recognize the

role of fire in ecosystem function and identify those instances where fire suppression or fuel management activities could be damaging to long-term function. (FM-1, C-35)

Fell trees in Riparian Reserves when they pose a safety risk. Keep felled trees on-site when needed to meet coarse woody debris objectives. (RA-2, C-37)

Local Assessment:

The Fall Creek Watershed Analysis (USDA, 1995) recommends that salvage activities are acceptable management activities when catastrophic events degrade riparian conditions. The site-specific CWD requirements need to be met and silvicultural practices applicable to attaining ACS objectives (TM-, C-32) need to be used.

Old-Growth Groves - Management Area 7

Goals:

Preserve representative ecosystems of old-growth of the Western Cascades. Provide opportunities for the public to enjoy the educational, aesthetic and spiritual values associated with the old-growth timber successional stage.

Description:

The old growth grove was located next to a day-use developed recreation site. The site included the Johnny Creek Nature Trail, a wheelchair accessible interpretative nature trail, which looped through the old growth grove. The old growth groves were designed to provide a network across the Forest of outstanding, highly accessible examples of old-growth timber types of the Western Cascade. These groves are used to preserve the genetic base of native plant and animal communities and add to the structural diversity of the forest landscape. This old-growth grove was located in an area where the Clark Fire killed 80-100% of the trees. This Management Area is classified as Administratively Withdrawn in the Northwest Forest Plan.

Developed Recreation Sites - Management Area 12A

Goals:

The primary goals of this management area are to provide a safe, healthful, aesthetic, non-urban atmosphere for the pursuit of natural resource recreation, and to provide facilities and improvements, consistent with the resource protection needs and anticipated user demand where opportunities for meaningful recreation experiences exist.

Description:

Three developed recreation sites exist within the project area. As mention above, there is a day use recreation site associated with the Johnny Creek Natural Trail consisting of a parking area in addition to the trail interpretation facilities. The second developed recreation site is the Bedrock Campground and the third is the Slick Creek Cave Interpretative Site. These sites are part of the variety of forest settings that provide range of recreation opportunities dependent on developed facilities. Development usually includes campgrounds, picnic areas, visitor centers, scenic overlooks, boat ramps, swimming areas, parking lots, and access roads. Facilities are designed to be subordinate to the focal attraction and appear as natural, simple, and unobtrusive as possible. The uses and occupancy are regulated to protect natural resources and to ensure a safe and enjoyable recreation experience. The Clark Fire killed about half of the trees in the Bedrock Campground and consumed two of the vault toilet buildings and a number of small facilities such as picnic tables. The Late Successional Reserve Management Area overlies a majority of the Bedrock Campground site.

Forest-Wide Standards and Guidelines:

- **FW-014** - Service level for administration, operation, and maintenance of developed sites shall be based on site capacity, site protection needs, and seasonal demands by the public use. Selected sites should be open for public use during the managed use season.
- Administration of public use developed sites shall include inspection of hazards to public safety and health, compliance with applicable regulations, and prevention of resource damage.
- Clean up and sanitation of facilities at sites should accommodate public use.
- Site facilities shall be maintained in a condition to meet standards for public health and safety.
- Other resource management treatments should be accomplished for public safety and site or resource protection (e.g. vegetation management, rehabilitation).

Scenic Partial Retention – Management Area 11C

Goals:

To create and maintain desired visual characteristics of the forest landscape through time and space. Visually sensitive landscapes will be managed for a moderate level of scenic quality. The area will also be managed for other resource goals including timber production, recreation opportunities, watershed protection, and maintenance of wildlife habitats.

Description:

This Management Area provides a scenic buffer zone along the Special Interest Area. These scenic areas are managed to maintain a near natural setting. Forest management activities will be noticeable in the middle and background zones as viewed from major travel routes and recreation sites. Resource treatments are conducted in such a way that they are visually subordinate to the characteristic landscape. Alterations will remain subordinate by repeating the form, line, color and texture elements that are characteristics of the landscape. Visual contrast will be minimized through shape, edge effects, scale, and distribution of resource treatments. This Management Area is classified as Matrix in the Northwest Forest Plan.

General Forest - Management Area 14A

Goals: Produce a sustainable yield of timber and other commodities based on the growth potential of the land which is compatible with multiple use objectives and meeting environmental requirements for soil, water, air, and wildlife habitat quality. This Management Area is also classified as Matrix in the Northwest Forest Plan. The Matrix functions as connectivity between Late-Successional Reserves and provides habitat for a variety of organism associated with both late-successional and younger forests. The Matrix is designed to provide for important ecological functions such as dispersal of organisms, carryover of some species from one stand to the next, and maintenance of ecologically valuable structural components such as down logs, snags, and large trees. The Matrix will also add ecological diversity by providing early-successional habitat. In addition, this area can provide many opportunities for public use and enjoyment.

Description:

This area consists of forested lands physically suited for growing commercial tree crops and multiple uses such as timber, wildlife habitat, water quality, soil productivity, recreation, forest access, and cultural sites. Most timber harvest and silvicultural activities would be conducted in those portions of the General Forest/Matrix having suitable forest lands. Most scheduled timber harvest contributing to the probable sale quantity (PSQ) takes place in lands allocated as General Forest/Matrix.

Other Management Areas based on Standards and Guidelines

Special Habitats

The Forest Plan established standards and guidelines for the protection of biodiversity, including one that is directed toward the maintenance of special plant and wildlife habitats encountered during plan implementation. FW-211 provides direction for the maintenance of special habitats not currently identified in no-harvest Management Areas. Prescriptive measures should maintain the ecotone and a buffered area sufficient to maintain the microclimate of the site. Examples of special habitats include mineral springs, mineral licks, unique plant associations, small meadows, and caves.

Scope of Project and Decision Framework

The scope of the project and the decisions to be made are limited to: hazard tree reduction for public safety, fuels management, commercial salvage, reforestation, and mitigation and monitoring within the Fall Creek Special Interest Area burned by the Clark Fire of 2003. Chapter 2 details the designs of these actions.

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

- Select the proposed action, or
- Select an action alternative that has been considered in detail, or
- Modify an action alternative, or
- Select the no-action alternative, and
- Identify what mitigating measures will apply.

The decision regarding which combination of actions to implement will be determined by comparing how each factor of the project purpose and need is met by each alternative and the manner in which each alternative responds to the significant issues raised and public comments received during the analysis. The alternative that provides the best mix of prospective results in regards to the purpose and need, the issues, and public comments will be selected for implementation

Tiered Documents and Local Assessments

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

guidelines for the management of National Forest lands within the project area as summarized in the preceding section.

The Fall Creek Watershed Analysis (USDA, 1995) and the Winberry and Lower Fall Creek Watershed Analysis (USDA, USDI, 1996) are incorporated by reference. These documents provides the Responsible Official with comprehensive information upon which to base land management decisions and establishes a consistent, watershed level context to project level analysis. The watershed analyses provide descriptions of the reference, historic, and existing conditions of the important physical, biological, and social components of the fifth field watersheds. The studies analyzed activities and processes that cumulatively altered the Fall Creek and Winberry Creek landscapes over time and recommends watershed management activities based upon landscape and ecological objectives.

The watershed analyses were used to characterize elements of the watersheds, provided background information for the cumulative effects analyses, and provided recommendations for management activities that move the systems toward reference conditions or management objectives.

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

The LSRA provided help in evaluating the fire risk in the project area and provided recommendations for coarse woody debris (CWD) following a stand-replacing disturbance events. The fire risk assessment analyzes the fire zone type, landscape fire risk, and local fire risk in making recommendations for CWD prescribed levels and fine fuel treatment priority.

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

The Forest Road Analysis Report provided recommendations for key roads to be kept open and maintained and for non key roads that should be considered for closure. The District Supplemental Road Analysis Report provides specific road and closure level recommendations for roads within the project area.

The Clark Fire Suppression Rehabilitation Plan (Emch and Gardner, 2003a) and the Burned Area Emergency Rehabilitation (BAER) Report (Emch and Gardner, 2003b) are incorporated by reference. The fire suppression rehabilitation plan provided mitigation for the fire suppression activities associated with the Clark Fire. The plan included erosion control seeding and mulching, water barring, and re-scattering of downed logs on over 9 acres of staging areas, 6 miles of hand fire-lines and 4 miles of dozer fire-lines. The plan also included the re-decommissioning, cleaning, brushing, and chipping on over 100 miles of surrounding road system used as contingency fire-lines.

Immediately following the Clark Fire, a BAER team met to evaluate threats to resources, property, and human life. Value at risk included public health and safety, critical heritage resources, transportation infrastructure, and ecological integrity/site productivity. The BAER plan included falling of hazard

trees, reconstruction of trail stairs to the Slick Creek Cave Interpretative Site, culvert replacement, capping vault toilets in Bedrock Campground, erosion control, and noxious weed prevention.

The Fire Suppression Plan and BAER Report were used by this project to assess where rehabilitation work had been accomplished and to monitor the effectiveness of the projects.

Scoping and Public Involvement

The scoping and public involvement process started soon after the fire was controlled with a series of informal field trips lead by the District Ranger (see Public Involvement section of Analysis File). The District Ranger invited a variety of individuals and groups representing a spectrum of opinions toward natural resource management. The District Ranger listened to their comments, reviewed the Forest direction and local assessments, and incorporated the information into a project initiation letter (Scott, 2004a).

The planning for this project was initiated with a scoping meeting on May 5, 2004. A Forest Service interdisciplinary team of resource specialists and Middle Fork Ranger District management staff attended the scoping meeting. The purpose of the scoping meeting was to define the proposed actions, identify preliminary issues and opportunities, identify interested and affected persons, and select an interdisciplinary team. The results of the scoping were also used to identify public involvement methods, establish analysis criteria, and explore possible alternatives and their probable environmental effects.

The scoping record (Scott, 2004b) and an attached cover letter seeking comments and additional information was send out May 12, 2004 to specific individuals, organizations, agencies, and tribes identified as being interested or affected by the proposal.

The Proposed Action was also published in the Willamette National Forest's Schedule of Proposed Action (SOPA) (Forest Focus) which is mailed out to an extensive Forest mailing list of people interested in the management activities of the Forest. The proposal first appeared in the Winter Quarter/February 2003 issue. The SOPA provides one means of keeping the public informed of the progress of individual projects. The SOPA is also made available to the public on the Willamette Forest website.

An internet website was also created for the Fall Creek Special Interest Area project, linked from the Willamette Forest website. The website provided background information on the Fall Creek Special Interest Area, provided access to other Clark Fire recovery and restoration planning documents, and provided specific Fall Creek SIA project planning documents and process updates.

About twelve letters and electronic mail responses were received as a result of these notifications. Copies of the letters can be found in the Public Involvement section of the Analysis File. The following is a listing of these individuals or organizations and a brief summary of the comment topics raised specific to the Fall Creek Special Interest Area Fire Recovery Project proposal:

Table 2. – List of commenters and summary of Comment Topics

Individuals or Organizations	Comment Topics Summary
Oregon Natural Resource Council, Cascadia Wildlands Project, American Lands Alliance, Western Fire Ecology Center.	Public safety, restoration, no economic recovery, Johnny Creek Trail Interpretative site, fall and leave hazard trees, close dispersed recreation sites, CWD, fuel loading and treatments, vegetation recovery, scenic quality, noxious weeds, soils damage, Beschta report, owls, salmon, research, origin of fire, standards and guidelines
Oregon Natural Resource Council	Riparian area management, salvage logging concerns, effective fuel reduction, roadless areas, road building, no old-growth harvest, wildlife surveys, water quality, ACS, range of alternative, restoration alternative
Susan Applegate	No logging, recreation values, CWD, high risk hazard trees, sign hazards
Sally Streeter	Public Safety, high risk hazard trees, sign hazards
Rod Korkoske	CWD
Peggy Robinson	No old-growth logging
James Carpenter	No logging, public safety, high risk hazard trees, CWD, sign hazards
Joanne Vinton	No logging, soil compaction, CWD, sign hazards
S.Fox	Fire ecology interpretation
Bob and Ann Vaughn	Log dead trees, soil erosion, public safety, reforestation, logs in reservoir
Judy Wilganowski	No old-growth harvest

The interdisciplinary team reviewed all the written comments, electronic mail responses, and notes from fieldtrips and incorporated the concerns into the issues where applicable and appropriate. Information related to these concerns was either addressed in the discussion of the issues and environmental consequences or can be found throughout the different sections of the EA, Analysis File or Decision Notice. Issues related to old-growth or spotted owl habitat were not considered as significant issues because the proposed action would only cut dead hazard trees. The fire-killed timber no longer meets the definitions of old-growth or spotted owl habitat. These issues were included in some of the other analysis issues because of the importance of the legacy of coarse woody debris. Comments on these issues were also incorporated into the design of the alternatives such as no commercial extraction of burnt timber or no logging of old-growth in Alternative A – No Action and Alternative B. The comment on considering recommendations in the Beschta report were generally followed in all action alternatives, with the exception of the coarse woody debris prescription in Alternative C, D, and E. Several comments on treating fuels in high risk area on private lands or non-federal lands, the investigation of the origin of the fire, and applicability of Willamette Forest Plan’s Standards and Guidelines are outside the scope of the proposed action. For more information on how specific comments were incorporated into the EA or reasons for not considering comments as an issue, see the Public Involvement section in the Analysis File.

A public notice will be published in the local newspaper requesting comments on the proposed actions and EA. The EA and a letter identifying the proposed actions will also be sent to people who have participated in the environmental analysis process. After this 30-day public comment period, the responsible official will review the comments along with their supporting reasons before making the final decision.

The final decision on the selected alternative along with the rationale for that decision will be documented in a Decision Notice. This notice of the decision will be published in the local newspaper and sent out to the people who submitted comments.

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

Issues

Issues are points of discussion, debate, or dispute about environmental effects that may occur as a result of the proposed action. Issues provide focus and influence alternative development, including development of mitigation measures to address potential environmental effects, particularly potential negative effects. Issues are also used to display differing effects between the proposed action and the alternatives regarding a specific resource element.

The ID Team sorted the comments received during initial scoping into categories to help issue tracking and response. The issues are categorized as follows:

Significant Issues

The following issues were identified as the significant issues for the project area. Significant issues are used in environmental analysis to formulate alternatives, prescribe mitigation measures, or analyze environmental effects. Issues are significant because of the extent of their geographic distribution, the duration of effects, or the intensity or resource conflict. The interdisciplinary planning team studies, develops, documents appropriate alternatives, and discusses in detail their effects in relation to the significant issues in this environmental assessment as required by the National Environmental Policy Act of 1969 (NEPA).

Public Safety

The fire has killed numerous trees adjacent to developed and dispersed recreation sites and along Forest Service roads. These roads and recreational facilities are within the Fall Creek Special Interest Area that is a heavily used recreation area. The public recreating in the fire-affected portion of Fall Creek could be injured or killed by falling dead trees or falling tops and branches of fire-killed trees. The risk increases for recreation activities with long residence time, such as day-use or overnight camping, where the public is exposed to the danger over a longer period of time. The risk of dead trees falling and hitting someone using the recreation facilities, hiking the trails, or traveling along the roadways has created hazardous conditions to public safety and commercial and administrative use.

Evaluation Criteria:

- Miles of hazardous road conditions abated and relative risk of injury,
- Miles of hazardous trails abated and relative risk of injury,
- Number of developed sites abated and relative risk of injury,
- Number of dispersed sites abated and relative risk of injury.

Fuel Loading

The future fuel loadings that will be created from the fire-killed trees may exceed the standards and guidelines established for fine fuels and coarse woody debris. The high recreation usage in this area provides a potential ignition source for future fires that could burn in a catastrophic manner given the expected build up of fuels over time as the fire-killed trees deteriorates. These future fuel loadings could cause an increase in fire intensities; increase the resistance to control and the ability of the firefighters to fight fire safely; increase fire spread which could threaten the safety of recreationists, the surrounding recreation facilities, private property; and impede the recovery of forest conditions.

Evaluation Criteria:

- Rate of spread and intensity as determined by fuel models shown in years after the fire: 1 year, 5 years, 10 years, and 25 years,
- Resistance to control.

Spring Chinook Salmon

Fall Creek contains and provides habitat for spring chinook salmon, a federally listed (threatened) anadromous fish species. The Forest Service is required, pursuant to the Endangered Species Act (ESA) of 1978, as amended, to consult with the Fisheries Division of the National Oceanic and Atmospheric Administration (NOAA- Fisheries) on the determination of effects for land management projects on anadromous fish species. The ESA requires that federal agencies shall ensure that any actions they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of critical habitat. Spring chinook salmon life cycles, such as spawning and rearing, can be disrupted by the presence of excess fine sediments and increases in stream temperatures. Proposed activities in the riparian reserves have the potential to impact water quality and fish habitat. In addition, large woody debris in stream channels aids in creating salmon habitat. The removal of the dead trees could adversely affect the current and future recruitment of large woody debris for fish habitat.

Evaluation Criteria:

- Large woody material as measured by the number of trees to be felled into Fall Creek.

Non-significant (Analysis) Issues

The following issues were identified as being non-significant for the purposes of this project. Generally, these issues are mitigated by standards and guidelines provided in the Willamette Forest Plan, addressed through resource prescriptions, or decided upon by laws and regulations. Issues may be non-significant because the proposed action has little or no impact or limited duration of the effects. While important, these issues are generally less focused on the elements of the Purpose and Need, than are the significant issues and are discussed in less detail in the assessment.

Recreational Use Capacity

There is a concern for either increasing or decreasing the diversity and amount of recreation opportunities in the Fall Creek area. Previous analysis indicates the Fall Creek Special Use Area is at or near its carrying capacity in terms of recreational use. The fire may have created opportunities for expansion in the number of dispersed camping sites, as understory vegetation has been significantly reduced and much of the area is flat enough the people could be tempted to drive vehicles off the main

roads and create new, unofficial vehicle access to new camping sites. On the other hand, if dispersed sites are closed due to safety concerns, additional pressures could be put onto the existing developed and dispersed camping sites, and provide additional pressure for people to locate new dispersed sites in other portions of the SIA.

Evaluation criteria:

- Length of road treated with traffic control barriers
- Number of dispersed sites closed

Vegetation Recovery

Forest Service Road #18 is a main travel route along the Fall Creek Special Interest Area. This area receives high recreation use and is known for its scenic qualities and late-successional and old-growth forest conditions. It is the goal of the Middle Fork Ranger District to recover the area affected by the fire to its former condition as soon as possible. While recovery of this condition will take a considerable amount of time, there is a concern that this recovery could take even longer than absolutely necessary. Considering that there was not a good conifer seed crop the year the fire occurred, there may be a need to plant trees to get conifers re-established and to prevent this area from going through an extended shrub and brush stage. There is also concern that recovery of the appearance of this area could be set back by several decades or more if another fire starts in the area and burned with great intensity due to a high accumulation of dead fuels.

Evaluation Criteria:

- Acreage of high mortality areas reforested
- Years to establish 10' to 20' tall forest conditions.

Damage to Recreational Infrastructure

The same phenomenon of fire-killed tree deterioration that generates the safety concern above also applies to the high value structures associated with recreational use of this area. Falling portions of dead trees could damage trail bridges, restroom facilities, and parking areas. There will likely be little future funding to replace these structures should they be severely damaged by falling dead trees.

Evaluation criteria:

- Number of developed structures at risk of damage from falling trees

Snag and Coarse Woody Debris (CWD) Habitat

The ecological significance of dead and decaying wood is becoming more and more evident in conifer forests of the Pacific Northwest. Large accumulations of snag and CWD provide wildlife habitat and influence basic ecosystem processes such as soil development and productivity, nutrient recycling, and stream habitat structure. The Clark fire burned with various intensities but left a fairly significant area of higher mortality within the planning area boundary. Removal or treatment of a portion of this burned material may impact availability of snag and CWD habitat for species dependent on these habitat components.

Evaluation Criteria:

- quantity, size and distribution of snags and CWD remaining after treatments

Terrestrial Threatened, Endangered and Sensitive Species

Known sites for certain terrestrial Threatened, Endangered, and Sensitive (TE&S) species do occur within or immediately adjacent to the project area and potential habitat exists for other species that are suspected to occur. The project area contains spotted owl designated critical habitat. Salvage associated activities could affect T,E&S species and their habitats within the project area.

Evaluation Criteria:

- acres of suitable spotted owl habitat removed or degraded.
- acres of suitable spotted owl habitat removed or degraded within proposed critical habitat.
- acres disturbed within 0.25 mile of the main stem of Fall Creek.

Water Quality

Riparian area vegetation was killed by the fire along approximately 2 miles of Fall Creek and within the riparian area of several tributaries. The loss of stream-side vegetation will adversely affect water quality due to a reduction in vegetative shade during the summer season, leading to an increase in water temperature. In portions of the fire area, soil stabilizing vegetation and organic matter on the ground surface were consumed. These effects could result in an increase in soil erosion and an adverse impact on water quality due to an increase in sediment delivery to streams.

Evaluation Criteria:

- potential change in water temperature in Fall Creek during July and August (as measured by number of trees cut in the primary shade zone and the percent change in shade),
- potential change in peak stream flow due to vegetative condition (as measured by change in ARP),
- potential change in suspended sediment and turbidity by Alternative (as measured by acres potentially disturbed within unit boundaries, road culverts replaced, miles of road maintained, and log haul over aggregate surface roads).

Potential Soil Erosion and Detrimental Soil Conditions

Soils within the Fall Creek SIA project area have a low to moderate surface soil erosion potential and a low to moderate potential for land failures (shallow and mass wasting) which could be a source of fine grain sediments to the streams. Roads in the Fall Creek SIA are the primary detrimental soil condition that has occurred from past management activities. Soils of the project area are susceptible to cumulative detrimental soil conditions (soil compaction, soil erosion, severely burned, soil displacement, and road construction), which will affect the long-term potential for soil erosion and soil productivity of the project area.

Evaluation criteria:

- Percent of activity area with detrimental soil conditions.
- Tons of potential soil erosion by management activities.

Economics

Economic efficiency is important in assessing the cost of planning and implementing forest management treatments and the benefits or revenues the project generates. Forest stands which have sustained severe or complete mortality may not currently have value in providing scenic qualities or late-successional habitat. Such stands do have value for wood products. This value will be lost over time as the dead trees deteriorate due to insect and fungal activity. This deterioration process is especially rapid in

hemlock and hardwood species. Revenue produced from the sale of the dead timber would provide a return to the government and provide employment and income to local communities. The fire-killed timber would provide a domestic source of forest products and help offset the cost of accomplishing the restoration activities.

Evaluation Criteria:

- Timber Volume (MMBF)
- Present Net Value (PNV)

Noxious Weeds

Fire restoration activities (including falling and removal of hazard trees, timber haul, project-related vehicle access, and road work) have the potential to spread noxious weeds that occur throughout the area. One aggressive non-native grass, false brome (*Brachypodium sylvaticum*), is located in the vicinity of the fire area. This perennial grass has the potential to invade the fire area and form large colonies and may choke out tree seedlings and native plant communities. Established species such as evergreen and Himalayan blackberries (*Rubus laciniatus* and *R. discolor*) and Scot's broom (*Cytisus scoparius*) are also a concern with abundant populations present within the watershed. Continued vehicle access, project activities, and ground disturbance in the fire area may contribute to the spread of these and other noxious weeds. The spread of noxious weeds displaces native plants and may affect biotic communities.

Evaluation Criteria:

- Acres of soil disturbances

CHAPTER 2 – ALTERNATIVES

This chapter describes and compares the alternatives considered for the Fall Creek SIA Fire Recovery Project. It describes how the alternatives were developed, includes a description and map of each alternative considered, mitigating measures associated with the alternatives and briefly discusses alternatives considered but eliminated from detailed analysis. This section also presents the alternatives in comparative form, defining the differences between alternatives and provides a clear basis for choice among options by the decision maker and the public. Some of the information used to compare the alternatives is based upon the design of the alternative (i.e., where and how much of the area is treated, or types of logging systems) and some of the information is based upon the environmental, social and economic effects of implementing each alternative (i.e., the amount of soil compaction, or present net values).

Alternative Development Process

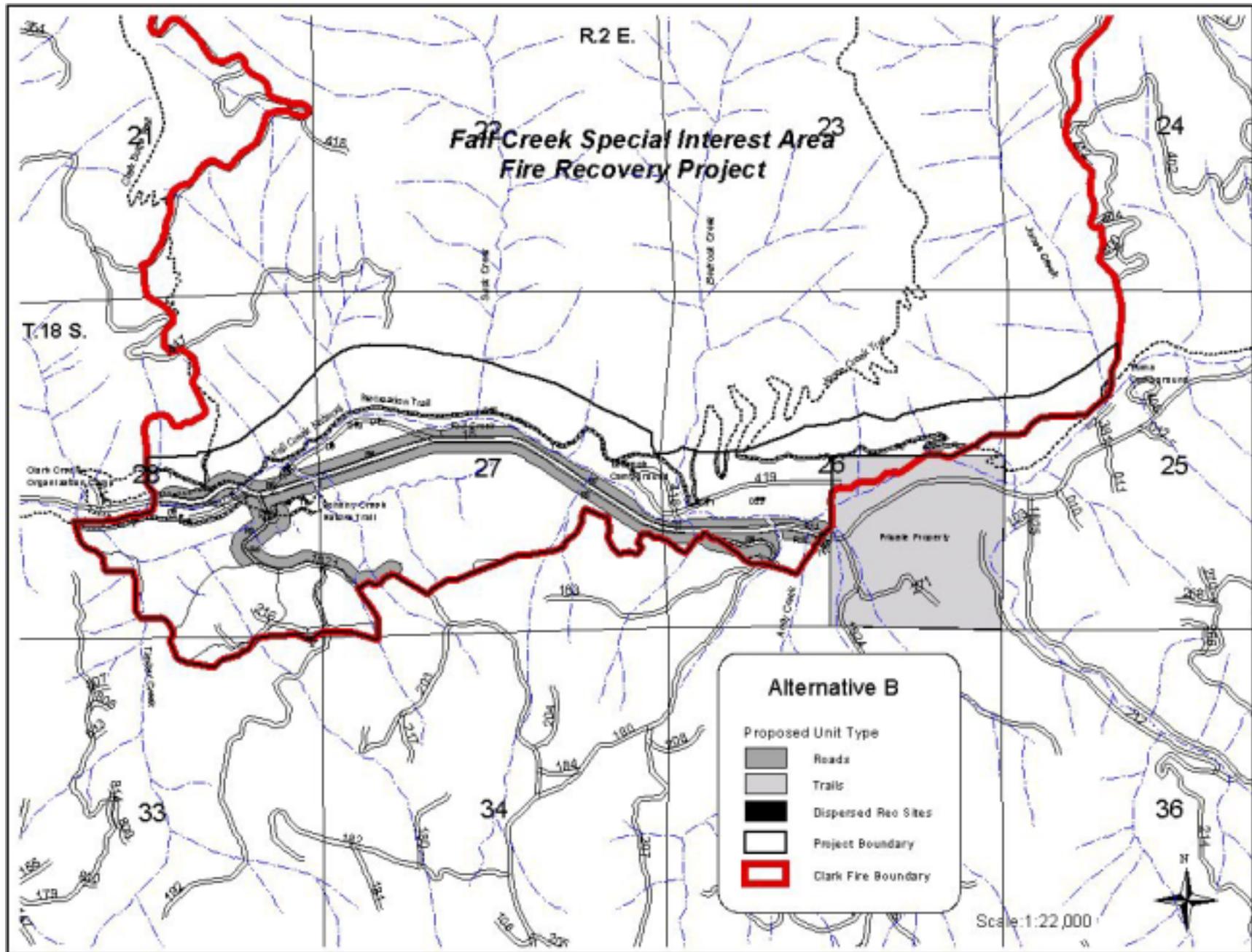
Alternatives were developed through an issue-driven process designed to address both Forest Service and public concerns. Three significant issues were derived from the scoping process described above. Each alternative responds to the significant issues by providing a different strategy for resource management in responding to the meet the Purpose and Need for Action.

On July 19, 2004, the interdisciplinary team (IDT) presented a proposed range of alternatives to the District management staff for discussion and comment as a process midpoint review. The alternatives presented were four action alternatives and the No Action alternative. The proposed treatment areas, prescriptions, and mitigations were described, as well as the alternatives and the effects of their implementation. The acting District Ranger re-confirmed the significant issues for the project and approved the range of alternatives at this meeting.

Alternatives

Alternative A - No Action

Alternative A is the No Action alternative where the proposed project does not take place. No further activities would take place to treat the dead hazard trees standing along roads, trails, dispersed recreation sites, and the developed (Johnny Creek) recreation site. The No Action alternative provides a benchmark, or a point of reference for describing the environmental effects of the proposed action and other alternatives.



Alternative B

Alternative B is designed to respond to the public safety issue and incorporating various public comments and publications which advocated for no removal of fire-killed trees. This alternative would fall and leave moderate to high risk hazard trees. All fallen trees would be left on site or moved to other locations in the project area to meet various resource needs.

This alternative addresses the public safety issue by falling hazard trees on about 15% of the project area, responds to the fuel loading issue by treating 15% of the project area, and addresses the spring chinook salmon issue by proposing activities that would minimize adverse impacts to the spring chinook salmon in Fall Creek.

This alternative would fall moderate to high risk hazard trees (Harvey and Hessburg, 1992) within 200 feet of roads, within 200 feet of the developed (Johnny Creek) recreation site parking area, and fall only highly rated hazards trees within 25 feet along trails and dispersed recreation sites.

There would be no commercial sale of trees in this alternative. Therefore, no timber would be salvaged from the Special Interest Area, Late Successional Reserve, or Riparian Reserves within the project area.

No healthy, green trees would be cut in this alternative. The exception would be trees with less than 10-20% crown that were scorched by the fire and are assessed to have a low probability of survival (Scott et al, 2002). Trees that die in the next 2-3 years and become a hazard to public safety would also be felled and left on site.

This alternative would rely on natural regeneration and recovery of native species. Some seeding of native grasses or plants would take place to stabilize soils disturbed by the fire, but no artificial planting of conifer seedlings would take place.

This alternative would generally rely on the natural recruitment of coarse woody debris into Fall Creek. About 100-120 hazard trees within about 150 feet of Fall Creek would be felled to contribute coarse and fine woody debris structure to the stream system.

The alternative would include about 116 acres of fuel treatments (97 acres of hand pile and burn and 19 acres of grapple pile and burn) to manage concentrations of fine fuels (0-3") near high-use recreation areas.

No new roads would be constructed. Road #1821-100 accessing the Johnny Creek Nature Trail would be maintained to repair the road surface, and 6 culverts would be replaced on Road #1800. Several parking areas associated with previously decommissioned roads would be closed and road closure barriers improved. Roads #1821-190 and #1821-216 and road tributaries (total 2.5 miles) would be closed with gates or bermed and waterbarred (USDA, 2004d, USDA, 2003b).

The Johnny Creek Nature trail would be decommissioned. The trail would be blocked off and allowed to naturally grow over with vegetation. The parking area associated with the site would be converted to a fire ecology interpretative site with a sign or kiosk located in the parking area.

The alternative would not close any dispersed recreation sites, but would close the parking area associated with the sites.

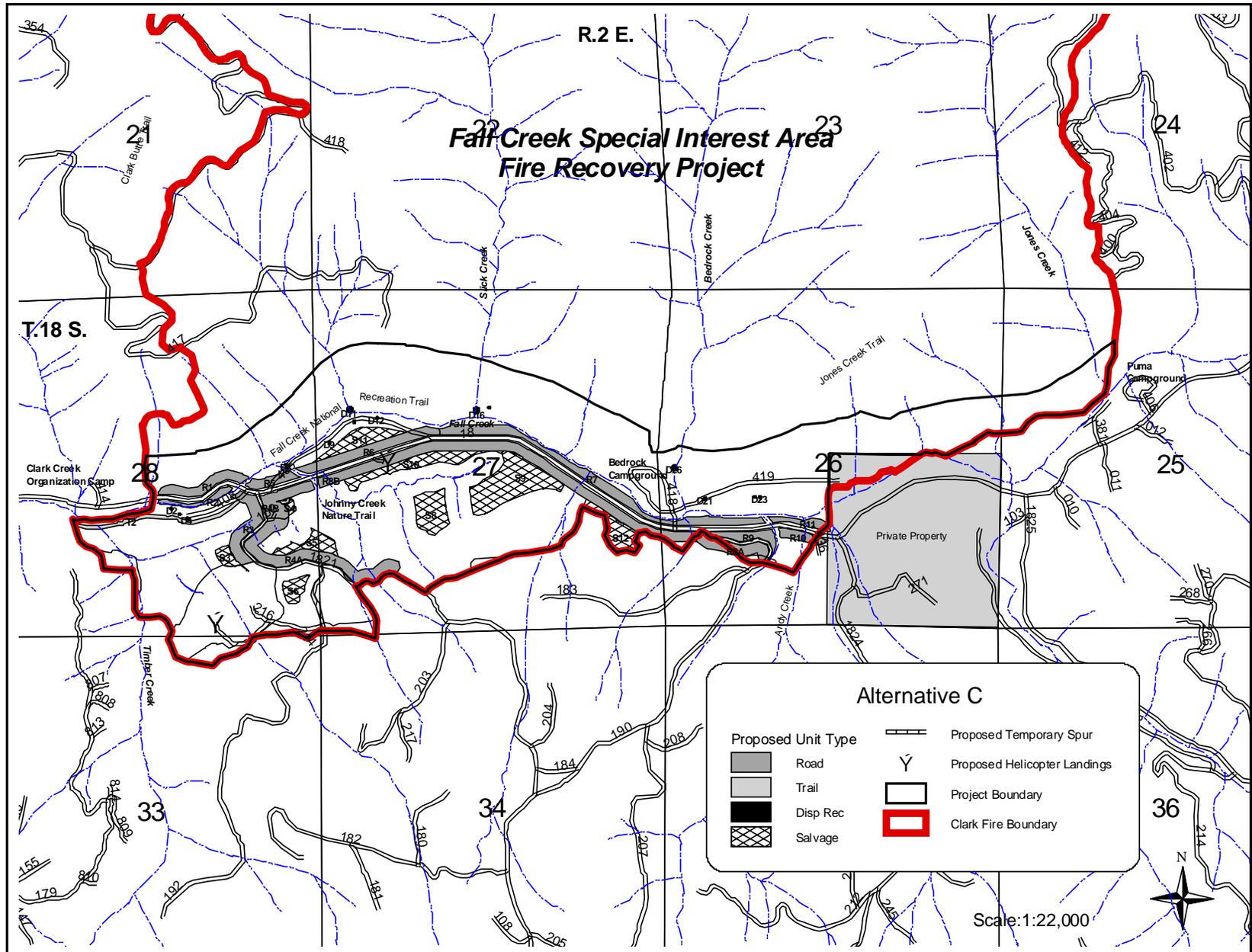
A program of posting warning signs on trails, dispersed sites, and parking areas to make recreationalists aware of the potential dangers of fire-killed trees within the fire area would be implemented.

This alternative would fall about 500-600 trees to abate the risks to public safety on approximately 116 acres. The fallen trees would be left on site. No timber volume would be produced with this alternative.

All proposed activities would be funded through the appropriated budget process.

Table 3 - Alternative B Unit Summary

Units #	Acres	Logging System	Silviculture Prescription	CWD Prescription	Fuels Treatment
Road Units					
R1	4.9	None	Fall & Leave / Nat. Regen.	Leave All	Hand Pile
R2	2.0	None	Fall & Leave Nat. Regen.	Leave All	Hand Pile
R3	6.1	None	Fall & Leave / Nat. Regen.	Leave All	Hand Pile
R4	18.7	None	Fall & Leave Nat. Regen.	Leave All	Hand Pile 5.1 Grapple Pile 13.6
R5	2.6	None	Fall & Leave / Nat. Regen.	Leave All	Hand Pile
R6	7.5	None	Fall & Leave Nat. Regen.	Leave All	Hand Pile
R7	14.3	None	Fall & Leave / Nat. Regen.	Leave All	Hand Pile
R8	27.1	None	Fall & Leave Nat. Regen.	Leave All	Hand Pile 14.1 Grapple Pile 13.0
R9	3.4	None	Fall & Leave / Nat. Regen.	Leave All	Hand Pile
R10	2.3	None	Fall & Leave Nat. Regen.	Leave All	Hand Pile
R11	2.3	None	Fall & Leave / Nat. Regen.	Leave All	Hand Pile
Trail Units					
T1	1.7	None	Fall & Leave / Nat. Regen.	Leave All	Hand Pile
T2	3.1	None	Fall & Leave Nat. Regen.	Leave All	Hand Pile
T3	0.9	None	Fall & Leave / Nat. Regen.	Leave All	Hand Pile 0.5 Grapple Pile 0.4
T4	11.2	None	Fall & Leave Nat. Regen.	Leave All	Hand Pile
T5	6.8	None	Fall & Leave / Nat. Regen.	Leave All	Hand Pile
Dispersed Rec. Units					
D2	0.045	None	Fall & Leave / Nat. Regen.	Leave All	Hand Pile
D3	0.045	None	Fall & Leave Nat. Regen.	Leave All	Hand Pile
D4	0.045	None	Fall & Leave / Nat. Regen.	Leave All	Hand Pile
D8	0.045	None	Fall & Leave Nat. Regen.	Leave All	Hand Pile
D9	0.045	None	Fall & Leave / Nat. Regen.	Leave All	Hand Pile
D10	0.045	None	Fall & Leave Nat. Regen.	Leave All	Hand Pile
D11	0.045	None	Fall & Leave / Nat. Regen.	Leave All	Hand Pile
D17	0.045	None	Fall & Leave Nat. Regen.	Leave All	Hand Pile
D21	0.045	None	Fall & Leave / Nat. Regen.	Leave All	Hand Pile
D22	0.045	None	Fall & Leave Nat. Regen.	Leave All	Hand Pile
D23	0.045	None	Fall & Leave / Nat. Regen.	Leave All	Hand Pile



Alternative C

Alternative C is designed to resolve the spring chinook salmon habitat issue, while addressing the public safety and fuel loading issues. The location of treated areas and the methods of treatments were designed to minimize adverse impacts to spring chinook salmon and its habitat in Fall Creek. This alternative addresses the public safety issue by falling and removing hazard trees on about 13% of the project area, and responds to the fuel loading issue by proposing that about 19% of the project area be treated for fuel reduction.

In this alternative, some fire-killed timber would be removed from portions of the Riparian Reserves adjacent to the main Fall Creek Road #18 to meet public safety, scenic and vegetation recovery, and fuel loading objectives, but otherwise no fire-killed trees would be removed from Riparian Reserves in the rest of the project area. No fire-killed trees would be removed from the Late Successional Reserve.

This alternative would fall and remove moderate to high risk hazard trees (Harvey and Hessburg, 1992) within 200 feet of roads, within 200 feet of the developed (Johnny Creek) recreation site parking area, and only highly rated hazard trees within 25 feet along trails and dispersed recreation sites outside the LSR, and around trail bridges inside the LSR. Hazard trees and dead trees in excess of the riparian and wildlife coarse woody debris habitat needs would be removed via a timber sale.

This alternative would introduce woody debris structure into Fall Creek to improve fish habitat and water quality. About 70-90 hazard trees within about 150 feet of Fall Creek would be felled to contribute coarse and fine woody debris structure to the stream system. The alternative would also include seeding of native grasses and plants to stabilize soil disturbed by the fire and planting of conifer tree species to restore the riparian habitat.

No healthy, green trees would be cut in this alternative. Two exceptions would be hazard trees with less than 10-20% green crown which are assessed to have a low probability of survival (Scott et al, 2002) and green hazard trees which threaten the safety of workers during logging operations. And it is expected that some trees will die in the next 2-3 years from the effects of the fire. If these dead trees present a hazard to public safety, they would be managed according to the prescriptions of this alternative.

This alternative would include about 436 acres of conifer planting for reforestation throughout the Special Interest Area and about 146 acres of fuel treatments (82 acres of hand piling and burning, 33 acres of grapple machine piling and burning, and 31 acres of strip cover and burning) to reduce fuel loading and fire intensities.

The logs would be removed using two different types of log yarding systems (81 acres of helicopter, 64 acres of loader, and 1 acre not logged) which provide full to partial suspension of the logs to minimize soil disturbance.

This alternative would require the construction of about 300 feet of temporary spur road to access one helicopter landing. The spur road and landing would be closed and rehabilitated after the sale. No new permanent road would be constructed. Approximately 7.9 miles of haul route roads would be maintained by brushing, blading, and ditch cleaning, and 6 culverts replaced on Road #1800. Several parking areas associated with previously decommissioned roads would be closed and road closure barriers improved. Roads #1821-190 and #1821-216 and road tributaries (total 2.5 miles) would be closed with gates or bermed and waterbarred (USDA, 2004d, USDA, 2003b).

The Johnny Creek Nature Trail would be decommissioned. The trail would be blocked off and allowed to naturally grow over with vegetation. The parking area associated with the site would be converted to a fire ecology interpretative site with a sign or kiosk located in the parking area.

The alternative would decommission 16 dispersed recreation sites. The sites would be decommissioned by falling dead trees into the center of the sites, and dispersal, removal, or obliteration of any structures such as fire rings, or picnic tables, to discourage the sites use.

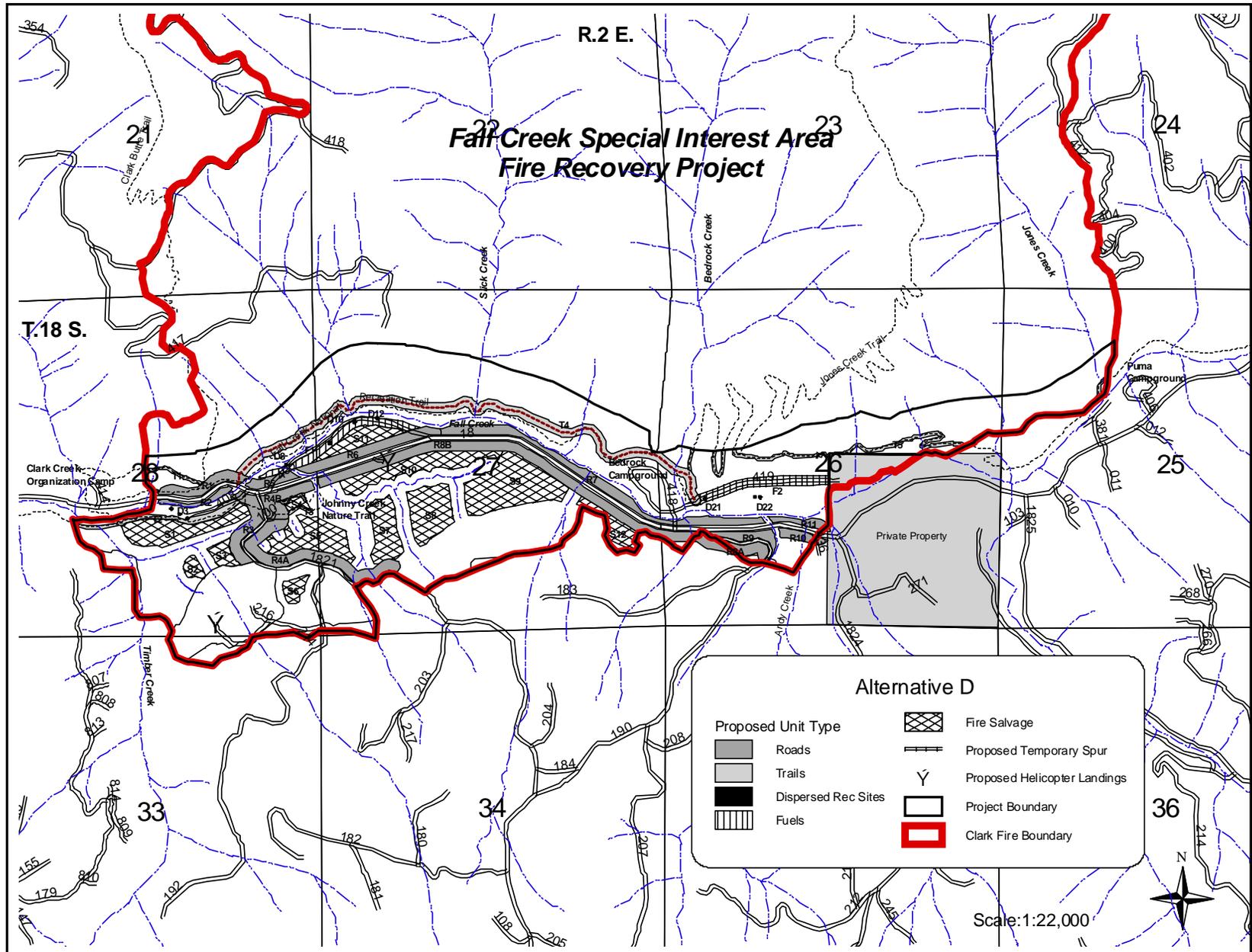
A program of posting warning signs on trails, dispersed sites, and parking areas to make recreationalists aware of the potential dangers of fire-killed trees within the fire area would be implemented.

This alternative would fall and remove fire-killed trees on a total of 146 acres and would produce about 3.0 MMBF of wood products. This alternative would salvage the fallen hazard trees and other dead fire-killed timber to ensure vegetation recovery, reduce fuel accumulations, and recover the economic value of fire-killed timber.

All proposed activities would be accomplished either through the timber sale contract or Sale Area Improvement funded from timber sale receipts, except that falling of the fish habitat improvement would be funded with appropriated fisheries funding.

Table 4 - Alternative C Unit Summary

Units #	Acres	Logging System	Silviculture Prescription	CWD Prescription	Fuels Treatment
Road Units					
R1	4.9	Loader	Salvage / Plant	Low (8/ac)	Hand Pile
R2	2.0	Loader	Salvage / Plant	High (22-24/ac)	Hand Pile
R3	6.1	Helicopter	Salvage / Plant	Low (8/ac)	Hand Pile
R4A	13.8	Helicopter	Salvage / Plant	Low (8/ac)	Hand Pile
R4B	4.9	Loader	Salvage / Plant	Low (8/ac)	Grapple Pile
R5	2.6	Loader	Salvage / Plant	Low (8/ac)	Hand Pile 0.7 Grapple Pile 1.9
R6	7.5	Helicopter	Salvage / Plant	Low (8/ac)	Hand Pile
R7	14.3	Loader	Salvage / Plant	Variable Low to High	Hand Pile
R8A	5.1	Helicopter	Salvage / Plant	Low (8/ac)	Hand Pile
R8B	22.0	Loader	Salvage / Plant	Low (8/ac)	Grapple Pile
R9	3.4	Helicopter	Salvage / Plant	Low (8/ac)	Hand Pile
R10	2.3	Loader	Salvage / Plant	Low (8/ac)	Hand Pile
R11	2.3	Loader	Salvage / Plant	Variable Low to High	Hand Pile
Trail Units					
T2	3.1	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Hand Pile
T3	0.4	Loader	Salvage / Plant	Moderate(14-16/ac)	Grapple Pile
Dispersed Rec. Units					
D2	0.045	None	Fall & Leave / Plant	High (22-24/ac)	Hand Pile
D3	0.045	None	Fall & Leave / Plant	Moderate(14-16/ac)	Hand Pile
D4	0.045	None	Fall & Leave / Plant	Moderate(14-16/ac)	Hand Pile
D8	0.045	None	Fall & Leave / Plant	High (22-24/ac)	Hand Pile
D9	0.045	None	Fall & Leave / Plant	Moderate(14-16/ac)	Hand Pile
D10	0.045	None	Fall & Leave / Plant	Moderate(14-16/ac)	Hand Pile
D11	0.186	None	Fall & Leave / Plant	High (22-24/ac)	Hand Pile
D12	0.045	None	Fall & Leave / Plant	High (22-24/ac)	Hand Pile
D16	0.197	None	Fall & Leave / Plant	High (22-24/ac)	Hand Pile
D17	0.045	None	Fall & Leave / Plant	High (22-24/ac)	Hand Pile
D21	0.045	None	Fall & Leave / Plant	High (22-24/ac)	Hand Pile
D22	0.045	None	Fall & Leave / Plant	Moderate(14-16/ac)	Hand Pile
D23	0.045	None	Fall & Leave / Plant	Moderate(14-16/ac)	Hand Pile
D26	0.183	None	Fall & Leave / Plant	Moderate(14-16/ac)	Hand Pile
Fire Salvage Units					
S3	1.7	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Strip Cover
S4	0.5	Loader	Salvage / Plant	Moderate(14-16/ac)	Grapple Pile
S5	4.0	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Strip Cover
S6	2.7	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Strip Cover
S8	6.7	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Strip Cover
S9	15.5	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Strip Cover 11.1 Grapple Pile 4.4
S10	7.9	Loader	Salvage / Plant	Moderate(14-16/ac)	Grapple Pile
S11	5.8	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Hand Pile
S12	5.1	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Strip Cover



Alternative D - The Proposed Action

Alternative D was designed to resolve the issues around public safety and fuel loading while addressing the issue of spring chinook salmon. This alternative addresses the public safety issue by falling and removing hazard trees on about 20% of the project area, and addresses the fuel loading issue by proposing about 33% of project area for fuel reduction treatments. The location of treated areas and the methods of treatments were designed to balance the tradeoffs between public safety, fuels loading, and effects to spring chinook salmon.

In this alternative, fire-killed trees would be removed from portions of the Riparian Reserves throughout the Special Interest Area to meet public safety, scenic and vegetation recovery, fuel loading, and economic recovery objectives.

This alternative would fall and remove moderate to high risk dead hazard trees (Harvey and Hessburg, 1992) within 200 feet evaluation area of roads, within 25 feet of trails except a section of the Fall Creek Trail (see below), within 25 feet of dispersed recreation sites, and within 200 feet of the developed (Johnny Creek) recreation site parking area. The hazard trees and dead trees in excess of the riparian and wildlife coarse woody debris habitat needs would be removed with a timber sale.

The 1.6 mile of the Fall Creek National Recreation Trail affected by high tree mortality would be re-located and an understory fuel break created along the trail corridor and Road #419. These activities were designed to reduce trail hazards and to reduce the risk of fire spreading into the LSR, and to minimize the effect on salmon in Fall Creek. Dead moderate to high rated hazard trees would be removed from this re-located section of the trail located along the edge of the Late Successional Reserve and generated slash would be reduced to created fuel break.

This alternative would provide woody debris structure into Fall Creek to improve fish habitat and water quality. About 70-90 hazard trees within about 150 feet of Fall Creek would be felled and contribute coarse and fine woody debris structure to the stream system. The alternative would also include the seeding of native grasses and plants to stabilize soil disturbed by the fire, and the planting of conifer tree species to restore the riparian habitat.

No healthy, green trees would be cut in this alternative. Two exceptions would be green hazard trees with less than 10-20% green crown that are assessed to have a low probability of survival (Scott et al, 2002) and green hazard trees which threaten the safety of workers during the logging operations. And it is expected that some trees will die in the next 2-3 years from the effects of the fire. If these dead trees present a hazard to public safety, they would be managed according to the prescriptions of this alternative.

This alternative would include about 436 acres of conifer planting for reforestation throughout the special Interest Area and 249 acres of fuel treatments (146 acres of hand piling and burning, 44 acres of grapple machine piling and burning, and 59 acres of strip cover and burning) to reduce fuel loading and fire intensities.

Dead hazard trees would be removed using two different types of log yarding systems (171 acres of helicopter, and 78 acres of loader) which provide full to partial suspension of the logs to minimize soil disturbance.

This alternative would require the construction of about 300 feet of temporary spur road to access one helicopter landing. The spur road and landing would be closed and rehabilitated after the timber sale. No new permanent road would be constructed. Approximately 8.9 miles of haul route roads would be

maintained by brushing, blading and ditch cleaning and 6 culverts would be replaced on Road #1800. Several parking areas associated with previously decommissioned roads would be closed and road closure barriers improved. Roads #1821-190 and #1821-216 and road tributaries (total 2.5 miles) would be closed with gates or bermed and waterbarred (USDA, 2004d, USDA, 2003b).

A short section of the Johnny Creek Nature Trail would be made safe from falling trees and used to access a fire ecology interpretative site. A display sign or kiosk would be constructed for the site. Two 2 acres plots contrasting passive and active fire recovery management would be developed on the slope above the site to provide examples of different management approaches to fire mortality.

The alternative would decommission 16 dispersed recreation sites. The sites would be decommissioned by falling dead trees into the center of the sites, and dispersal, removal, or obliteration of any structures such as fire rings, or picnic tables, to discourage the sites use.

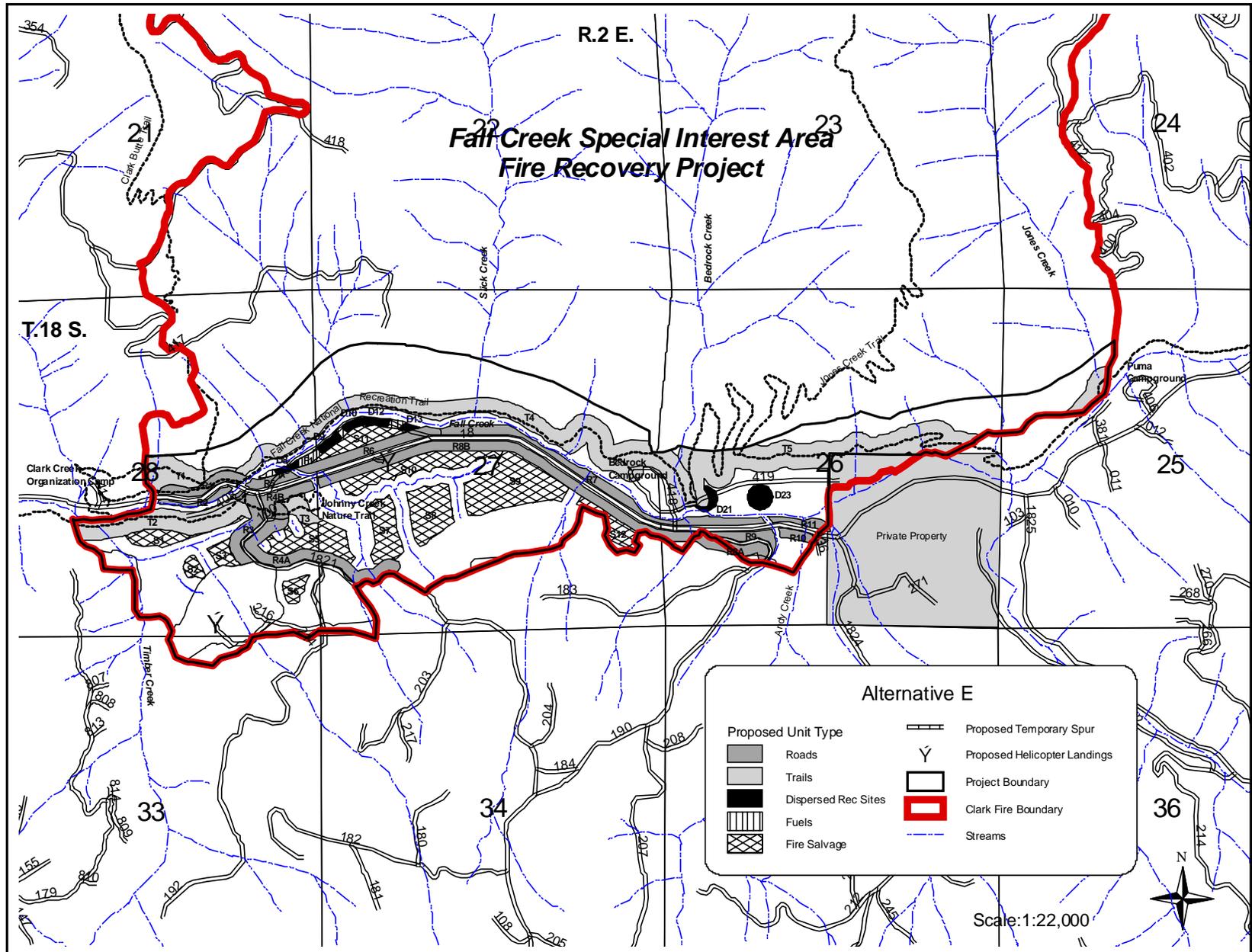
A program of posting warning signs on trails, dispersed sites, and parking areas to make recreationalists aware of the potential dangers of fire-killed trees within the fire area would be implemented.

This alternative would fall and remove fire-killed trees on a total of about 249 acres and would produce about 5.6 MMBF of wood products. This alternative would salvage the fallen hazard trees and other dead fire-killed timber to ensure vegetation recovery, reduce fuel accumulations, and recover the economic value of fire-killed timber.

All proposed activities would be accomplished either through the timber sale contract or Sale Area Improvement funds collected from timber sale receipts, except for trees felled for fish habitat improvements would be funded with appropriated fisheries funding.

Table 5 - Alternative D Unit Summary

Units #	Acres	Logging System	Silviculture Prescription	CWD Prescription	Fuels Treatment
Road Units					
R1	5.0	Loader	Salvage / Plant	Low (8/ac)	Hand Pile
R2	2.0	Loader	Salvage / Plant	High (22-24/ac)	Hand Pile
R3	6.1	Helicopter	Salvage / Plant	Low (8/ac)	Hand Pile
R4A	13.8	Helicopter	Salvage / Plant	Low (8/ac)	Hand Pile
R4B	4.9	Loader	Salvage / Plant	Low (8/ac)	Grapple Pile
R5	2.6	Loader	Salvage / Plant	Variable Low to High	Hand Pile 0.7 Grapple Pile 1.9
R6	7.5	Helicopter	Salvage / Plant	Low (8/ac)	Hand Pile
R7	14.3	Loader	Salvage / Plant	Variable Low to High	Hand Pile
R8A	5.1	Helicopter	Salvage / Plant	Low (8/ac)	Hand Pile
R8B	22.0	Loader	Salvage / Plant	Low (8/ac)	Grapple Pile
R9	3.4	Helicopter	Salvage / Plant	Low (8/ac)	Hand Pile
R10	2.3	Loader	Salvage / Plant	Low (8/ac)	Hand Pile
R11	2.3	Loader	Salvage / Plant	Variable Low to High	Hand Pile
Trail Units					
T1	1.2	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Hand Pile
T2	4.6	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Hand Pile
T3	0.9	Loader	Salvage / Plant	Moderate(14-16/ac)	Grapple Pile
T4	29.5	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Hand Pile
T5	7.2	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Hand Pile
Dispersed Rec. Units					
D2	0.045	Helicopter	Salvage / Plant	High (22-24/ac)	Hand Pile
D3	0.045	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Hand Pile
D4	0.045	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Hand Pile
D8	0.045	Helicopter	Salvage / Plant	High (22-24/ac)	Hand Pile
D9	0.045	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Hand Pile
D10	0.045	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Hand Pile
D12	0.045	Helicopter	Salvage / Plant	High (22-24/ac)	Hand Pile
D21	0.045	Loader	Salvage / Plant	Moderate(14-16/ac)	Hand Pile
D22	0.045	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Hand Pile
D23	0.045	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Hand Pile
Fire Salvage Units					
F1	7.0	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Hand Pile
F2	7.1	Loader	Salvage / Plant	Moderate(14-16/ac)	Hand Pile
S1	12.8	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Hand Pile
S2	2.0	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Strip Cover
S3	2.8	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Strip Cover
S4	1.2	Loader	Salvage / Plant	Moderate(14-16/ac)	Grapple Pile
S5	11.4	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Strip Cover
S6	2.7	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Strip Cover
S7	8.9	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Strip Cover
S8	11.6	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Strip Cover
S9	21.8	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Strip Cover 14.8 Grapple Pile 7.0
S10	12.9	Loader	Salvage / Plant	Moderate(14-16/ac)	Grapple Pile
S11	6.6	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Hand Pile
S12	5.0	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Strip Cover



Alternative E

Alternative E is designed to resolve the issues around public safety and fuel loading. The location of treated areas and the methods of treatments were designed to minimize the risk of hazard trees to public safety. This alternative addresses the public safety issue by falling and removing hazard trees on about 31% of the project area, and addresses the fuel loading issue by proposing about 43% of project area be treated for fuel reduction.

In this alternative, fire-killed timber would be removed from the Riparian Reserves throughout the Special Interest Area to meet public safety, scenic and vegetation recovery, fuel loadings, and economic recovery objectives.

This alternative would fall and remove moderate to high risk hazard trees (Harvey and Hessburg, 1992) within 200 feet of roads and associated parking areas, within 200 feet of all trails, within 200 feet of dispersed recreation sites, and within 200 feet of the developed (Johnny Creek) recreation site parking area. The hazard trees and dead trees in excess of the riparian and wildlife coarse woody debris habitat needs would be removed and sold via a timber sale.

This alternative would provide woody debris structure to Fall Creek for fish habitat improvements and water quality. About 150-170 hazard trees within about 150 feet of Fall Creek would be felled and contribute coarse and fine woody debris structure to the stream system. The alternative would also include the seeding of native grasses and plants to stabilize soil disturbed by the fire, and the planting of hardwood and conifer tree species to restore the riparian habitat.

No healthy, green trees would be cut in this alternative. Two exceptions would be green hazard trees with less than 10-20% green crown which are assessed to have a low probability of survival (Scott et al, 2002) and green hazard trees which threaten the safety of workers during the logging operations. And it is expected that some trees will die in the next 2-3 years from the effects of the fire. If these dead trees present a hazard to public safety, they would be managed according to the prescriptions of this alternative.

This alternative would include 436 acres of conifer planting for reforestation throughout the Special Interest Area and 328 acres of fuel treatments (220 acres of hand piling and burning, 44 acres of grapple machine piling and burning, and 64 acres of strip cover and burning) to reduce fuel loading and fire intensities.

The logs would be removed using two different types of log yarding systems (252 acres of helicopter, and 76 acres of loader) which provide full to partial suspension of the logs to minimize soil disturbance.

This alternative would require the construction of 300 feet of temporary spur road to access one helicopter landing. The spur road and landing would be closed and rehabilitated after the sale. No new permanent road would be constructed. Approximately 8.9 miles of haul route roads would be maintained by brushing, blading and ditch cleaning and 6 culverts would be replaced. Several parking areas associated with previously decommissioned roads would be closed and road closure barriers improved. Roads #1821-190 and #1821-216 and road tributaries (total 2.5 miles) would be closed with gates or bermed and waterbarred (USDA, 2004d, USDA, 2003b).

A short section of the Johnny Creek Nature Trail would be made safe from falling trees and used to access a fire ecology interpretative site. A display sign or kiosk would be constructed for the site. Two 2 acres plots contrasting passive and active fire recovery management would be developed on the slope above the site to provide examples of different management approaches to fire mortality.

The alternative would not close any dispersed recreation sites.

A program of posting warning signs on trails, dispersed sites, and parking areas to make recreationalists aware of the potential dangers of fire-killed trees within the fire area would be implemented.

This alternative would fall and remove fire-killed trees on a total of 328 acres and would produce about 5.8 MMBF of wood products. This alternative would salvage the fallen hazard trees and other dead fire-killed timber to ensure vegetation recovery, reduce fuel accumulations, and recover the economic value of fire-killed timber.

All proposed activities would be accomplished either through the timber sale contract or Sale Area Improvement funds collected from timber sale receipts, except for trees felled for fish habitat improvements would be funded with appropriated fisheries funding.

Table 6 - Alternative E Unit Summary

Units #	Acres	Logging System	Silviculture Prescription	CWD Prescription	Fuels Treatment
Road Units					
R1	5.0	Loader	Salvage / Plant	Low (8/ac)	Hand Pile
R2	2.0	Loader	Salvage / Plant	High (22-24/ac)	Hand Pile
R3	6.1	Helicopter	Salvage / Plant	Low (8/ac)	Hand Pile
R4A	13.8	Helicopter	Salvage / Plant	Low (8/ac)	Hand Pile
R4B	4.9	Loader	Salvage / Plant	Low (8/ac)	Grapple Pile
R5	2.6	Loader	Salvage / Plant	Variable Low to High	Hand Pile 0.7 Grapple Pile 1.9
R6	7.5	Helicopter	Salvage / Plant	Low (8/ac)	Hand Pile
R7	14.3	Loader	Salvage / Plant	Variable Low to High	Hand Pile
R8A	5.1	Helicopter	Salvage / Plant	Low (8/ac)	Hand Pile
R8B	22.0	Loader	Salvage / Plant	Low (8/ac)	Grapple Pile
R9	3.4	Helicopter	Salvage / Plant	Low (8/ac)	Hand Pile
R10	2.3	Loader	Salvage / Plant	Low (8/ac)	Hand Pile
R11	2.3	Loader	Salvage / Plant	Variable Low to High	Hand Pile
Trail Units					
T1	9.4	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Hand Pile
T2	20.2	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Hand Pile
T3	3.5	Loader	Salvage / Plant	Moderate(14-16/ac)	Grapple Pile
T4	54.8	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Hand Pile
T5	47.7	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Hand Pile
Dispersed Rec. Units					
D2	0.045	Helicopter	Salvage / Plant	High (22-24/ac)	Hand Pile
D8	0.7	Helicopter	Salvage / Plant	High (22-24/ac)	Hand Pile
D9	1.2	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Hand Pile
D10	1.1	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Hand Pile
D12	1.1	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Hand Pile
D13	0.6	Loader	Salvage / Plant	Moderate(14-16/ac)	Hand Pile
D21	1.4	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Hand Pile
D23	2.9	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Hand Pile
Fire Salvage Units					
F1	2.6	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Hand Pile
S1	4.8	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Strip Cover
S2	2.0	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Strip Cover
S3	2.8	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Strip Cover
S5	10.6	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Strip Cover
S6	2.7	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Strip Cover
S7	8.9	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Strip Cover
S8	11.6	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Strip Cover
S9	21.8	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Strip Cover 15.3 Grapple Pile 6.5
S10	12.9	Loader	Salvage / Plant	Moderate(14-16/ac)	Grapple Pile
S11	6.6	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Hand Pile
S12	5.0	Helicopter	Salvage / Plant	Moderate(14-16/ac)	Strip Cover

Road Management

Table 7 - Haul Route Summary

Road No.	Alt A No Action	Alt B	Alt C	Alt D	Alt E
1800	0.00	0.00	6.06	6.06	6.06
1800418	0.00	0.00	0.00	0.10	0.10
1800419	0.00	0.00	0.00	0.30	0.30
1821	0.00	0.00	0.80	0.80	0.80
1821100	0.00	0.00	0.10	0.10	0.10
1821190	0.00	0.00	0.30	0.30	0.30
1821192	0.00	0.00	0.20	0.20	0.20
1821216	0.00	0.00	0.40	0.40	0.40
Miles of temp spur road construction	0.00	0.00	0.06	0.06	0.06
Total miles of haul route	0.00	0.00	7.86	8.26	8.26

Table 8 - Road Reconstruction & Maintenance Summary

Road No.	Segment	Maintenance Reconstruction Level*	Alt A No Action	Alt B	Alt C	Alt D	Alt E
1800	MP 9.19-13.01	Maintenance	0.00	0.00	4.08	4.08	4.08
1800	MP 13.01-14.99	Moderate.	0.00	0.00	1.98	1.98	1.98
1800418	1800 -1800419	Maintenance	0.00	0.00	0.00	0.10	0.10
1800419	1800418 - End	Maintenance	0.00	0.00	0.00	0.30	0.30
1821	1800 – MP 0.80	Maintenance	0.00	0.00	0.80	0.80	0.80
1821100	1802147-1912	Low	0.00	0.10	0.10	0.10	0.10
1821190	1800 – MP 0.30	Maintenance	0.00	0.00	0.30	0.30	0.30
1821192	1821 – 1821416	Maintenance	0.00	0.00	0.20	0.20	0.20
1821216	1821192 – End	Maintenance	0.00	0.00	0.40	0.40	0.40
Totals			0.00	0.10	3.78	4.18	4.18

*** Maintenance and Reconstruction Levels**

- **Maintenance** can consist of brushing roadside vegetation, falling of snags and danger trees, blading of road bed, cleaning of ditches and culvert inlets and outlets, removing slough and slide material and placing crushed aggregate. These are standard maintenance activities that occur on all roads when commercial activity occurs or on a rotating basis on all roads determined by use and need.
- **Low level** reconstruction may consist of brushing roadside vegetation, falling of snags and danger trees, blading of road bed, cleaning of ditches and culvert inlets and out lets, removing slough and slide material and placing crushed aggregate or asphalt surfacing and removing and replacing or installing new ditch relief culverts. These are standard maintenance and/or reconstruction activities that occur on all roads when commercial activity occurs or on a rotating basis determined by use and need.
- **Moderate level** reconstruction includes the same items of work as the low level with the addition of replacing culverts in intermittent and non-fish bearing perennial streams.

- **High level** reconstruction could involve all the work items in low and moderate levels with the addition of replacing culverts in fish bearing perennial streams and repairing major road failures within riparian areas.

Table 9- Culvert Replacement Summary – All Action Alternatives

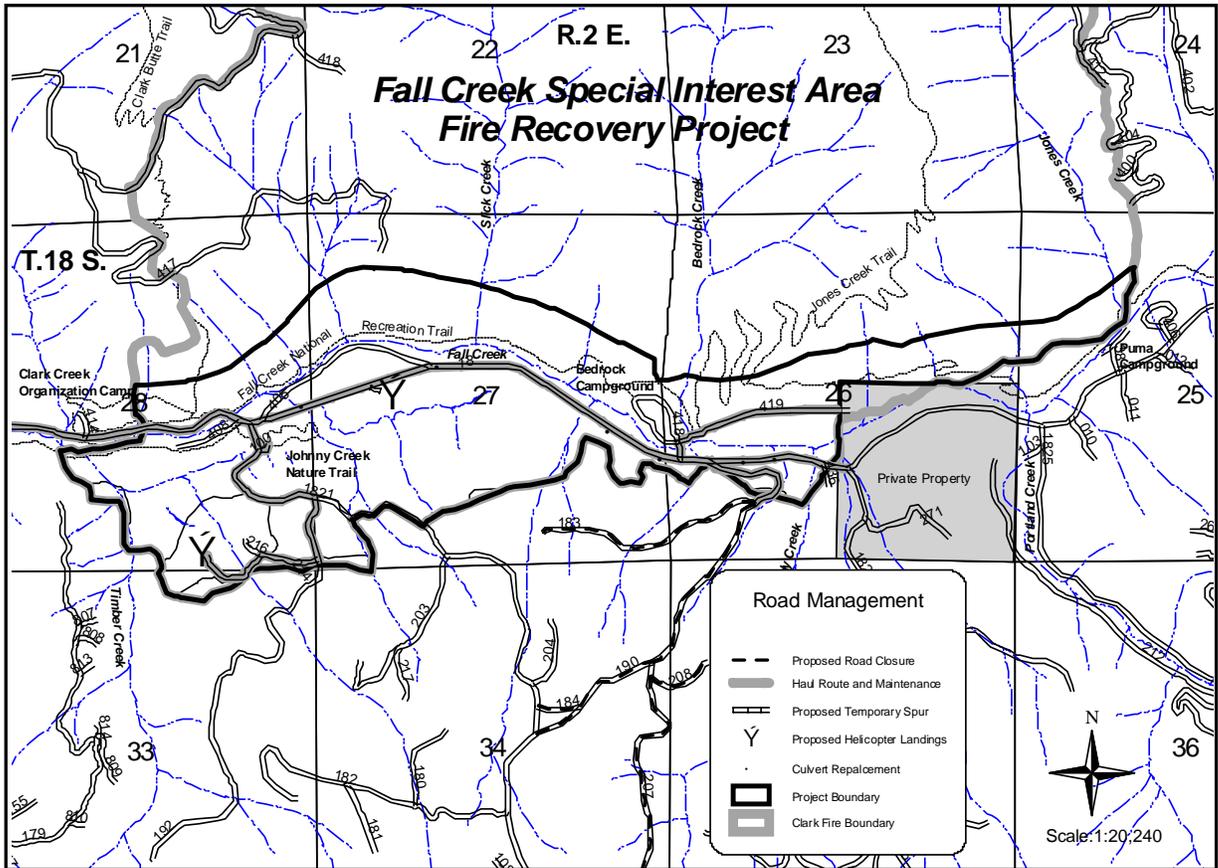
Road 1800 Culvert Replacement Needs				
Mile Point	18"	24"	30"	Crossing type
13.40			X	Overflow pipe
13.78	X			Ditch Relief Pipe
14.35		X		Intermittent Stream
14.51		X		Intermittent Stream
14.70		X		Intermittent Stream
14.86		X		Intermittent Stream

Table 10. Road Closures Summary – All Action Alternatives

Road Number	Miles	Closure*
1821190	1.33	Low
1821207	0.80	Low
1821208	0.10	Moderate
Totals	2.23	

*Closure level

- **Low level closure:** Barrier could be a berm or gate with water bars to be constructed as needed. Waterbars could be driveable or not. Administrative closures would fall in this category.
- **Moderate level closure:** Barrier would be a berm with water bars to be constructed as needed, possible removal of culverts in stream channels that are not in high fills. There could sidecast pull back if needed. Waterbars would not be driveable.



Map 7 – Location of road management work

Mitigation Common to All Alternatives

The following mitigation measures are a part of the four action alternatives. Most of the measures apply to implementing established standards and guidelines to comply with management direction and environmental laws and to minimize any adverse impacts from the proposed forest management activities. Specific details can be found in the Analysis File under individual resource prescriptions.

Water Quality

Riparian Reserves - Alternative B and C

Riparian Reserves would protect all fish bearing streams, permanently flowing non-fish-bearing streams, seasonal flowing or intermittent streams, and small wetlands in or adjacent to any treatment areas. The Riparian reserves would protect the area on each side of the stream to a slope distance equal to greater than 400 feet on fish-bearing streams and 200 feet on non-fish-bearing, seasonal flowing, intermittent stream. Riparian Reserves protect water quality and riparian –dependent resources, and provide dispersal corridors to many terrestrial animals and plants.

Limited salvage would occur in the Riparian Reserves adjacent to Road #18 corridor where hazard trees need to be felled for public safety and possibly removed if excess of riparian and CWD habitat needs. No salvage would occur in Riparian Reserves throughout the rest of the project area.

Riparian Reserves - Alternative D and E

Modified Riparian Reserves would protect all fish bearing streams, permanently flowing non-fish-bearing streams, seasonal flowing or intermittent streams, and small wetlands in or adjacent to any treatment areas with no cut zones. The modified Riparian Reserves would protect the area on each side of the stream to a slope distance equal to greater than 200 feet on fish-bearing streams and 100 feet on non-fish-bearing, seasonal flowing, intermittent stream. The lower half of the Riparian Reserves would continue to protect water quality and riparian –dependent resources.

Salvage of fire-killed trees would occur in the upper half of Riparian Reserves. The up-slope portion of the riparian reserves from 200-400 feet on fish bearing streams and 100-200 feet on non-fish bearing streams would be partially harvest to meet a balance of resource objectives while maintaining CWD habitat. The up-slope portion of riparian reserves area would still provide dispersal corridors for many terrestrial animals and plants. Limited salvage would occur in the Riparian Reserves adjacent to Road #18 corridor where hazard trees need to be felled for public safety and possibly removed if excess of riparian and CWD habitat needs.

Soils

Full log suspension and partial (one- end) suspension is required to minimize soil disturbance. In the case where mineral soil is exposed in specific locations beyond the level of maximum allowable disturbance, the site would be water-barred, seeded, and fertilized immediately following harvest.

Best Management Practices would be used during construction of temporary logger spurs and during road maintenance activities to reduce soil erosion and sedimentation.

Roadsides on haul routes within the project area would be re-vegetated by native grass seeding and mulching where needed, and along with checking, cleaning, and replacing all culverts. All logger constructed temporary spur roads and landings used on the project would be closed by berming, scarifying, water-barring, seeding, and mulching after post-sale activities are completed.

Dry season operating restriction (October 1 to July 15, on a conditional basis as determined by resource specialist) would be applied during culvert replacement, during construction and use of temporary logger spur, and during the re-location of the trail. A seasonal restriction during these activities reduces soil erosion and potential sedimentation.

Wildlife and Fisheries

Coarse woody debris - Prescriptions provide varying amount of CWD specific to the portions of salvage units to meet various resource objectives, such as fuel loadings, fire fighter safety, and scenic quality. All existing downed coarse woody debris would be left in place. The protection of coarse woody debris ensures adequate nutrient cycling for maintenance of long-term site potential and provides valuable habitat structure for a diversity of species.

Seasonal restriction for noise producing activities would be implemented for a number of activities to avoid disturbance of breeding pairs of northern spotted owl. This restriction would be implemented for any noise producing activity (falling, yarding, and hauling of timber, road construction) which might occur within one quarter mile of known spotted owl activity centers or un-surveyed habitat from March 1 through July 15 (critical nesting period) unless non-nesting is determined. Salvage units that are helicopter logged outside the 0.25 mile area may also need to be restricted depending on the flight path and helicopter landing locations.

A seasonal restriction to minimize impacts on disturbance to spring chinook salmon would be implemented only for the falling of hazard trees adjacent to Fall Creek. The restriction applies from June 15 to May 15, with review of fish biologist.

Directional falling would be required to ensure placement of hazard trees for stream structure, CWD recruitment, and for resource protection.

Fuels and Fire

Fuel treatments are prescribed to reduce management-created fuel loadings and the future build-up of fuels. Fuel prescriptions are designed to minimize soil duff and litter disturbance. In the case where mineral soil is exposed in specific locations beyond the level of maximum allowable disturbance, the site would be seeded, and fertilized immediately following treatment.

Air quality would be maintained by adhering to the Oregon Smoke Management Plan and additional monitoring of low level winds to insure that burning occurs when the risk of smoke intrusions into designated areas and Class I airsheds is very low. Alternative fuel treatment methods such as yarding tops, grapple piling along roads, and hand piling and burning concentrated areas within salvage units would be used. Grapple machines would work on a bed of slash and debris to minimize the soil disturbance and compaction. The slash piles would be covered and dry when burned which reduces the amount of smoke produced.

Vegetation

No healthy, green trees would be cut. Trees scorched by the fire would be assessed by a process developed by Scott et al (2002) to determine the probability of survival. Trees with less than 10-20% green crown may be cut due to low probabilities of survival. Trees that die in the next 2-3 years and become a hazard to public safety would be salvaged depending upon coarse woody debris retention needs.

A green tree may be cut if it presents a hazard (as determined by OSHA) to the falling and yarding operations. Landings and access roads may require the cutting of green hazard trees to ensure OSHA safety standards for the workers during logging operations.

Noxious Weeds

The spread of noxious weed would be minimized by requiring the following actions:

1. All off-road equipment used to implement the proposed action to be cleaned before entering the project area, between infested units, and between infested areas and non-infested areas. This includes a thorough cleaning of the undercarriage in a designated cleaning area. Start work in non-infested areas and then move to infested areas. Follow up and control weed seed that has been removed in designated cleaning areas following logging activity
2. Pre-treat road systems before maintenance or harvest activities to get rid of weeds and lessen the soil bank. This may take several years and follow-up treatment and monitoring is imperative.
3. Try to conduct work during the dry season when mud and seed would be less likely to be transported in vehicle undercarriages.
4. Re-vegetate all disturbed areas (culvert, road shoulders) with weed-free native seed to compete with noxious weed seed that blows in.
5. If straw is used in re-vegetation efforts, make sure it is weed-free.
6. Minimize soil disturbance to the extent practical.
7. Monitor road systems and disturbed areas for new localized populations for 2 years following treatment.
8. Use certified weed-free gravel on all road construction.
9. When temporary spur is removed, re-vegetate with native weed-free grass seed and mulch to compete with weed seed.
10. Develop yarding corridors around, rather than through, false brome infestations along road shoulders and re-vegetate along road shoulders to prevent movement of weeds into salvage areas.

Cultural Resources

Proposed treatment units were surveyed for cultural resources. Several sites would be protected by avoiding the areas and or buffering the sites by 50-100 feet. If any cultural sites are found during any proposed activity, the activity would be discontinued, and timber sale contract provisions would be invoked until the site is evaluated for significance and appropriate mitigation measures are performed.

Helicopter yarding system that provides full suspension of logs would be used to reduce disturbance to the soil around areas with cultural resource sites.

Dead hazard trees would be directionally felled and left in place to provide protection barriers to cultural resource sites.

Recreation

Sections of the Fall Creek National Recreation Trail, Clark Butte Trail, and Jones Trail would be closed during logging operations. The time period of trail closures would be kept to a minimum.

Log and boulder barriers would be placed in areas adjacent to Road #1800 and various dispersed recreation sites parking areas to prevent off-road vehicle travel.

Several dispersed recreation sites would be decommissioned. These sites are not part of the regularly maintained recreation facilities and have various resource and social problems associated with the sites, such as causing soil erosion, litter and garbage dumps, and situations requiring law enforcement.

Hazardous trees within 100 feet of roads would have stumps flush cut or angled away to minimize the visual effects.

Closure of Road 18 and recreation facilities along Fall Creek SIA would be kept to the minimum to allow recreation in the area while providing public safety from the log yarding operations. Logging operations would be restricted to weekdays during the high recreation season (May 30 to September 5)

Mitigation Specific to Alternative D

Alternative D would re-locate 1.6 miles of the Fall Creek National Recreation Trail to avoid impacts to spring chinook salmon and their habitat in Fall Creek while still enabling safe trail use to occur..

Alternative D would implement seasonal restrictions during the re-location of the trail to prevent erosion and sedimentation at stream crossings. The use of rock boulders as stepping stones would minimize impacts to water quality.

Alternative D would create an understory fuel break along the trail corridor and would provide a strategic access and anchor fire line to provide protection to the LSR. The fuel break would treat surface, woody fuels, low vegetation, and the shrub layer. The removal of dead hazard trees along the trail corridor would reduce continuity of the forest canopy and accumulation of large fuels. These activities decrease the chances that a surface fire would transition to a crown fire.

Alternatives Considered But Eliminated from Detailed Analysis

Several management options to alternatives were considered but not considered in detail. They include the following:

Closure of Fall Creek Road #1800 - The Fall Creek Road #1800 is a paved road which provides access to the highly used recreation area. The road provides important administrative access to the Fall Creek watershed for fire protection, law enforcement, and resource management. The road also provides access to a parcel of private property. Road #1800 is identified in the Forest Road Analysis (USDA, 2003b) as a key road to be kept opened and maintained. The closure of Road #1800 would require about a 10 mile detour over low maintenance roads to access the upper portion of Fall Creek watershed. Due to the high recreation use, key road designation, and need for administrative and private property access, this option was eliminated from detail analysis.

Topping of hazard trees – The topping of fire-killed trees was considered as an option to abate the hazards to public safety. Tree topping is regularly used to create wildlife trees or snags in harvest units. The technique creates a snag by leaving the majority of the bole of the tree while removing the top and most of the branches. As a dead tree deteriorates naturally over time, it is typically the top section of the tree and the branches which breaks off and creates the hazard. The bark of the dead trees also loosens in about 3-5 years and begins to slough off. In order to top trees, the trees need to be climbed before the bark begins to loosen. It is estimated that there are over 500 dead trees which are creating a hazard to roads, trails, and dispersed and developed recreation sites. These trees would need to be climbed and topped in the first year after the fire in order to maintain safe working conditions. There was no funding available to implement this practice at the appropriate time. Funding could be generated through a timber sale, but by the time the timber sale is completed and sale area improvement funding is made

available, it would be 3-5 years after the fire and the tree bark would be too loose to safely climb the trees. Due to the timing and cost, this option was eliminated from detail analysis.

Prescribed Burning – Use of prescribed fire, given the right circumstances, may be appropriate to manage forest structure and diversity, create fuel breaks and reduce the risk of catastrophic fire. The reference vegetation conditions cited in the watershed analysis discusses how aboriginal burning prior to 1900 may have played a significant role in vegetation patterns and fire regimes in the Fall Creek Area. The present day forest conditions in the Special Interest Area may not be conducive to broadcast underburning anymore. Several factors contribute to this reasoning: 1) the area is now a high-use recreation area serving a growing population; 2) the area has numerous recreation facilities and infrastructure such as the historic Clark Creek Organization Camp, campground building and trailheads; 3) the presence and locations of private property; 4) the forest series and plant community types of this valley bottom along the river are not typically the type to be managed by fire; 4) the Clark Fire has recently burned the area, therefore the fire disturbance effects have occurred; 5) future fuel loadings may be too high to allow broadcast prescribed burns without additional fuel reduction treatments. Due to these factors, prescribed burning was eliminated from detail analysis.

Summary and Comparison of Alternatives

This section provides a summary of the effects of implementing each alternative. Information in the table is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives.

Table 10 – Comparison of Alternatives.

Comparison Factors	Alt. A No Action	Alt. B	Alt. C	Alt. D	Alt. E
Acres Treated by Feature:					
Roads	0	91	91	91	91
Trails	0	24	4	43	136
Disperse Rec. Sites	0	1	1	15	12
Other Salvage Areas	0	0	50	100	90
Totals	0	116	146	249	328
Timber Volume Harvested					
Million Board Feet (MMBF)	0	0	3.0	5.5	5.8
Acres by Logging System					
Helicopter	0	0	81	171	252
Loader	0	0	64	78	76
Not yarded	0	116	1	0	0
Acres of Fuel Treatment Method					
Hand Pile & Burn	0	97	82	146	220
Grapple Pile & Burn	0	19	33	44	44
Strip Cover & Burn	0	0	31	59	64
Acres of Reforestation					
Total Acres Planted	0	0	436	436	436
Miles of Road Management					
Reconstructed or Maintained	0	0.10	3.78	4.18	4.18
Total Haul Route	0	0	7.86	8.26	8.26
New Construction Temporary Spur Roads	0	0	0.06	0.06	0.06
Road Closures	0	2.2	2.2	2.2	2.2
Helicopter Landing Constructed			1	1	1

Table 11 – Comparison of Alternatives by Purpose and Need.

Comparison Factors	Alt. A No Action	Alt. B	Alt. C	Alt. D	Alt. E
Purpose and Need					
Public Safety					
Acres (% Area) Treated	0	116 (15%)	96 (13%)	149 (20%)	239 (31%)
Vegetation Recovery					
Acres of Reforestation	0	0	436	436	436
Riparian Habitat					
Trees felled into Fall Ck	Natural recruitment	100-120	70-90	70-90	150-170
Acres of Riparian Planting	0	0	304	304	304
Fuel Loading					
Acres (% Area) Treated	0 (0%)	116 (15%)	146 (19%)	249 (33%)	328 (43%)
Economic Recovery					
Timber Volume (MMBF)	0	0	3.0	5.5	5.8

Table 12 – Comparison of Alternatives by Issues

Evaluation Criteria	Alt. A No Action	Alt. B	Alt. C	Alt. D	Alt. E
Significant Issues					
Public Safety					
- Miles of Roads abated	0	2.9	3.8	4.1	4.1
- Miles of Trail Abated	0	2.2	0.9	2.2	2.2
- # of Developed Sites Abated	0	1	1	1	1
- # of Dispersed Sites Abated	0	16	16	16	16
Fuel Loading					
Fuel Model 5 (fire spread) and Fuel Model 10 (fire intensity) in 5 years - Acres (% of project area)	418 (54%)	319 (42%)	290 (38%)	212 (28%)	172 (22%)
Fuel Model 5 (fire spread) and Fuel Model 10 (fire intensity) in 10-25 years - Acres (% of project area)	480 (63%)	376 (49%)	349 (46%)	261 (34%)	207 (27%)
Resistance to Control	High	High	Moderate	Low.	Low
Spring Chinook Salmon					
Number of Trees felled into Fall Ck	Natural recruitment	100-120	70-90	70-90	150-170

Evaluation Criteria	Alt. A No Action	Alt. B	Alt. C	Alt. D	Alt. E
Other Analysis Issues					
Recreation Use Capacity					
- # of dispersed sites closed	0	0	16	16	0
- Feet of road treated with traffic barriers	0	4,200-10,500	4,200-10,500	4,200-10,500	4,200-10,500
Recreation Infrastructure					
# & type of structures abated	0 bridges 0 parking areas 0 rest rooms	5 bridges 9 parking areas 2 rest rooms			
Vegetation Recovery					
- Acres of planting	0	0	436	436	436
- Years to Scenic recovered condition	30-50 years	30-50 years	15-25 years	15-25 years	15-25 years
Snags and CWD Habitat					
- Tree or snags/acre retained	All	All	Variable	Variable	Variable
Terrestrial TE&S					
- Acres of Owl habitat removed or degraded	0	0	0	0	0
- Acres in CHU	0	All	All	All	All
- Acres w/i 0.25 mi of Fall Ck	0	0	0	0	0
Water Quality					
-Number of Trees Cut on south bank of Fall Creek	0	35-45	35-45	35-45	50-60
- Percent change in Fall Creek shade	0	-0.7%	-0.7%	-0.7%	-0.9%
Aggregate Recovery Percent	Year 2004	Year 2014	Year 2014	Year 2014	Year 2014
- Slick Creek	68	70	70	70	70
- Bedrock Creek	75	75	75	75	75
- Jones Creek	87	89	89	89	89
- South Fall Tributaries	62	73	73	73	73
Acres of Salvage Yarding	0	0	146	249	328
Number of Culverts Replaced	0	6	6	6	6
Miles of Road Maintenance	0	0.1	3.8	4.2	4.2
Miles of Haul on Gravel Roads	0	0	1.8	2.2	2.2
Number of log truck loads	0	0	373	733	773
Soil Erosion & Compaction					
- Meets S&G FW-081 for Detrimental Soils	NA	All units	All units	All units	All units
- Tons of soil erosion	1008	1008	1119	1208	1204
Economic					
- Timber Volume (MMBF)	0	0	3.0	5.5	5.8
- Present Net Value	-\$175,178	-\$323,782	-\$107,124	\$115,720	\$143,240
Noxious Weeds					
Mile of Road Soil disturbance activities	0	0.1 mi roadside	3.8 mi roadside	4.2 mi roadside	4.2 mi roadside
Acres of soil disturbance activities	0	18 ac fuel trmt.	33 ac fuel trmt. 64 ac loader yarding	44 ac fuel trmt. 78 ac loader yarding	44 fuel trmt. 76 ac loader yarding

CHAPTER 3 - ENVIRONMENTAL CONSEQUENCES

This chapter describes the environmental effects of implementing the alternatives. This analysis is organized by resource area and the associated issues. Within each section, the issue is stated first, and then the existing conditions are summarized, followed by the management direction pertinent to the resource or issue, and then the effects of the alternatives, starting with the no action alternative and then the discussion and comparison of the action alternatives.

Recreation

Public Safety - *Significant Issue*

The fire has killed numerous trees adjacent to developed and dispersed recreation sites and along Forest Service roads. These roads and recreational facilities are within the Fall Creek Special Interest Area which is a heavily used recreation area. The public recreating in the fire-affected portion of Fall Creek could be injured or killed by falling dead trees or falling tops and branches of fire-killed trees. The risk increases for recreation activities with long residence time such as day use or overnight camping where the public is exposed to the danger over a longer period of time. The risk of dead trees falling and hitting someone using the recreation facilities, hiking the trails, or traveling along the roadways has created hazardous conditions to public safety and commercial and administrative use.

Existing Conditions

The Fall Creek corridor is the most heavily used recreational area on the Middle Fork Ranger District, and possibly on the entire Willamette National Forest. This popularity results from its year around accessibility, proximity to the Eugene/Springfield metropolitan area, the attractive nature of its old-growth forests, the National Recreation Trail that parallels Fall Creek, and the unique fishing, swimming, and scenic opportunities afforded by Fall Creek itself. A recently compiled report, entitled “Fall Creek and Winberry Creek Social Use and Strategy Paper” (USDA, 2004b) more fully describes the recreation uses in this area, and can be found in the Analysis File.

Developed sites

Foremost among the developed recreational facilities within the project area is the Bedrock Campground. Hazardous trees in the campground, those killed by the fire and which, as they deteriorate could fall into the campground or the adjacent heavily used section of Fall Creek, have already been removed and documented in a separate analysis -Bedrock Campground Fire Recovery Project Environmental Assessment (USDA, 2004a).

The portions of the SIA affected by the Clark fire also contain two other developed recreational sites, the Johnny Creek Nature Trail and Slick Creek Cave Interpretative Site. The Johnny Creek Nature Trail is a fully accessible, paved nature trail and associated parking lot and restroom facility was created to interpret the old-growth forest ecosystem and is associated with a formally designated Old-Growth Grove (MA-7). The fire did little damage to the trail tread (aside from burning out several buried logs under the asphalt tread) and parking facility, but it killed most of the trees within sight of the trail. The fire also consumed all the trail signs and most of the associated benches along the trail. The fire also

destroyed the wooden stairs and sign for the Slick Creek Cave Interpretative Site. The BAER replaced these structures.

Trails

The Fall Creek trail (#3455) is designated a National Recreational Trail. About 3.8 miles of this trail are within the project area and of that about 2.2 miles were affected by high-severity fire. The fire effects include damage and consumption of trail bridges, signs, and bin wall structures; some tread damage from burning of buried roots and stems; and several large trees have fallen and block the trail in steep portions where re-routing is not possible. The fire portion of the SIA also contains the lower portions of the Clark Butte trail (somewhat affected by fire suppression, but it has been rehabilitated) and the Jones Creek trail (moderately affected in its lower portions). A total of five trail bridges are within the project area. These bridges are in the process of being replaced, and the replacement will be completed before the SIA restoration plan is finalized. There is a concern, however for the longevity of these bridges; they could be severely damaged if a fire-killed tree falls and hits them. There is a similar concern for the trail tread structures such as switchback cribs and bin walls. Trail structures such as bin walls and bridges are expensive and there will likely be limited funding to replace such structures if they are damaged by falling trees.

One other trail with some developed interpretive facilities, the Clark Creek Nature Trail, is partially within the fire affected portion of the SIA. About half of this trail was severely burned over by the fire. All interpretive signs were destroyed on that portion of the trail, and the trail tread was heavily damaged.

All the trails mentioned above are designated as Class I trails by the Willamette Forest Plan (Forest Plan; USDA, 1990a). See page IV-53-55 of the WNFP for the standards and guidelines under which trails are to be managed.

Dispersed camping

Informal camping occurs throughout the SIA, primarily in areas accessible from Road #18. There are approximately 16 sites that are heavily used within the project area. Most are associated with Fall Creek and popular swimming holes. Dispersed camping has been considered somewhat of a problem in this area in that considerable amounts of trash tends to accumulate, sanitary facilities are lacking in these unregulated areas, and occasionally there have been problems with transient use and people staying in the area for long periods of time. Most of the trees adjacent to most of the dispersed camping sites were killed by the fire. The fire also removed understory vegetation in some areas to the point where vehicles may now be able to drive off Road #1800; allowing people to create new dispersed sites. About 10,500 feet in various locations either side of Road #1800 has been so affected, and is on topography that could allow vehicles to leave the road.

Day use

Fall Creek is a very popular day-use area. Hikers can be seen nearly any day of the year, though most use occurs in the summer when nearly every available swimming hole can be occupied. Most of the day use aside from hiking is river related; consisting of swimming, fishing, and partying. There are dead trees immediately adjacent to nearly every swimming hole. There are 13 popular swimming holes within the project area.

Roads

Road #1800 is the primary access to all the recreational activities and facilities in the SIA, and provides a pleasant recreational experience in its own right. Vehicle counts on this road have averaged 380 per day during summer and early fall over the last 15 years, and have ranged from 427 to 313. The most

recent vehicle count per day (in 2001) was 364. This is the second highest vehicle count made on the Willamette National Forest, not counting State highways. Approximately 2 miles of Road #1800 were affected by the fire. Trees presenting imminent hazard to road users (generally dead trees with branches overhanging the road or if a tree top broke out and could reach the road) have been removed through the Clark Fire Roadside Salvage Decision Memo (USDA, 2003a), but many trees with the potential to land on the road as they begin to deteriorate remain along all sections of Road #1800 and all tributary roads within the fire area.

Recreation Safety

There are two aspects to safety concerns resulting from a large, high mortality fire in relation to recreational use. First is the potential for recreationists to be injured or killed by falling trees or tree branches as dead trees deteriorate. The second relates to the fact that recreation sites can be a source of wildfire ignition, either from improper camp-fire management, poor smoking habits, accidents with lighting devices, or vehicle related fires. The first concern for safety will be discussed in this section and the second concern will be discussed in the Fire and Fuels section.

Fire-killed tree deterioration

Whether fire-killed trees pose a safety concern is dependent on many factors. Trees can be burnt by a fire such that they are a high risk of falling if they had open wounds or defects in their root collar or stems, allowing fire to burn into the roots or boles and reduce the strength of supporting wood. For the most part, these danger trees were felled during fire suppression and mop-up activities to provide for fire fighter safety. As the standing, dead, and reasonably sound trees age, they will begin to deteriorate. This deterioration progresses differently depending on the size of the tree. In general, smaller diameter trees fall first and tend to fall as one piece, since their roots are relatively small and both roots and stems contain a relatively high proportion of decay-prone sapwood. Larger trees tend not to fall as one intact stem.

The following discussion of how dead trees deteriorate comes from observations of fire effects in fires that have burned on the Middle Fork Ranger District over the last 20 years (Bailey, 2004). In that period of time approximately 30,000 acres have been burned in wildfires of varying intensities and across a variety of forest types and ages. These general observations have been corroborated by a study of the effects of the large Warner Creek fire by Brown, et al. (2003). Additionally, these observations have included snag conditions and configurations in naturally regenerated stands created by past fires from 70 to 150 years ago.

The first step in the deterioration of large dead trees is the shedding of limbs. This is a natural occurrence in all forests as branches of the lower crown die from shading, but in a fire-killed stand of trees, most of the limbs will fall to the ground over a 5 to 15 year period. This process has already begun in the Clark fire, and will be accelerating over the next several years. Next the bark begins to be shed. Bark on very large Douglas-fir can be greater than 4 inches in thickness and can come off the tree in large slabs. On fire-killed Douglas-fir trees, bark generally begins to loosen during the 2-3rd year, and falls beginning in the 5-10th year (Kimmey and Furniss, 1943).

As the large trees slowly deteriorate, the smaller, upper portion of the stems are weakened before the larger, lower stem, so the tops tend to break out. Over time the entire tree comes down in pieces, from the top down. Wallis et al. (1971, 1974) found that, after fire on Vancouver Island, percent of decay in Douglas-fir and western hemlock increased with increased height in the tree (which is different from east side reports). Western hemlock decayed faster than Douglas-fir. Twenty-nine months after fire-kill, Douglas-fir had 12 percent of volume decayed, with a higher proportion of sapwood decayed in

mature timber. In western hemlock, mature trees had 24 percent of volume decayed, while immature trees had over 50 percent volume decayed after 29 months.

Surveys on the Colville, Okanogan, and Wenatchee National Forests indicate that for fire-killed Douglas-fir, over 25 percent broke below the crown within 5 years. Breakage increased significantly after the third year. Within 5 years, more than half of the branches on half of the trees had fallen (Hadfield and Magelssen, 2000). Failure of boles and branches of Douglas fir and western hemlock on the Middle Fork Ranger District would be accelerated because conditions are generally more conducive to decay, with milder winters and more moisture.

It is common in this ecosystem for the lower portion of a very large diameter tree stem (greater than 40 inches in diameter) to stand up to 100 years. These large remnant snags are often seen in 100 to 150 year old stands that have regenerated after a severe wildfire, and the pieces of the stem that sequentially fell are often readily apparent. The root system and lower bole of a large tree are massive and contain a large percentage of rot resistant heartwood, so such trees tend not to fall due to root or lower stem failure (assuming these portions of the tree were sound at the time a fire killed them). In addition, the dead crown of a large tree does not provide much wind resistance (at least compared to a tree with a dense, live crown), so wind stress is less likely to topple an entire large, dead tree than is would a live tree. But during the time it takes a large tree to deteriorate to a relatively short snag, several sections of the bole ranging in lengths from 10 to 30 feet long will have fallen out of that one tree, in addition to all the branches.

Dead trees, tops, branches, and bark will be falling in the area of the Clark Fire for the next two to three decade or more. Significant amounts of failure can be expected beginning at least by fall of 2006 (Hildebrand, 2004).

Degree of risk

The amount of risk a person experiences when in the vicinity of fire-killed trees is a function of exposure time. The longer you stand within reach of a dead tree, which will eventually fall in some direction, the more likely it becomes that you will be hit by a portion of that tree. This risk can increase exponentially if you are standing near the trees when environmental conditions, such as strong winds, heavy snows, or heavy machinery operation might cause the trees to fall. Hence, activities such as camping, where a person spends many hours in one spot, and some of those hours are spent in sleep when a person is not aware of surrounding environmental conditions, present much more risk in terms of being affected by a falling dead tree than one pursuing other, more mobile activities. Of course, if it takes five years before the top of a large dead tree breaks out; a one day stay under that tree presents only five hundredths of one percent chance of being hit on that given day, but during that five years hundreds of branches and chunks of bark would also be falling out of the tree.

While an individual camping in a campground with many dead trees for one day would not be exposed to much of a risk, in a popular campground such as those along Fall Creek, there will be (as in Bedrock Campground) over 200 tree tops falling over the next 15 years. Even though the risk for an individual is low, in an area that is almost always occupied by people, there is a high probability that over time someone will get hurt or killed. It is almost a certainty that a person could be in a position to be hit by one of these tree tops when it comes down, if the campground is open and generally filled to near capacity, a condition which occurs in the Bedrock campground during the entire summer.

Day use, such as swimming, within the fire area would present less risk than camping, but the relative risk is still somewhat high in that a person would be more or less in on place for an extended period of time. Trails use risk would be relatively low, since the person would be on the move most of the time

and would not spend very much time at all in the risk zone of any given tree. However, that person would also be passing by a large number of potentially hazardous trees if they were walking through a large fire area, so they would still be exposed to a long-term risk for the entire time they were within the fire area. Road-use related risk would be relatively very low, since the time spent in a given area is very short, but injuries could also occur even after a given tree fell if a driver was not paying close attention and hit a tree that had fallen across the road.

One way to address the above risks (aside from wholesale tree removal in all areas where people may potentially be) is to fall varying amounts of trees depending upon the degree of risk a particular user is exposed to. For example, in a well-used campground that is well advertised (in the sense of being on maps and recreation guides) where exposure times are long and people are present nearly any time of the day or year, it would be reasonable to fall all trees that could potentially fall and land within the campground, as has already been provided for by the Bedrock Campground Fire Restoration analysis. Such hazard removal may also need to be done around well-used dispersed camping sites if these sites are to remain available to public use, although there is no direction that dispersed recreational use be provided for with no risk. Dispersed camping provides the same long-term risk exposure as exists for developed campgrounds.

Since trail use presents less risk, safety concerns for hikers could be addressed by removing only those trees most likely to impact the trail tread. In this scenario, all small trees that could fall full length could be felled or removed if they could potentially land on the trail. And only large trees within a certain distance of the trail (depending upon the length of stem that is predicted to break out) would need to be felled and/or removed since they are less likely to fall all at once, and tops coming out of the trees could only affect the trail to the length of the broken out top and the horizontal distance it could travel on its way to the ground. Safety provisions for road use could use the same rationale as that for trails.

Management Direction

There is little direction or detailed discussion of recreation safety in the Standards and Guidelines contained in the Willamette Forest Plan. Standards and Guidelines for Special Interest Areas (WNFP, page IV-138) do not mention anything in regard to recreational safety, but there are some general safety goals presented in other management area guidelines. The Forest Plan directs, in relation to dispersed recreation (FW-015), that a broad range of recreation opportunities in a variety of settings be provided. Standards for dispersed use (pages IV-48 and 49) also make no mention of the need to provide for user safety. Restrictions of dispersed recreational use are provided for only if use exceeds area capacity in terms of a given Recreation Opportunities Spectrum (ROS) class (FW-017; see FEIS, page III-94, for a definition of Recreation Opportunities Spectrum classes). Given the varying specificity of Forest Plan guidelines for public safety, there is a higher expectation for provision of safe conditions along roads and developed campgrounds than there is along trails or in the vicinity of dispersed camping sites.

The Desired Future Condition statement for developed recreational sites (i.e. campgrounds; WNFP, page IV-216) states “use and occupancy will be regulated to protect natural resources and to ensure safe, enjoyable recreation experiences”. Forest Wide standards and guidelines for trails (WNFP, page IV-51, FW-039) includes “operation and maintenance activities should be conducted:....to meet requirements for user safety”. Those requirements are not specified. It is apparent these standards and guidelines were not developed in anticipation of the possibility that a popular recreation area could burn with high severity and killing most of the trees in an area. The forest plan makes an implicit assumption that dispersed use may occur anywhere unless there has been a specific determination that such use is not consistent with the ROS class of a given area.

Forest Service policy (FSM 7733.2) directs that the safety provisions on forest development roads with maintenance levels 3-5 are subject to the Highway Safety Act of 1966 (P.L. 89-564) and shall comply with the applicable Highway Safety Program Guidelines, as specified in the Memorandum of Understanding found in FSM 1535.11. About 61% of roads in this project area are at maintenance levels 3-5 (Sayre, 2004).

Oregon Occupational and Safety and Health Division (OR-OSHA) pertains to those individuals involved in forest activities, such as activities associated with this project. OR-OSHA defines danger trees in Division 6, Forest Activities and in Division 7, the new Forest Activities standard. The roads are considered work areas when they are used to access work sites. Trees need to be evaluated over time for their danger status and trees which could reach the road, or slide into the road must be removed. Division 7, Forest Activity code requires danger trees to be felled, or work arranged so that workers are not exposed to the hazard. These requirements apply to any road that is used for commercial purposes, maintenance levels 2-5. A closed road does not require hazard tree removal.

Additionally, there is also a liability concern regarding people's presence in a fire affected stand of trees. The U.S. Government and USDA Forest Service have been successfully sued in the past for the death of a recreationist who was hit by a falling dead tree near an attractive recreational facility. Successful suits have also been brought over damage to a vehicle caused by a falling tree. Monetary awards from these judicial findings of liability have been large, and have generally been associated with prior recognition that hazardous trees existed in or adjacent to a given recreation area. The U.S. Government is self-insured, and such judicial findings of liability (depending upon the magnitude) are sometimes paid for by funds allocated to the Willamette National Forest and the Middle Fork Ranger District. There are no budget items for legal settlements and such expenditures, which come from taxpayers to begin with, can have profound effects on other local Forest Service management programs.

Environmental Consequences by Alternative

As discussed above, the degree of injury risk in terms of trees or limbs falling depends upon the size and species of tree and the type of activity (in term of residence time within the potentially unsafe area). This risk is also progressive as trees deteriorate, and there may be little risk in the short-term (especially for larger trees) but the risk can last for a decade or more as trees deteriorate, limbs progressively fall, and the smaller diameter portions of the stem break out as the wood decays.

While the action alternatives all address trail safety to some extent, some alternatives provide a safer trail experience than may be indicated simply by the miles of trail hazards abated. Alternatives B, C and D remove hazardous trees from the trail, but not all trees that could hit the trail would be removed, so those alternatives would not provide as completely safe a hiking experience as would Alternative E, which removes a greater proportion of trees that could potentially land on the trails (see the above discussion under "Degree of Risk" regarding the potential for trees of differing sizes and distances from the trail to hit the trail).

Since even a tree immediately adjacent to a recreation site or trail still only has a 50 percent chance of hitting that site when and if it falls (including the tree's branches), and since it is impossible to predict when a tree will fall and how exactly it may break apart, it is not possible to give a quantitative or concrete estimation of risk. Since most of the Alternatives discussed below do not propose removal of every tree that potentially could hit a recreation site, the risk of injury relative to other alternatives will be presented in addition to the evaluation criteria below. The only developed site to be considered in this discussion is the Johnny Creek Nature Trail, since safety concerns for the only other developed site

affected by the Clark fire, the Bedrock Campground, have been abated in a previous analysis and decision (USDA, 2004a).

Evaluation Criteria:

- Miles of hazardous road conditions abated and relative risk of injury,
- Miles of hazardous trails abated and relative risk of injury,
- Number of developed sites abated and relative risk of injury,
- Number of dispersed sites abated and relative risk of injury.

For the purposes of estimating relative risk to recreational users, the following convention was used; a high to very high risk results from the removal of less than 10 percent of the hazardous or potentially hazardous (in the future) trees, a moderate risk results from removal of less about half the potentially hazardous trees, and a low risk results from removal of greater than 80 percent of hazard trees. A very low risk results from removal of all hazards.

Since the probability of a given tree falling at a give time or whether it would or could injury a person is unknown, there is a data gap in estimating the effects regarding the Public safety issue. The above relative ratings were developed to give the responsible official some way to compare the risk presented by each alternative.

Direct and Indirect Effects

Alternative A – No Action

This alternative does not respond to the public safety issue and would not abate falling tree and branch hazards along any roads or trails in the fire area, other than the trees that have already been removed from within up to 50 feet of the road that present a short-term probability of falling. Therefore, this alternative still presents a moderate risk hazard for road use since many trees still stand that could potentially strike the road as they deteriorate. This alternative results in a very high relative risk for personal injury for trail users. No dispersed sites would receive hazard abatement treatments, resulting in a very high relative risk for people who still choose to camp in these sites. No dispersed swimming sites would be abated and their use would still entail a very high public risk. The Johnny Creek Nature trail developed site would not be treated to reduce public safety concerns.

Alternative B

This alternative would completely abate hazards along the 2.9 miles of roads and the five parking areas within the Special Interest Area affected by the Clark fire, resulting in a relatively low risk of injury in associated with road use. This alternative responds to the public safety issue related to trails by provision of signing and removing overhead hazards no more than 25 feet from the trail, resulting in a moderate to high risk of injury. About 2.2 miles of this trail would be made somewhat safer in this way.

Hazards would be abated somewhat around the 16 dispersed camping sites within the fire area in the sense that trees would be felled if they are immediately overhanging the sites or leaning towards the sites (generally averaging within 25 feet of the site center). The sites would be signed as being hazardous, resulting in a relative safety rating of moderate, since the sites would not be formally closed. The five parking areas typically used to access the walk-in dispersed camping sites would be closed to discourage use. Dispersed swimming sites would not be directly abated but some hazard trees adjacent to swimming holes may be felled for fish habitat purposes and their use would still entail a moderate to high public risk.

The Johnny Creek Natural trail parking lot would be made safe by removal of all trees that could hit the developed area, so the risk to public safety would be low. The trail itself away from the parking area would be decommissioned and made unusable.

Alternative C

This alternative would completely abate hazards along the 4.4 miles of roads and parking areas within the Special Interest Area affected by the Clark fire, resulting in a low risk of injury to road users. This alternative responds to the public safety issue related to trails by provision of hazard warning signs and removal of overhead hazards no more than 25 feet from the trail along the 0.9 miles of the trail affected by the Clark fire that is not within the LSR (that area south of Fall Creek), resulting in a moderate to high risk of injury in the section outside the LSR, since more than 50 percent of the trees that could hit the trail would be left standing. A high to very high risk would exist on those portions of the trail inside the LSR where no potential hazardous trees would be felled, a total of 1.2 miles of trail.

Hazards would be abated somewhat around 16 dispersed camping sites in the sense that trees would be felled to decommission the sites and make them less attractive for use, but only trees immediately overhanging the sites or leaning towards the sites would be felled (generally averaging within 25 feet of the site center). Some hazard would still exist if people were not deterred from using the sites due to the tree felling and site disturbance, resulting in a relative safety rating of moderate. Dispersed swimming sites would not be directly abated but some hazard trees adjacent to swimming holes may be felled for fish habitat purposes and their use would still entail a moderate to high public risk.

The Johnny Creek Natural trail parking lot would be made safe by removal of all trees that could hit the developed area, so the risk to public safety would be low. The trail itself away from the parking area would be decommissioned and made unusable.

Alternative D

This alternative would completely abate hazards along the 4.7 miles of roads and parking area within the Special Interest Area affected by the Clark fire, resulting in a low risk of injury to road users. This alternative responds to the public safety issue related to trails by rerouting most of the 2.2 miles of the Fall Creek trail affected by the fire to move it away from Fall Creek so that hazard trees may be removed without impact to fisheries resources. Dead and hazardous trees would be removed within 50 to 100 feet of the new trail location. Not every tree that could potentially hit the trail would be removed but the ones that are not removed would have a relatively low potential to hit the trail, resulting in a low to moderate risk of injury to trail users.

Hazards would be abated somewhat around the 16 dispersed camping sites in the sense that trees would be felled to decommission the sites and make them less attractive for use, but only trees immediately overhanging the sites or leaning towards the sites would be felled (generally averaging within 25 feet of the site center). The five parking areas accessing the walk-in dispersed sites and swimming holes would be provided with hazard advisory signing. Some hazard would still exist at the dispersed sites if people were not deterred from using the sites due to the tree felling and site disturbance, resulting in a relative safety rating of low to moderate, since less people are likely to use these areas given the signing and decommissioning. Dispersed swimming sites would not be directly abated but some hazard trees adjacent to swimming holes may be felled for fish habitat purposes and their use would still entail a moderate to high public risk.

The Johnny Creek Natural trail parking lot would be made safe by removal of all trees that could hit the developed area, and a portion of the nature trail would be salvaged and the trail kept open, so the risk to

public safety would be low. The trail itself away from the parking area would be decommissioned and made unusable.

Alternative E

This alternative would completely abate hazards along the 4.7 miles of roads and parking area within the Special Interest Area affected by the Clark fire, resulting in a low risk of injury. This alternative responds to the public safety issue related to trails by removing all trees that could potentially hit the 2.2 miles of the trail affected by the fire, resulting in a low risk of injury.

Hazards would be completely abated around 16 dispersed camping sites in the sense that all trees with potential to hit the sites would be felled and removed and slash would be abated, resulting in a relatively low risk of public injury. No dispersed swimming sites would be abated and their use would still entail a very high public risk where dead trees around them would not be removed in the abatement of trail, road, and dispersed site hazards adjacent to swimming holes.

The Johnny Creek Natural trail parking lot would be made safe by removal of all trees that could hit the developed area, and a portion of the nature trail would be salvaged and the trail kept open, so the risk to public safety would be low. The trail itself away from the parking area would be decommissioned and made unusable.

Cumulative Effects

The cumulative effects analysis for public safety evaluated the past, present, and foreseeable future actions on the entire 3,300 acre Fall Creek Special Interest Area. Foreseeable future actions will be addressed over the next ten years, as few activities beyond that time period can be predicted or estimated.

An additional 0.6 mile of the Fall Creek National Recreation Trail has been affected by past actions relative to public safety problems caused by fire-killed trees. The 1999 Puma fire killed trees along this trail section, which is immediately to the east of the areas affected by the Clark Fire, and no trees adjacent to the trail were removed for public safety reasons. This portion of the Fall Creek National Recreation Trail presents a very high hazard to trail users. Trees killed by the Puma fire were removed from along 49 acres adjacent to Road #1800 and #1825 within about 150 feet of the pavement. In addition, hazardous fire-killed trees have already been removed adjacent to Road #1800 (USDA, 2003a) and in the Bedrock Campground (USDA, 2004a). The reasonably foreseeable future action is the hazard tree management that occurs annually in high use recreation areas and along roads throughout the SIA. The endemic mortality of hazard trees along Road #1800 and within or adjacent to developed campgrounds in the SIA averages about 6 trees per year (personal communication with Larry Lassiter, recreation maintenance technician). Such trees would be removed during routine road and campground maintenance to provide for user safety.

These past and reasonably foreseeable actions have abated public safety problems (in particular along the road system). The action alternatives continue this abatement so the combined cumulative effect would be a lowered hazard for recreation and other users in this area. All the action alternatives respond to this public safety issue by reducing the risk to public safety from high to moderate or low levels. The high risk associated with that portion of the Fall Creek National Recreation Trail affected by the 1999 Puma fire would not be reduced by any of the proposed actions, so cumulatively, the current risk for trail users is reflected by the risk rating given above to each alternative since the trail section affected by the Puma fire represents 4% of the entire Fall Creek trail (the portion affected by the Clark fire represents

about 16%). The No Action Alternative A increases the risk to public use of the Fall Creek National Recreation Trail, since there would be a high risk for trail users if this alternative were implemented. Alternative A – No Action would add 16% of the Fall Creek National Recreation Trail with a high level of risk along with the 4% of the trail affected by the 1999 Puma fire.

Recreation Use Capacity - *Analysis Issue*

There is a concern for either increasing or decreasing the diversity and amount of recreation opportunities in the Fall Creek area. Previous analysis indicates the Fall Creek Special Use Area is at or near its carrying capacity in terms of recreational use. The fire may have created opportunities for expansion in the number of dispersed camping sites, as understory vegetation has been significantly reduced and much of the area is flat enough the people could be tempted to drive vehicles off the main roads and create new, unofficial vehicle access to new camping sites. On the other hand, if dispersed sites are closed due to the safety concerns, additional pressures could be put onto the existing developed camping sites, and provide additional pressure for people to located new dispersed sites in other portions of the SIA.

Existing Conditions

While some may expect recreation use to decrease in this area as a result of the Clark fire, this likely will not be the case. Fall Creek is the major attraction in this area, and it will still provide quality fishing and swimming opportunities. There are a great number of people who are quite attached to the Fall Creek area for a variety of reasons, and they will likely continue to use this area they know and love. While no formal counting or censuring of post-fire use has occurred, personal observations over the spring and summer of 2004 indicate that all areas affected by the fire, including trails, dispersed camp sites, and swimming holes appear to be used about as much as they have been in the past. Developed camping has not yet occurred within the fire area, as the Bedrock Campground was closed during the fire and has not been open through 2004 so that fire-killed trees (which pose a hazard) can be removed and fire-damaged infrastructure can be replaced.

In addition, the public's interest in general ecology and fire ecology in particular has increased in recent years, and we expect many people to visit the Clark Fire area specifically to view the effects of the fire and to observe the recovery of the forest.

Interpretation Potential

The Johnny Creek Nature Trail would be an ideal, fully accessible place to interpret the effects of wildfire. Unfortunately, the Middle Fork Ranger District cannot be put in the position of attracting a number of people to an area that is entirely occupied by serious overhead hazards. To make this nature trail safe for use, essentially all the dead trees within a couple of hundred feet of the trail and parking lot would have to be felled or removed, leaving little in terms of fire effects to be obviously interpreted. Considering this trail tread is still relatively intact, it may be desirable to fell or remove all trees that could fall onto the trail, but leave those on the north-facing slope above the trail so that people could view a fire-killed forest from a safe distance. There could also be some interpretive potential to talk about fire recovery along the trail itself.

In a more general sense, the Fall Creek and Winberry Creek Recreational Strategy Paper (USDA, 2004b) identified the general interpretive objective to provide education of the dynamic nature of forests with an emphasis on wildfire effects, general disturbance regimes forests are subject to, and fire recovery. There may be some opportunities to provide interpretative facilities through the SIA project

development, but again they would be limited to some extent by concerns that the public not be exposed to undue hazards.

Management Direction

The management direction for recreation use is summarized under the preceding issue.

Environmental Consequences by Alternatives

Given the popularity of the Fall Creek SIA, there is concern that proposed actions might either increase or decrease recreational use of the area. The Fall Creek SIA is a heavily used recreation area (USDA, 2004b) that appears to be close to its carrying capacity. Additional recreation use, such as that which could occur as a result of people being able to drive off the road and establish new dispersed sites, could cause site degradation, while restriction of use could result in moving recreationists to other areas not able to handle an increase in use. Either instance of increased use would also have the potential to impact the overall quality of recreational experiences in the Fall Creek Special Interest Area in that one recreationist could negatively affect the experience of another due to crowding.

Evaluation criteria:

- Length of road treated with traffic control barriers
- Number of dispersed sites closed

Direct and Indirect Effects

The direct effects are discussed above under the preceding issue. There may be indirect effects to the extent that Alternatives (A and B) which do not close dispersed sites and do not remove all hazard trees could result in a reduction of use by people who are aware of the hazards of camping in a stand of dead and deteriorating trees. Alternative B may also have the indirect effect of creating unsafe parking conditions along road #18, as that alternative would close traditional day use parking sites, with no other provisions for day use. Another indirect effect occurring in all action alternatives would be the temporary closure of areas while falling and/or log removal activities area occurring.

Alternative A – No Action

This Alternative would not reduce the recreational use capacity of the SIA as it would not close any sites. Implementation of this Alternative, however, could result in an increase in dispersed camping sites to the extent that the fire has removed understory vegetation along the roads, making it possible for people to establish new dispersed sites and potentially even new site access roads in some places.

Alternative B

This Alternative would provide for the installation of from 4,200 to 10,500 feet of traffic control barriers along road #18 (depending upon how changed use patterns evolve) in order to prevent vehicles from leaving the road resulting in the development of new dispersed camping sites in areas where the topography and the fire effects have made that a possibility. These barriers would consist of, for the most part, logs that would be felled to provide for road safety, but some large rocks may also be used either where logs are not available or may not be effective in preventing vehicles from leaving the road.

No dispersed sites would be closed, though signs would be posted advising users of the potential hazards. Five parking areas which access dispersed camping sites and swimming holes would be closed. Such parking facility closure may reduce the use of dispersed sites, but it is more likely to result in hazardous parking along road #1800.

Alternative C

This Alternative would provide for the installation of from 4,200 to 10,500 feet of traffic control barriers along road #18 in order to prevent vehicles from leaving the road and the development of new dispersed camping sites in areas where the topography and the fire effects have made that a possibility. These barriers would consist of, for the most part, logs that would be felled to provide for road safety, but some large rocks may also be used either where logs are not available or may not be effective in preventing vehicles from leaving the road.

Sixteen dispersed sites would be decommissioned through falling trees into the center of the sites, though there would be no official prohibition of camping in these areas. All dispersed camping sites would be closed and the sites and the five parking areas which access dispersed camping sites and swimming holes would be provided with signs to advise the public of the safety hazards involved in using the area.

Alternative D

This Alternative would provide for the installation of about 10,500 feet of traffic control barriers along road #18 in order to prevent vehicles from leaving the road, resulting in the development of new dispersed camping sites in areas where the topography and the fire effects have made that a possibility. These barriers would consist of, for the most part, logs that would be felled to provide for road safety, but some large rocks may also be used where either logs are not available or may not be effective in preventing vehicles from leaving the road.

Sixteen dispersed sites would be decommissioned through falling trees into the center of the sites, though there would be no official prohibition of camping in these areas. All dispersed camping sites and the five parking areas which access dispersed camping sites and swimming holes would be provided with signs to advise the public of the safety hazards involved in using the area.

Alternative E

This Alternative would provide for the installation of from 4,200 to 10,500 feet of traffic control barriers along road #18 in order to prevent vehicles from leaving the road, resulting in the development of new dispersed camping sites in areas where the topography and the fire effects have made that a possibility. These barriers would consist of, for the most part, logs that would be felled to provide for road safety, but some large rocks may also be used either where logs are not available or may not be effective in preventing vehicles from leaving the road.

All sixteen dispersed sites would remain open since hazard tree removal would result in a low risk of injury to sites users. The five parking areas which access dispersed camping sites would remain open as they would be made safe through removal of the roadside hazard trees.

Cumulative Effects

The cumulative effects analysis for recreation use capacity evaluated the past, present, and foreseeable future actions on the entire 3,300 acre Fall Creek Special Interest Area. Foreseeable future actions will be addressed over the next ten years.

While several of the developed campgrounds in the SIA have been closed temporarily in the past (Broken Bowl during a water systems upgrade project, and Bedrock during fire recovery and hazard tree removal projects), there have been no past actions that have permanently changed the recreational use capacity of the SIA in the last 10 years. Vehicle access to some of the dispersed sites has been

eliminated in the last several years (specifically by the closing of the Roads #1800-405 and #1800-408), changing the way these sites are accessed and used by the public, but from the condition of these sites (in that they still appear to be heavily used) the walk-in nature of these sites does not appear to have materially affected the amount of use they receive. Restriction of vehicles on these roads may have changed the type of user at these sites, but not the capacity of this area to provide dispersed camping opportunities. There are no reasonably foreseeable future actions that would change the recreational use capacity of the Fall Creek Special Interest Area. Therefore, there is essentially no accumulation of effects due to past or reasonably foreseeable future actions above and beyond the effects, as listed above, for each alternative.

If the No Action alternative were selected, a reasonably foreseeable future action would be closure of the area. The closure would be mandated by various State and Federal laws and regulations, in particular the Highway Safety Act and the Oregon Occupational Health and Safety Act, since Road #1800 is paved, open for public use, and used by commercial carriers. The only way for a No Action alternative to comply with those legal requirements would be to close the road to public traffic.

Damage to Recreational Infrastructure - *Analysis Issue*

The same phenomenon of fire-killed tree deterioration that generates the safety concern above also applies to the high valued structures associated with recreational use of this area. Falling portions of dead trees could damage trail bridges, restroom facilities, and parking areas. There will likely be little future funding to replace these structures should they be severely damage by falling dead trees.

Existing Conditions

The existing recreation facilities in the project area are summarized above. The infrastructures associated with recreation facilities include 5 trail bridges located along the Fall Creek National Recreation Trail; 6 restroom buildings (1 restroom at Johnny Creek Nature Trail, 4 new restrooms in the Bedrock Campground, and 1 new restroom at the parking area at the Road# 1800-190); and 9 parking areas along Road #1800.

Environmental Consequences by Alternatives

Evaluation criteria:

- Number of developed structures at risk of damage from falling trees

Direct and Indirect Effects

Alternative A – No Action

Under this alternative all five main trail bridges on the Fall Creek Trail would remain at risk of damage as fire-killed trees deteriorate and fall. The restroom at Johnny Creek Nature Trail and the restroom at Road #1800-190 would remain at risk along with all 9 of the parking areas along Road #1800. The Bedrock Campground Restoration Project EA (USDA, 2004a) removed the dead hazard trees in the campground; therefore the 4 restrooms are no longer at risk.

Action Alternatives B, C, D, and E

These alternatives would fall dead hazard trees that could potentially fall and hit the Fall Creek Trail bridges, so no such structures would experience a higher than ambient risk of damage from falling trees. Dead hazard trees would be felled around the 2 restrooms at Johnny Creek Nature Trail and Road

#1800-190 and 9 parking areas along Road #1800 to eliminate the risk. The Bedrock Campground Restoration Project EA (USDA, 2004a) removed the dead hazard trees in the campground; therefore the 4 restrooms are no longer at risk.

Cumulative Effects

The cumulative effects analysis for damage to recreation infrastructure evaluated the past, present, and foreseeable future actions on the entire 3,300 acre Fall Creek Special Interest Area. Foreseeable future actions will be addressed over the next ten years.

A forested environment that has not been affected by a severe wildfire has dead snags and or green trees that from time to time do eventually fall over. Such trees have been known to damage trail bridges. There is always a chance that in any forest environment both dead and green live trees can fall and damage a trail bridge. This background risk is obviously in addition to the risks discussed above. There are no known reasonably foreseeable future actions that could cause damage to recreation infrastructure in this area, nor would past actions have an effect on bridge damage as a result of the proposed actions.

Fire and Fuels

Fuel Loading - *Significant Issue*

The future fuel loadings created from the fire-killed trees may exceed the standards and guidelines established for fine fuels and coarse woody debris. The high recreation usage in this area provides the ignition sources for future fires that could burn in a catastrophic manner given the expected build up of fuels over time as the fire-killed timber deteriorates. These future fuel loadings could cause an increase in fire intensities; increase the resistance to control and the ability of the firefighters to fight fire safely; increase fire spread which could threaten the safety of recreationists, the surrounding recreation facilities, private property; and impede the recovery of forest conditions.

Existing Conditions

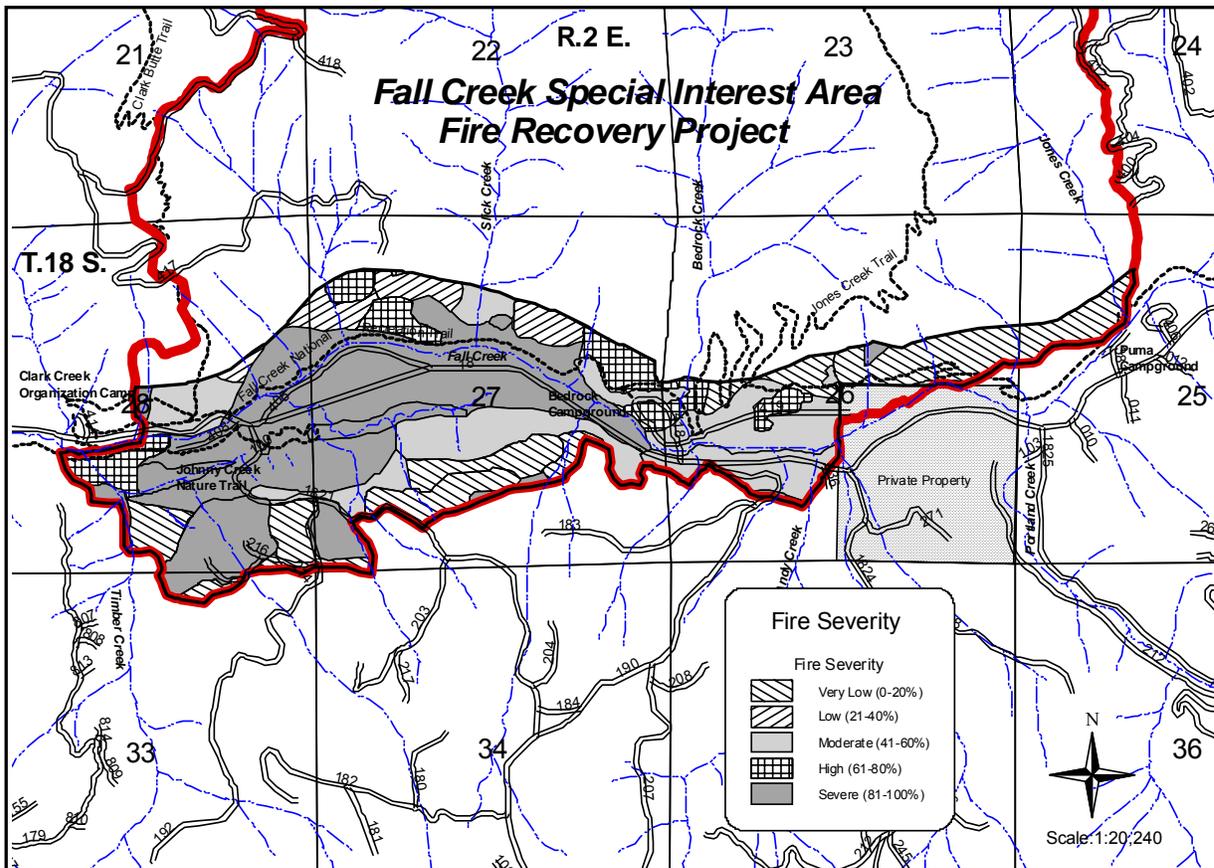
As fire-killed trees deteriorate and ground vegetation recovers, large amounts of fuels, both fine and large diameter, can build up on the forest floor. Standing dead trees, especially well deteriorated ones, can also be very flammable if a hot fire reaches them during the dry portion of the year, and if ignited, they can serve to spread a fire quickly by dropping embers from high above the ground. Fires started from recreational use in an area of high fuels accumulation can potentially create extremely hazardous situations, both for people in the recreation site where the fire starts and for others in nearby sites that could potentially be affected by fire spread. Fire suppression in an area with large numbers of standing dead trees can be very problematic; if fire catches in dead trees, it is likely that fire fighting efforts would be indirect, as fire fighting under burning dead trees can be so hazardous that the fire would have to be left to burn until it reaches an area more conducive to safe suppression actions.

Fire Severity

Table 13 shows the results of the fire severity for both the whole Clark Fire area and Fall Creek SIA project area as measured in terms of crown (or overstory) mortality. Severe crown mortality (81-100%) is considered stand replacing. Crown mortality was determined using aerial photo interpretation and field reconnaissance. Fire Severity Map 7 displays this information spatially for the project area.

Table 13. - Fire severity of the whole Clark Fire and Fall Creek SIA project area.

Severity	Crown mortality	Clark Fire		Fall Creek SIA	
		Acres	% of Total	Acres	% of Total
Very Low	0-20%	1798.9	36.5%	161.8	21.2%
Low	21-40%	901.4	18.3%	38.1	5.0%
Moderate	41-60%	502.1	10.2%	174.1	22.8%
High	61-80%	280.7	5.7%	69.1	9.1%
Severe	81-100%	1451.2	29.4%	320.1	41.9%
Total		4934.3	100.0%	763.2	100.0%



Map 7. - Map of Fire Severity in the SIA project area

Fuel Loading

Surface fuel inventories for the Fall Creek SIA were completed using the techniques described in the *Handbook for Inventorying Surface Fuels and Biomass in the Interior West* by James K. Brown, Rick D. Oberheu and Cameron M. Johnston (1982). As stated in this Fire and Fuel Report (located in the Analysis File), collecting and weighing downed woody material is impractical in most forest stands. The planar intersect technique (Brown 1974) adopted here is nondestructive and avoids the time-consuming and costly task of collecting and weighing large quantities of downed woody material. It has the same theoretical basis as the line intersect technique. The planar intersect technique involves counting intersections of woody pieces with vertical sampling planes that resemble guillotines dropped through the downed debris. Volume is estimated; then weight is calculated from volume by applying estimates of specific gravity of woody material.

For the Fall Creek SIA inventories, a total of 121 surface fuel plots were taken for the purpose of determining the existing fine fuel loading (0-3 inch diameter material) and the existing large woody fuel loading (> 3 inch material). A summary of findings is found in Table 14.

Table 14. - Summary of fuel inventory plot findings

Mortality	Number of Plots	Surface fuels after Clark Fire (tons/acre)					Aerial dead fuels after Clark Fire		Predicted Total
		0-3 inch	3-9 inch	9-16 inch	≥ 16 inch	Total tons/ac	Trees/ac	Average DBH	0-3 inch tons/ac
Severe 81-100% mortality	53	2.1	3.2	9.2	28.9	43.4	62	23"	9.7
Moderate 41-80% mortality	36	2.4	5	7.7	38	53.1	38	10"	3.9
Low ≤ 40% mortality	32	2.3	5.1	5.9	21.9	35.2	32	15"	5.2

Fine fuels (0-3 inches)

The 0-3 inch diameter size class fuel, or fine fuel, is one factor that can determine a fire’s rate-of-spread. Its abundance is used to identify fuel models and associated fire behavior. Aerial (crown) fine fuels of dead trees can also be calculated based on species and bole size (Brown 1982). Combining aerial and surface fine fuel loading calculations can help determine expected fuel loadings. Forest Standards and Guidelines determine the amount of surface fine fuels that can be left after management activities. For 0-3 inch diameter fuels the acceptable level in the Standards and Guidelines is 7-11 tons per acre.

For the Fall Creek SIA, the current fine fuel loadings and the predicted total fine fuel loadings were calculated and are displayed in Table 15. A comparison analysis with an untouched snag patch area in an adjacent fire (Puma Fire burned in 2000) was completed to see how well predicted fuel loadings for Fall Creek SIA match the surface fine fuels currently found in this five-year old fire. The following calculations from the Fall Creek SIA only address the severely burned areas (80-100% mortality) as the areas less severely burned showed negligible change from previous conditions.

Table 15. - Comparison of fine fuel loading between Fall Creek SIA and Puma Fire

Current surface fine fuel loading Fall Creek SIA (80-100% mortality)	Current fine fuel loading of aerial dead trees	Predicted total fine fuel loading with dead tree felling	Current fine fuel loading from the Puma snag patch
2.1 tons/acre	7.6 tons/acre	9.7 tons/acre	7.7 tons/acre

Should felling of dead trees occur, the aerial fine fuel would reach the ground all at once. Mixed with the current surface fuels the calculations show that *on average* the fine fuel loading would fall within Forest Standards and Guidelines.

Should the dead trees remain standing, the aerial fine fuel would reach the ground in stages rather than at the same time. Therefore at any particular time the surface fine fuel loading would remain within acceptable levels. The Puma snag patch calculations seem to support this prediction as this area was not harvested.

These calculations were only *one factor* of the analysis to determine the current and predicted fine fuel loadings in relation to Forest Standards and Guidelines and fuels treatment activities. It is important to remember that fine fuel calculations for the treatment of fuels involve branch wood only and do not

consider the shrub and brush species that would dominate the landscape and would be the primary fire carrier should another ignition occur.

Large Woody Material (> 3 inches)

In the fuel models, woody material greater than three inches is called large woody material. Coarse woody debris (CWD) is used to describe downed logs 16 inch diameter and greater in various stages of decay. CWD definitions and levels are determined by wildlife guidelines. A wide range in CWD is indicated for wildlife because desirable quantities vary greatly by species (Brown et al. 2003).

Fire hazard measured by the resistance to control and fire behavior reach high ratings when large fuels exceed about 25-30 tons per acre in combination with small woody fuels of five tons per acre or less (Brown et al. 2003). Brown suggests that the optimum quantity of CWD is about 10-30 tons per acre for cool Douglas-fir vegetation types when accompanied by small dead fuels loadings of about five tons per acre or less. However, higher loadings of CWD may be acceptable where larger piece sizes predominate, as in accumulated falldown of old growth trees (Brown et al. 2003).

Under the wildlife CWD guidelines it is acceptable to leave 80-120 tons per acre of this material. Under these conditions, fire managers would likely use indirect attack as the method of control, increasing the fire size but providing for firefighter safety.

CWD levels are a measure of burning *intensity* not spread rate, as the fire would carry through the shrub and brush layers leaving behind this larger material to burn for hours or even days after the flame front has passed.

The current CWD levels in the Fall Creek SIA were calculated but due to the variability of this material across the landscape there were not enough plots to adequately address the CWD levels. An approximate range of existing CWD is 20-40 tons per acre. The CWD levels vary where some areas are devoid of this material and some areas yield greater concentrations. Should no management activity occur within the severely burned areas, the fire-killed timber would collapse over time and increase the CWD fuel loadings.

Table 16. - Comparison of CWD between Fall Creek SIA and Puma Fire

Current CWD loading for the Fall Creek SIA	Current CWD loading in the Puma snag patch
20 – 40 tons per acre	66.1 tons per acre (average)

A comparison was made of the current CWD levels within the Fall Creek SIA and the Puma snag patch area (see Table 16). From this comparison it can be determined that the CWD loading has increased in the snag patch over time and this indicates it would also increase in the Fall Creek SIA if left untreated.

Should no dead tree bole removal occur within the Fall Creek SIA, the CWD loading would increase over time and would impede future fire suppression under dry weather conditions. Greater CWD levels would also cause detrimental effects to soils and other resources if a reburn occurs.

Fuel Models

Fuel models are used as an aid in predicting fire behavior by representing the surface fuel properties of grass, brush, timber litter, and slash. The difference in fire behavior among these groups is related to the

fuel load and its distribution among the fuel particle size classes (e.g., < 3 inch, ¼ inch, etc.). In this analysis, fuel models were used to represent broad fuel loadings and their associated fire behavior.

Fuel load and depth are significant fuel properties for predicting fire ignition, its rate of spread and intensity. Grasses and brush are vertically oriented fuel groups, which rapidly increase in depth with increasing load. Timber litter and slash are horizontally positioned and slowly increase in depth as the fuel load increases. Detailed descriptions of fuel models are found in *Aids to Determining Fuel Models for Estimating Fire Behavior* by Hal E. Anderson (1982).

Fire behavior in the Fall Creek SIA is best expressed by one fuel model which represents fire spread and one fuel model representing fire intensity. These can be the same or different fuel models.

In the SIA, rate of spread is determined by the shrub layer and is classified as Fuel Model 5. In this fuel model, fire is generally carried in surface fuels comprised of shrubs and grasses or forbs in the understory. Fires spread relatively quickly due to “flashy” fuels but do not have a long duration.

One year after the fire, Fuel Model 2 best represents the conditions for both fire spread and intensity in the SIA. Most of the fine fuels and shrubs were burned in the fire and a new layer is in the process of development. Inventories show very little fuel on the ground at this time. Instead forbs and grasses have sprung up creating abundant fine herbaceous fuels. Hence the primary fuel model for both rate of spread and intensity one year post-fire is Fuel Model 2. As the shrub layer regenerates, it would become the layer which carries the fire, represented by Fuel Model 5 for fire spread.

However, as the fire-killed trees fall and break, the dead-down fuels in the project area would progressively include greater quantities of 3 inch or larger limb wood. This increasing load of dead material on the forest floor would cause greater burning intensities and are best represented by Fuel Model 10. In this model, crowning, spotting and torching of individual trees are more frequent leading to potential fire control difficulties.

The following descriptions of the fuel models found in the Fall Creek SIA come from Hal E. Anderson’s *Aids to Determining Fuel Models for Estimating Fire Behavior* (1982).

Fuel Model 2

Fire spread is rapid, primarily through the fine herbaceous fuels, either curing or dead. These are surface fires where the herbaceous material, in addition to litter and dead-down stem and branch wood from the open shrub or timber overstory, contribute to the fire intensity. Open shrub lands or dry Douglas-fir stands that cover one third to two thirds of the area may generally fit this model; such stands may include clumps of fuels that generate higher intensities and that may produce firebrands. Rate of spread is high in this fuel model (see Table 17).

Fuel Model 5

Fire is generally carried in the surface fuels comprised of shrubs and grasses or forbs in the understory. The fires are generally not very intense because surface fuel loads are light, the shrubs are young with little dead material, and the foliage contains little volatile material. Usually shrubs are short and almost totally cover the area. Young, green stands up to 6 feet with little or no dead wood would qualify for this model. The live vegetation produces poor burning properties. Rate of spread is moderate (see Table 17).

Table 17. - Fuel Models 2, 5 and 10 – Comparison of characteristics at 90th percentile weather conditions

Fuel Model	Rate of Spread*	Heat per unit area (btu/ft ²)	Fireline intensity (btu/ft/sec)	Flame lengths (ft)	Resistance to Control** (ch***/person/hr)	Burning duration**** (fuel size class)
2	MOD-HIGH	LOW	HIGH	HIGH	LOW	LOW
	Grass	< 500	> 100	> 4	> 2	0 – 3 inch
5	MOD-HIGH	MOD	HIGH	HIGH	HIGH	LOW
	Brush	500-1,000	> 100	> 4	0.4 – 1.0	0 – 3 inch
10	LOW-MOD	HIGH	HIGH	HIGH	HIGH	HIGH
	Timber litter	> 1,000	> 100	> 4	0.4 – 1.0	> 16 inch

* From Fireline Handbook 2004

** This table uses the line production rates for Initial Action from the Fireline Handbook (2004) as a measure of resistance to control. The range for a Moderate resistance to control is 1.1 – 2.0 chains/person/hr.

*** One chain = 66 feet

**** For this analysis, a measure of woody fuel diameter: the larger the diameter, the longer fuel takes to burn. 3 – 16 inch fuels represent the Moderate class.

Flame length: Low = 0-2 ft; Moderate = 2-4 ft; High = >4 feet

Fireline intensity: Low = 0-50 btu/ft/sec; Moderate = 50-100 btu/ft/sec; High = >100 btu/ft/sec

Resistance to control: the degree of difficulty to control and suppress a wildfire. In this analysis, the parameters used to measure resistance to control are:

- Line production rates for Initial Action from the Fireline Handbook (2004)
- Expected fire size in two hours compared to eight hours from BEHAVE PLUS calculations
- Fire intensity

Burning duration: Represented by fuel size class

Fuel Model 10

Fires burn in surface and ground fuels with greater fire intensity than in other timber litter models. Dead-down fuels include greater quantities of 3-inch or larger limb wood resulting from over maturity or natural events that create a large load of dead material on the forest floor. Crowning out, spotting, and torching of individual trees are more frequent in this fuel situation, leading to potential fire control difficulties. Any forest type may be considered a Fuel Model 10 if heavy down material is present. Rate of spread is low to moderate (see Table 17).

Table 17 compares characteristics of the fuel models used in the Fall Creek SIA analysis under 90th percentile (high) weather conditions.

Seasonality

Unlike dead fuel components which can burn any time of year when dry, the volatility of live shrubs and brush is driven by the seasonality of the live woody moisture. Generally, in the spring when live woody moisture is high, fires would tend to burn slowly with small flame lengths and any fire spread would be determined by the surface fuel loading of dead and downed material as fire would not carry well through the live component. In the summer and fall, however, when the live woody moisture is low, fires would burn readily through the live component and would exhibit potentially dangerous fire behavior. As live shrubs and brush are common throughout the project area (Fuel Model 5 is the prevalent model) it is

important to track the live woody moisture through the course of the fire season to detect trends (such as drought) and to better predict fire behavior. For example, the live wood fuel moistures in July 2002 were similar to those expected in August, indicating that fire behavior at that time would be similar to August conditions.

Crown fires

Surface fuel models are helpful in analysis of fire behavior under most conditions but these models are not designed to address fires that spread from the surface into aerial fuels. When a surface fire develops into a sustained independent crown fire, predicting rate of spread and intensity is difficult because as the fire grows it can create its own fire environment (e.g., winds, intense pre-heating, and erratic spread) that ultimately dictates the fire behavior. These sustained crown fires are the fires that most concern fire managers because they can burn uncontrolled over long periods of time and cover vast tracts of land.

Crown fires are the result of many factors, both physical and weather. Factors which are significant to sustaining an independent crown fire include:

- *Surface fuel loading* – Heavy surface fuel results in high fire intensity which would readily pre-heat the aerial fuel and initiate combustion.
- *Ladder fuels* – Crowns of smaller understory trees can easily carry a surface fire into the overstory. However, the absence of understory ladder fuel does not necessarily protect a stand from a crown fire. Convective heat and embers from the surface fuel are more significant factors.
- *Canopy bulk density and Canopy closure* – Canopy bulk density is key for determining if a fire reaching into the canopy has sufficient fuel to support a crown fire. Neither crown nor canopy bulk density can be directly measured. Instead, they are mathematically estimated based on individual tree characteristics such as tree height and crown ratio. When canopy bulk density is too low to support a crown fire, but surface fire intensity and canopy base height are sufficient to support transition into a crown fire, the reasonable fire behavior to expect would be torching. If canopy bulk density is marginal for supporting a crown fire, then a passive crown fire results. If all three factors are sufficient, an active crown fire results. (Rotherme, R.C. 1991a and b., Wagner, C.E. 1977, Fahnestock, G.R. 1970.)
- *Topography* – Convective heat on flat ground would affect less aerial fuel as the convective energy moves directly upward (with little or no wind). On steeper slopes the convective energy moves through the entire upslope crown mass so pre-heating of the aerial fuel is more widespread and more intense.
- *Extreme fire weather* – Most ignitions over the course of a season do not develop into large fires primarily because weather conditions are normally not “extreme fire weather conditions” (e.g., hot, dry, windy). Of course successful fire suppression is a factor, but when weather conditions become extreme control effort often fail and the fires cannot be controlled. Seasonal trend indices such as the live wood moisture levels are important in predicting expected fire behavior. Extreme fire weather conditions normally do not occur until late summer and fall when live woody moistures are at their lowest.
- *Weather catalysts* – Coupled with actual surface weather indices are factors such as atmospheric stability, frontal movement, climate trends, and the positioning of high and low pressure cells which favor the development of foehn winds (also known as “east winds” in this area). Though normally only occurring less than ten days over an entire season, an ignition during an “east wind” event can quickly develop into a conflagration, only to “settle down” when conditions change to favor a more westerly air flow (e.g., Puma Fire).

The Clark Fire spread primarily through the tree crowns. There was little opportunity for direct attack and it was ultimately contained by back burning from existing roads.

Future fire ignition risk

A risk relating to the Fall Creek SIA area (and adjacent private property and LSR) with a large number of fire-killed trees is the risk of another wildfire. This risk is very low immediately after the first fire. All the fine ground fuels have been consumed and there is little to carry a fire. But as the branches begin to fall out of the trees, small tree stems start to fall down, and ground vegetation (in particular flammable young conifers) begins to develop, the fuel loading in a forest stand killed by wildfire can increase exponentially. As the larger tree stems deteriorate, they can deliver over a hundred tons of burnable material per acre over a period of several decades after a fire.

Such fuel loading creates a risk of future, very intense fires. The risk of having a fire burn in a large accumulation of ground fuels resulting from a past wildfire may appear to be fairly small; a previous analysis of this fire risk on a portion of the Middle Fork District (USDA, 1993a, Appendix B) indicated there was about a six percent chance of having a second fire within 25 years of the first. This risk peaks from 15 to 25 years after the first fire; as such a fire would be carried by the dense young stand of conifer trees that typically develop under a fire-killed stand of trees. In the Fall Creek SIA, this risk may be somewhat higher given that the amount of recreational use of the area generates a greater potential for fire ignitions than the area of the referenced study. Additionally, the import of that risk increases in the Fall Creek area, as there could potentially be many people, private lands, and the LSR that could be immediately and directly threatened should an ignition occur during dry and windy conditions.

Wildland Urban Interface

Integrated Natural Fuel Management Strategy (INFMS) (USDA, USDI, 2000a) advises that the protection of life and property are priorities in wildland fire management. Fires originating on Federal lands may cause destruction of private property and threats to the safety of private citizens. The Wildland Urban Interface (WUI) is any point where the fuel feeding a wildfire changes from natural (wildland) fuel to human-created (urban) fuel (USDA, USDI, 2000a).

There are several structures just outside the Fall Creek SIA boundary. These include Forest Service structures (buildings), campsites and structures on private land. Policy directs that protection of life and property are the priorities in wildland fire management. The following discussion focuses on two broad areas: protection of life and property and firefighter safety.

Protection of Life and Property

Fires originating on Federal lands may cause destruction of private property and threaten the safety of private citizens. This usually occurs when fires burn from public land into the WUI. In the case of a fire, such as the Clark, which threatened private land, fire managers work with the appropriate agency responsible for fire protection on private land. Generally, however, fire protection in the WUI is the responsibility of the state or rural fire districts.

To manage the risk to life and property, some researchers recommend establishing areas where a fuels management project is likely to reduce ladder fuels or horizontal fuel continuity or total loading of available fuels (USDA, USDI, 2000a). To the extent that this can be accomplished on federal property adjacent to at-risk private lands, this could be an effective option for minimizing the risk of fire moving onto private lands.

Prevention is also important in a WUI. Property owners can modify fuel loading and arrangement by pruning or thinning vegetation within 30 meters of structures. Removing debris from rooftops is also very effective in preventing structure loss from a wildfire. Local community groups can work with federal land managers to educate property owners in the WUI about minimizing risks of property loss due to a wildfire.

Firefighter Safety

Fire suppression is inherently hazardous. From 1901 to 1996 a total of 699 firefighters were killed while suppressing forest fires in the United States. Of these, 30 were killed fighting wildfires in the Northwest (Oregon and Washington).

Approximately 407 of the national fatalities were due to fast moving fires “burning over” firefighters who were unable to reach safety. Approximately 21 of the fatalities were from falling snags. Despite a heavy emphasis on safety and numerous advances in technology, roughly 20 workers lose their lives each year fighting fires in the United States.

By nature, firefighting is conducted in a wildland environment, with the usual hazards of working in the woods. Fighting fire presents additional safety challenges such as high to extreme fire behavior, risk of burn-over, smoke, fire damaged snags, rolling rocks, etc.

One way to mitigate these hazards is the reduction of fuel loadings or disruption of fuel continuity by treatment such as hand piling, grapple piling, machine piling, etc. and burning the resulting piles. Such treatment may reduce the intensity of a potential fire in the area.

Management Direction

The Willamette Forest Plan does not provide specific direction for fuel loading after catastrophic events, such as wildfires. The only direction provided is for fuel loading created due to management activities. FW-252 directs that to ensure control of wildfires within established parameters for non-Wilderness areas, treatments should be planned to maintain fuel loading in management activities at or below the maximum acceptable ranges on 95% of the affected acreage as indicated in the tables associated with FW-252 in the amendment to Chapter IV of the Willamette Forest Plan. The amount of downed wood larger than 16” diameter is based on the direction in FW-212, FW-212a, FW-213, and FW-213a, which are based on wildlife habitat requirements. Prescriptions for amounts exceeding the ranges specified in WNEP, Table IV-29 would be coordinated with fuel treatment personnel to ensure fire risks are considered.

The 2003 Willamette Fire Management Plan addresses the suppression of wildfires. It does not address recovery of burned areas and therefore is not applicable to this analysis.

The Fall Creek LSRA describes the watershed within a historic context. It indicates that use of prescribed fire may be appropriate to manage forest structure and diversity, create fuel breaks and reduce the risk of catastrophic fire. Use of different harvest treatments should attempt to mimic natural fire disturbances. It does not specifically address fire recovery.

The LSRA provides a process for determining CWD levels in potential salvage situations in Late Successional Reserves. The process includes a re-assessment of fire risk (by analyzing the fire zone, landscape fire risk, and local fire risk) to make recommendations for CWD levels and fine fuel treatment priority. Recommended CWD retention levels for mature and old growth in the Western hemlock series are given on page 134 of the LSRA. The levels of CWD required for some wildlife habitat is greater than those recommended by fire managers (< 40 tons/acre).

In the LSRA, the Fall Creek SIA was determined to have a moderate to high fire risk. The fire risk rating combines the risk of fire occurrence (which is linked to the heavy recreation use in this area) and the fire behavior risk, linked to the old growth vegetation type. The high recreation use in the Fall Creek SIA could provide an ignition source for future fires that may burn in a catastrophic manner given the expected buildup of fuels over time as fire-killed timber deteriorates.

The Integrated Natural Fuels Management Strategy (USDA, USDI, 2000a) provided several broad recommendations that may be applicable to this analysis:

1. Manage the risk to life and property; establish areas where a fuels management project is likely to reduce ladder fuels or horizontal fuel continuity or total loading of available fuels. A major objective of treatment should be to keep subsequent fires from torching and crowning, since crowning fires tend to move fast and spot frequently. Treatment by mechanical means may be most effective when used near areas where there is risk to private property from wildfires. Mechanical treatment may be most effective along strategic fuel breaks and within the wildland urban interface. Mechanical treatment may be effective when it serves to isolate an area of frequent fire starts.
2. Fire or mechanical treatment can be used to reduce available fuels.
3. Use prescribed fire in areas where risks to firefighters can be mitigated, at times when risk is determined to be at a minimum and conditions provide a good probability of meeting land management objectives.
4. Emissions from pile or spot burning can be timed to reduce impacts to air quality and reduce landscape size fires with attendant smoke events.
5. Suppress human-caused wildfires, fires near human habitation and other critical areas. Hazard and risk at the wildland urban interface should be addressed.
6. Risk to life and property is concentrated in the urban wildland interface zone. To reduce the risk to life and property, defensible space may be established both adjacent to developed areas and at strategic locations at some distance from developed areas.

In 2001, Congress funded the National Fire Plan to reduce hazardous fuels and restore forests and rangeland. The Healthy Forests Initiative (HFI) was launched in August 2002 to streamline and expedite administrative procedures for hazardous-fuels reduction and ecosystem restoration projects on Federal land.

The Healthy Forests Restoration Act (HFRA) of 2003 contains a variety of provisions to simplify hazardous fuels reduction and forest restoration projects on specific types of Federal land that are at risk from wildland fire or insect and disease epidemics. However, this project does not meet the definition of “authorized” or “covered” by the HFRA. In addition, the threatened and endangered species present in the project area are not dependent upon habitat maintained by fire.

Fire Behavior Prediction Assumptions used for Analysis

Weather Conditions and Fuel Moisture

Percentile Weather indicates how a historical weather record can be broken down into a percentage and then used as an indicator of fire behavior. For example, the 90th percentile marks the point at which 10% of all days in a historical record would produce intense fire behavior. Weather conditions in the

90th percentile range indicate a high probability of encountering high fire behavior should a fire begin. Moderate fire behavior can be expected in the 16-89 percentile range.

Observations from the Trout Creek Remote Automated Weather Station (RAWS), about eight miles north of the Clark Fire, were used to represent weather conditions at the Fall Creek SIA in this analysis. Table 18 shows the mean values for 1994-2003 in gray (a total of 829 weather observations were used). The two rows in white are based on the mean of observations from the RAWS between August 1 and October 25 (for 1994-2003). The range of expected fire behavior, mean fuel moistures and wind speed were calculated using this data from the Trout Creek RAWS.

Table 18. - Weather observations from Trout Creek RAWS

Range of Expected Fire Behavior (Variable/Component Range)	Low	Moderate	High	Extreme
Percentile Range	0-15	16-89	90-97	98-100
Percentage of Days in each Range (Climatologically Probability)	15	75	7	3
Number of Days in each Range during August 1 – October 25	9	37	17	5
Temperature (°Fahrenheit)	60°-70°	71°-80°	81°-90°	91°-100°
Relative Humidity (%)	50-40%	39-30%	20-29%	≤ 20%
1-Hour Fuel Moisture	12.99	8.08	6.11	5.50
10-Hour Fuel Moisture	17.36	9.49	7.17	6.31
100-Hour Fuel Moisture	24.84	15.12	11.37	9.55
1000-Hour Fuel Moisture	27.19	17.78	13.79	12.36
Herbaceous Fuel Moisture	144.80	86.10	73.69	61.49
Woody Fuel Moisture	196.97	135.77	100.20	87.50
20-Foot Wind Speed (mph)	3.33	4.16	4.88	5.80

One-hour fuels are less than ¼ inch in diameter and respond very quickly to changes in the environment. Such fuels would lose or gain ⅔ of their moisture content to equalize with the moisture in their environment in about an hour. These fuels are referred to as fine fuels; this is the most critical fuel size in starting and spreading fires. Increasing in size, fuels would lose or gain moisture less rapidly through time. Ten-hour fuels range in diameter from ¼ - 1 inch, 100-hour fuels from 1-3 inches, and 1,000-hour fuels from 3-8 inches.

These weather conditions are helpful in predicting expected fire behavior, but are not the only factors to consider. Weather conditions when the Clark Fire started were moderate. Yet the fire rapidly grew in size because ladder fuels and dry lichens and mosses provided access to the crown and the fire became a crown fire. In addition, the dry instability of the airmass (indicated by a Haines of 5) provided good vertical mixing which also increased the rate of fire spread.

Fire Behavior

BEHAVE PLUS (Andrews, et al, 2003) is a fire spread prediction model used to predict surface fire behavior characteristics for current, post-fire and future vegetation conditions represented by fuel models. This model predicts surface fire intensity and potential fire size, among other factors. It cannot, however, be used to predict crown fire spread.

This program was used to model expected fire behavior for each current and expected fuel model in the Fall Creek SIA. Inputs to the program include: fuel model, fuel moistures and wind conditions (from the Trout Creek RAWS), slope steepness, percent fuel shading, elapsed time, and type of resource responding. Output variables were used as a comparison between different fuel models in the alternatives.

Expected fire behavior was calculated under both moderate and 90th percentile weather conditions (see Table 18 for description of weather conditions). Weather conditions in this watershed usually fall within the moderate or 90th percentile range during the fire season. In calculations under moderate conditions, a Type II, model 80 engine with five personnel was input as the responding resource because this engine module is stationed at the Lowell Service Center and would be the most likely resource to take action in the Fall Creek area. Under 90th percentile weather conditions, three engine modules and a 20-person crew would be dispatched; therefore, these resources were input into the program for 90th percentile calculations. One engine module would be responding from the Lowell Service Center and two from Middle Fork; the 20-person crew is stationed at Middle Fork.

Calculations were completed for both a two hour and eight hour response time. Initial response time in this area is about two hours. However, if initial attack personnel cannot control and suppress the fire within one burning period *or* additional resources are requested by the Incident Commander, a Type II or Type I team would be activated. Arrival of the team generally occurs within 24 hours. However, the maximum elapsed time that the BEHAVE program can calculate is eight hours. Therefore, eight hours was used as the upper range in this report. In order to determine output variables for 24 hours, the numbers for eight hours could be tripled. However, the values would be an overestimate because this does not take into account that fire activity generally slows down during the night.

The following output variables were calculated by the program for each fuel model under high (90th percentile) and moderate weather conditions:

- Rate of spread (maximum) (chains¹/hour)
- Heat per unit area (btu/ft²)
- Fireline intensity (btu/ft/sec)
- Flame length (ft)
- Direction of maximum spread (degrees) (measured from upslope)
- Maximum wind exceeded?
- Area (acres)
- Perimeter (chains)
- Time from report (hours)
- Contain status
- Contained area (acres)

¹ One chain = 66 feet

- Fireline constructed (chains)
- Number of resources used
- Probability of ignition from a firebrand (%)

Table 19 and Table 20 show some of the calculations produced by the BEHAVE program for this analysis. The calculations shown are representative of the outputs most important to fire managers. All calculations with the exception of the last column were based on an elapsed time of two hours. A slope steepness of 20% was used for the calculations in Table 19. This is representative of the slope throughout most of the SIA. In comparison, Table 20 presents data for a slope steepness of 45%, which is found at the north end of the SIA, at the toe of the slope extending into LSR RO-219. See Table 18 for a description of the weather parameters associated with “High” and “Moderate” weather conditions.

Table 19. - Comparison of BEHAVE PLUS calculations under high (90th percentile) and moderate weather conditions – slope steepness is 20%

Fuel Model	Flame Length (ft)		Heat per unit area (btu/ft ²)		Fireline Intensity (btu/ft/sec)		Rate of Spread (ch/hr)		Acres within two hours		Acres within eight hours	
	High	Moderate	High	Moderate	High	Moderate	High	Moderate	High	Moderate	High	Moderate
2	6.7	6.3	485	472	359	313	40.4	36.2	250.4	204.1	4,005.9	3,265.8
5	6.1	2.3	631	236	294	34	25.4	7.8	98.5	9.5	1,575.4	152.4
10	5.3	4.7	1,284	1,203	215	160	9.1	7.3	12.7	8.1	203.3	130.3

Table 20. Comparison of BEHAVE PLUS calculations under high (90th percentile) and moderate weather conditions – slope steepness is 45%

Fuel Model	Flame Length (ft)		Heat per unit area (btu/ft ²)		Fireline Intensity (btu/ft/sec)		Rate of Spread (ch/hr)		Acres within two hours		Acres within eight hours	
	High	Moderate	High	Moderate	High	Moderate	High	Moderate	High	Moderate	High	Moderate
2	7.5	7.0	485	472	449	394	50.5	45.6	357.5	294.7	5,720.8	4,714.6
5	6.8	2.5	631	236	362	42	31.3	9.7	134.0	13.1	2,143.8	208.9
10	5.9	5.2	1,284	1,203	271	203	11.5	9.2	17.8	11.5	285.1	184.1

Values in the lightly shaded boxes in these tables are shown for comparison purposes only. They were not used in determining effects of the alternatives, since none of the alternatives show a rate of spread represented by Fuel Model 10. The rate of spread under all alternatives (including the No Action) is represented by Fuel Model 5 after the first year. Model 2 (rate of spread in the first year) is not a dominant feature, since it is currently transitioning into a Model 5 as the shrub layer regenerates. It is not generally considered in this analysis, and is primarily used for comparison purposes.

Note that the heat per unit area decreases the most between Fuel Model 2 and 5 under moderate weather conditions. This is probably a result of the increased live woody fuel moisture in the shrub layer of a Fuel Model 5, which is of greater significance during moderate weather conditions. The heat per unit area more than doubles between Fuel Model 5 and 10 under both high and moderate weather conditions due to the large woody material in Fuel Model 10.

There are also large differences between high and moderate weather conditions in both flame lengths and fire line intensity for Fuel Model 5. Under 90th percentile weather conditions fuel moistures are

very low and relative humidity recovery poor, which are conducive to more extreme fire behavior. If a Fuel Model 10 for intensity is added, resistance to control would be greatly increased.

Contain status was also calculated for both a two and eight hour response time. For resources responding within two hours, Fuel Model 2 escaped but Fuel Models 5 and 10 could be contained at approximately 99 acres within four hours. Given an eight hour response time, however, all fuel models lead to an escaped fire of approximately 1500 acres. Contain status was the same for both 90th percentile and moderate conditions.

It is important to note that these models do not take special conditions into consideration, such as east winds, a dry unstable air mass (high Haines index), arrangement of fuels on the landscape, etc. Such conditions could easily contribute to extreme fire behavior not demonstrated by these calculations.

Fuel Reduction Treatments

The following fuel reduction treatments are used to mitigate the effects of the fine fuel loading in the action alternatives. The treatment option of prescribed burning or underburning was considered but eliminated from further analysis (see page 44) because of the high use recreation area and proximity to private property.

- *Hand pile and burn* - Slash is piled by hand crews and burned during the fall and winter rainy season to minimize impacts on soil and smoke emissions. Treatment by this method helps reduce risk of fire spread by burning excess 0-3 inch fuels.
- *Grapple/Machine pile and burn* - Slash is piled by machine (grapple) and burned during the fall and winter rainy season to minimize impacts on soil and smoke emissions. Possibility of soil compaction, disturbance, and ability to work between existing trees should be taken into account.
- *Spot/Strip covering*- Concentrations of slash are covered in place and burned during the fall and winter rainy season to minimize impacts on soil and smoke emissions.
- *Yard tops* - Tops and other 0-3 inch limb material is yarded to a given location and burned during the fall and winter rainy season to minimize impacts from smoke emissions.
- *End haul* - Cull wood is hauled off site to a wide spot (usually next to a road), piled and burned during the fall and winter rainy season to minimize impacts from smoke emissions.

Environmental Consequences by Alternatives

Evaluation Criteria

- Rate of spread and intensity as determined by fuel models shown in years after the fire: 1 year, 5 years, 10 years, and 25 years
- Resistance to control

Direct and Indirect Effects

Fuel Loading Progression

Fuel models were used in this analysis to describe predicted conditions of fire spread and intensity under each alternative. The following assumptions were made:

- The same type of species and relative abundance in the shrub layer would return in 1-10 years post-fire.
- Heavy surface fuel loads would be created as snags fall down over time. The inventoried snag patch of the Puma Fire supports this assumption.

- There is limited background information on models and fuel loading progressions due to the practices of salvaging fires in the past.
- Some of the conclusions are drawn from the Warner Fire (1991) and Puma Fire (1999). The Puma Fire burned in the same fuel type as the Fall Creek SIA and most areas remain untreated.

Effects common to all Alternatives

There are a total of 764 acres in the Fall Creek SIA. Currently (one year after the fire) both fire spread and intensity are represented by Fuel Model 2 for both the action and no action alternatives. These are surface fires where fire spread is primarily through the fine herbaceous fuels (e.g., grasses), either curing or dead. Fire intensity would be low, since the herbaceous material and forest litter provide little burning duration. However, this fuel model is not considered in depth, since it is currently beginning to change to a Fuel Model 5 for both spread and intensity.

After the first year post fire, the rate of spread does not change (see Table 21). All alternatives show that Fuel Model 5 best represents spread. In all cases the brush layer becomes increasingly predominant over time and limb wood is more abundant as it falls from decaying snags. Under Fuel Model 5 conditions, fires carry primarily through the shrub layer with a limited burning duration (see Photo 3).

Photo 3 was taken on the north side of the Fall Creek SIA at the toe of the slope which extends into LSR RO-219. This photo shows the typical fuel loading on the Clark Fire in August 2004. It is transitioning from a Fuel Model 2 to a Fuel Model 5 (for both spread and intensity). The brush would increase in quantity and become more predominant, as shown in Photo 4 from the five-year-old Puma Fire.



Photo 3. Fuel Model 2 transitioning into Fuel Model 5. Typical fuel loading on Clark prior to the fire



Photo 4. Puma fire showing increasing brush in fifth year after the fire (Fuel Model 5) with Fuel Model 10 underneath



Photo 5. Untreated area in Puma fire showing Fuel Model 5 for spread and Fuel Model 10 for intensity

The difference between alternatives is in the treatment of increasing amount of deadfall as snags break and fall. This growing fuel loading of large woody material leads to greater fire intensity (represented by Fuel Model 10). Photo 5 shows an untreated area in the Puma Fire (adjacent to the SIA) five years after the fire. It is an example of a Fuel Model 5 for spread (as fire is carried through the brush layer) and Fuel Model 10 for intensity as the heavy fuel underneath the shrub layer burns with increased burning duration.

The amount of deadfall mixed in with regenerating shrub and brush layer is the major difference between alternatives. Management activities would not materially affect the shrub and brush layers. The greater the amount of fuel treatment in the various alternatives, the greater the probability that future fire behavior would be represented by Fuel Model 5 for both spread and intensity rather than a mixture of Fuel Model 5 (spread) and Fuel 10 (intensity).

All alternatives treat those areas most prone to ignition from human causes (i.e., along the roads and trails). With the exception of Alternatives A and B, the others propose the same treatment along the road. Alternative A has no treatment along the road and Alternative B proposes minimal treatment.

Alternative A – No Action

Since 42% of the Fall Creek SIA was stand replacing (80-100% mortality), fuel succession in these stands could be described in the following manner:

- Year 1 (post fire) – little forest floor fuel available; herbs predominate
- Year 5 – increasing fine fuel availability with some snags starting to fall and become surface fuels; shrub layer becomes predominate (i.e., ferns, vine maple, big leaf maple, assorted other shrubs)
- Year 10 – established shrub and brush layers mixed with increased fine and large woody fuels from collapsing dead trees result in heavier total fuel loadings and fuel bed depths; smaller snags (≤ 9 inches) have generally fallen by year 10 post fire.
- Year 25 – most of the snags have fallen producing high combined fuel loads of shrubs, brush and dead downed woody fuels; conifer regeneration increases both in density and vertical arrangement.

The effect of no action would be increasingly large accumulations of surface fuels resulting in greater fire intensities, greater potential for spotting and greater resistance to control (Brown et al. 2001).

Herbaceous fuels and shrubs would increase as this area regenerates. In areas with 80-100% tree mortality (42% of the SIA), many of the standing dead trees would fall and accumulate as surface fuels during the next five to fifteen years.

Historically the area did not have a high fuel loading of large woody material. Most of the existing CWD was in an advanced state of decay with a heavy covering of moss. After the fire, however, large woody fuel concentrations would increase significantly. Snags in the area are primarily Douglas-fir and hemlock, which tend to fall within five to seven years post-fire (Brown et al. 2004). Recent fuel inventories in an untreated snag patch within the Puma fire show an average of 66 tons/acre of large woody material (see Table 16), primarily from falling trees. The intensity of burning within this large woody debris is best represented by Fuel Model 10.

As discussed earlier, Brown et al. (2003) found that “fire hazard including resistance to control and fire behavior reach high ratings when large fuels exceed about 25-30 tons per acre in combination with small woody fuels of five tons per acres or less. Excessive soil heating is likely at approximately 40 tons per acre.” Future high large woody fuel loadings could cause an increase in fire intensities, resistance to control and decrease the options for firefighters to control and suppress fires safely.

In the No Action alternative (see Table 21), about 54% of the area could burn with the intensity of Fuel Model 10 in five years and 63% in 10-25 years due to the buildup of fuels resulting from the decay and falling of snags.

As in all alternatives, the spread rate after the first year would be Fuel Model 5, since the spread in this area is determined by the dominant shrub layer. Currently (about one year after the fire) the herb and grass layer is already transitioning to the shrub layer as the primary spread component of a potential fire (see Photo 3).

However, the intensity of such a fire would be much higher in the areas with increased fuel loading and is best represented by Fuel Model 10. This model has a high rate of heat per unit area (see Table 17), increased burning duration and a high resistance to control.

Using BEHAVE PLUS, fireline intensity and flame lengths of a potential fire were calculated for both moderate and high (90th percentile) weather conditions. In addition calculations were made for 20% slope (the average slope for most of the SIA) and 45% slope (representing the northern portion which extends into the LSR).

Under moderate weather conditions the fireline intensity is 34 btu/ft/sec for Fuel Model 5 at a slope of 20% and 42 btu/ft/sec at a 45% slope (see Table 19 and Table 20). Under the same conditions, the fireline intensity for Fuel Model 10 is 160 btu/ft/sec at 20% slope and 203 btu/ft/sec at 45% slope. Likewise, the flame lengths for Fuel Model 5 are 2.3 feet (20% slope) and 2.5 feet (45% slope) under moderate weather conditions. Calculations for Fuel Model 10 are flame lengths of 4.7 feet at 20% slope and 5.2 feet at 45% slope under the same weather conditions.

Flame lengths of four feet and fireline intensities greater than 100 btu/ft/sec are considered too intense for direct attack at the head of the fire by hand crews according to the Fireline Handbook (1998). In addition, the handbook points out that under these conditions “hand line cannot be relied on to hold [the] fire.” Therefore, under moderate weather conditions, safety concerns for firefighters suppressing a fire burning with Model 10 intensity are much greater than that of Model 5.

This difference between fuel models is less under high (90th percentile) weather conditions since the range of fire behavior under these conditions is considered high for both fuel models due to elevated temperatures and low relative humidity, as well as other conditions such as atmospheric stability (represented by the Haines index).

The heat per unit area (btu/ft²) is the heat released from a square foot of fuel while the flaming zone is in that area (Andrews 1986). This is a measure of fire intensity but should not be confused with the *fireline* intensity (btu/ft/sec), which is a measure of the heat at the flame front. The heat per unit area is more than doubled from Fuel Model 5 to Fuel Model 10 under both moderate and high conditions (see Table 1 and Table 20). Under moderate weather conditions with a 20% slope, Fuel Model 5 has a heat per unit area of 236 btu/ft² compared to 1,203 btu/ft² in a Fuel Model 10. During high (90th percentile) conditions (same slope) Fuel Model 5 burns with a heat per unit area of 631 btu/ft² compared to 1,284 btu/ft² for Fuel Model 10.

At the intensity represented by Fuel Model 10, torching, spotting and crowning may occur (USDA, 2004e). Depending on weather conditions, a crown fire could ignite in neighboring unburned stands if crews cannot contain the new fire start. In addition, standing snags in the previously burned area could ignite and scatter embers that, under the right weather conditions, could lead to crowning and put the LSR to the north of the SIA and nearby private land at risk. A 160 acre parcel of private land with five structures is found near the southwest corner of the SIA. The Forest boundary is located about two miles north of the Clark Fire (or approximately four miles north of the SIA) with private land beyond.

The higher fire intensities in Fuel Model 10 increase the resistance to control. As stated above, direct attack may not be feasible under high fireline intensities and flame lengths which would be generated by the increased large woody fuel load mixed with the shrub and brush layer. Control efforts at the head of the fire would probably be ineffective and hand lines cannot be relied upon to hold which could lead to increased fire size. It also takes longer for crews to build fireline through heavy wood than brush or forest litter. In addition, heavy concentrations of large woody debris could lead to a large (>200 acres) fire due to the inability of initial attack forces to control and suppress fires because the heat per unit area is too high.

In this alternative, approximately 63% of the area has the potential to burn with the intensity of Fuel Model 10. The large woody debris (Fuel Model 10) would be arranged as a continuous large patch throughout the whole river corridor. In this high use recreation area, Fall Creek and Road 18 are the only fuel breaks in Fuel Model 10.

The No Action alternative would have a moderate to high risk for fire starts to the extent that people would continue to use this popular recreation area. The opportunities for ignition coupled with no fuel reduction and increase fuel loading as dead trees deteriorate would maintain this high risk over decades.

Resistance to control under this alternative would be greater than in alternatives where fuels are treated. Heavy down fuels would contribute to increased fire intensities, spotting potential, receptive fuels for firebrands and extreme fire behavior. In addition, as snags fall, a lack of breaks in the fuel continuity would leave fewer strategic and tactical options for firefighters in future fire events increasing resistance to control.

The safety of firefighters and the public are always of concern to fire managers. Fires burning in high loads with high intensities are more likely to cause fire managers to attack the fire indirectly. As in the case of Clark, such indirect attack can increase the size of the fire significantly. If the burnout operation

on the Clark Fire had not succeeded, the fire could have grown over the northern ridge and into private land north of the Forest boundary.

It is important to note that potential fire behavior and size varies with the weather. Not all weather conditions would be conducive to crown fire development. However, this area has seen two crown fires in the last five years. Puma was a result of unexpected east (foehn) winds and was wind driven; Clark occurred during 90th percentile weather and drought conditions under an unstable, dry airmass.

A tabular summary is shown in Table 21. The number of acres in each fuel model remains the same 10-25 years post-fire. Most of the woody debris falls within the first ten years and the shrub layer has recovered. After 10 years the rate of fuel deposition is much less, with no significant change in fuel models.

Alternative B

In this alternative, about 15% of the area would be treated by falling hazard trees, primarily along Road 18. However, the large woody material would remain on site. This provides a pulse of large woody material, which would burn with the intensity of a Fuel Model 10. Spread would remain a Fuel Model 5 due to the reestablishment of the shrub layer.

Despite the 116 acres of hazard trees that would be felled in this alternative, the effects are similar to Alternative A because most of the woody debris would be left on site. As a result, more than 50% of the SIA would remain in Fuel Model 10 for intensity 5-25 years after the fire (see table 21). In fact, fire intensity could actually be greater during the first several years due to the pulse of large woody debris from felled snags. With both hazard trees that would be felled and left in place as well as snags that fall naturally, presents an example of where indirect attack might be used once a fire is actively burning in downed logs.

Fuel continuity of large woody material (Fuel Model 10) is similar to that in Alternative A, but some snags in Alternative A would become large woody surface fuels in Alternative B. This arrangement of large surface fuels across the landscape provides a greater resistance to control since it is more difficult to construct and hold line due to the fire behavior associated with Fuel Model 10.

As in Alternative A, this accumulation of large woody material leads to higher fire intensity, a greater resistance to control and increased safety concerns. The inability to suppress a new fire start can result in risk to the LSR and private land to the southwest and north of the SIA (see discussion under Alternative A).

There is an increase in defensible space (viable escape routes and safety zones in place) by falling hazard trees primarily along Road 18 and burning the fine fuels.

However, the increase in large wood fuel loading offsets the increase in defensible space provided by this alternative. Fires burning at higher intensities (e.g., Fuel Model 10) require much larger areas of defensible space than do those burning at lower intensities (e.g., Fuel Model 5).

Alternatives A and B are similar in that they both have large areas that would remain in Fuel Model 10 (intensity) over the years. The only difference is that Alternative B would include hazard tree felling and fine fuel reduction along Road 18. However, this is offset by the increase in surface large woody material, which would increase fireline intensity and flame length to a level that may not be feasible for direct attack (see discussion under Alternative A). In the short term, Alternative B may be worse because hazard trees would be felled and large woody debris left on site, increasing the surface fuel loading of large wood significantly.

If weather conditions are conducive to high or extreme fire behavior, alternatives A and B are the most likely to result in a large fire (> 200 acres). Safety concerns could prompt the decision to attack a growing fire indirectly, thereby increasing fire size. The Clark Fire doubled in size because fire managers had to attack the fire indirectly due to safety concerns, by using existing roads as holding lines and burning out large sections of forest uphill from the fire. Resources at risk, primarily from a large fast-moving fire, are the recreation facilities throughout the river corridor, the LSR to the north, and private land to the southeast of the area.

Alternative C

As in all alternatives, the SIA remains in Fuel Model 5 for spread as the shrub layer regenerates. This transition from a Fuel Model 2 (spread) is already occurring on site.

This alternative treats 19% of the SIA by felling some hazard trees along Road 18 and along the Fall Creek trail. However, the fuels from felled hazard trees in excess of wildlife requirements would be removed and/or treated. This decreases the amount of large woody material left in place to create Fuel Model 10 conditions for intensity. After the first year, the 146 acres treated in this alternative would be Fuel Model 5 in both spread and intensity with the removal of woody debris resulting from felling of hazard trees.

After treatment, snags would continue to fall providing large woody debris but this would happen over a period of years. Of the untreated area, 38% would become Fuel Model 10 by year 5 and 46% by years 10-25. The treated area is expected to be in Fuel Model 5 for both spread and intensity by the fifth year after the fire.

This alternative provides a few treated patches that would break up the continuity of large woody material. The primary break occurs along Road 18. The south side of the road would have a larger treated area than in Alternative B. Alternative C also provides treatment of some patches south of the road in the Riparian Reserves, resulting in a more discontinuous arrangement of large woody material.

This increased discontinuity in large woody fuels and removal of some large wood returns the treated portion of the SIA (19%) to a Fuel Model 5 for intensity by the fifth year post fire (see table 21).

Resistance to control would be lower than in Alternative A or B.

The primary difference between Alternative B and C is that Alternative C removes the hazard tree debris, which limits the amount of large woody material deposited as a result of management activities. Both alternatives would remove some of the fine fuel along the road by piling and burning.

Alternative D

Alternative D proposes to treat 33% of the SIA by felling trees that are a moderate to high hazard and removing the large woody material and treating the slash created by this action. It also proposes to relocate the Fall Creek Trail uphill to the toe of the slope extending uphill into the LSR. A fuel break would be created along this portion of the trail.

As with all alternatives, fire spread is represented by Fuel Model 5 as the shrub layer regenerates.

Decreasing the amount of large woody material by removing the hazard tree debris reduces fire intensity in treated areas. In addition, this alternative proposes additional treatment areas that continue to confine the large woody fuels to the more mesic riparian areas and draws, breaking up the continuity of Fuel Model 10 (intensity) across the SIA. Removal of larger fuels would decrease fire burning duration and reduce the fire intensity from a Fuel Model 10 to a Fuel Model 5 resulting in potentially less severe fire

behavior. This increases the range of options that fire managers can use to control and suppress a new fire safely during the first burning period (i.e., first day).

Alternative D is the only alternative that proposes rerouting of a portion of the Fall Creek Trail and creating a fuel break (approximately 150 foot wide) along this portion of the trail. The new trail would follow the toe of the slope which extends into the LSR. Building the fuel break at the toe of the slope provides firefighters with a better chance to control and suppress a fire while on the flat area of the SIA, before it has a chance to “run up the hill.” Without this fuel break, it could be easier for a fire to preheat the uphill vegetation, thus lowering the ignition point of these fuels and carrying the fire upslope into the burned and adjacent unburned portions of the LSR. A fire of this scale could also put nearby private land at risk.

This fuel break would assist firefighters in suppression of a new wildfire by providing a defensible space where line can be dug to mineral soil much more quickly than cutting through brush or large woody debris. As such it could also be used as a safety zone for firefighters. An easily cleared area can provide an opportunity to run hose lines and set up portable water tanks, supplying firefighters with water more quickly and efficiently. In addition, it would break up the continuity of large woody material, which decreases the intensity of the fire, providing firefighters more opportunities for direct attack. In order to remain functional over time, it would be necessary to clear the fuel break every 3-5 years.

The entire SIA portion of LSR R0-219 is just 0.0049% of the LSR. Therefore only a very limited part of the LSR would be treated to create this fuel break.

The reduction in large woody debris and the interruption of fuel continuity returns the treated areas to Fuel Model 5 intensity (see discussion under Alternative A). Together with that portion of the landscape that remains in Fuel Model 5 (intensity), 69% in 5 years and 63% in 10-25 years of the SIA would be in Fuel Model 5.

Returning this much of the landscape to its historic Fuel Model 5 condition also provides less resistance to control. Under moderate weather conditions (with a slope of 30%) fireline intensity is approximately 34 btu/ft/sec and flame lengths are approximately 2.3 feet (see Table 19 and Table 20). These conditions provide the potential for direct attack by hand and engine crews (see discussion under Alternative A), which in turn may allow firefighters to control and suppress a new fire within the first burning period.

Alternative E

As in all alternatives the spread rate is described by Fuel Model 5.

This alternative proposes to treat the maximum area for hazard tree reduction (43%). However, the Fall Creek trail would not be rerouted and would not be cleared to serve as a fuel break as in Alternative D. Instead, hazard trees would be assessed within 200 feet of the current location of Fall Creek trail. Large woody debris greater than 16 inches would be left to meet wildlife coarse woody debris requirements and fine fuels would be spot treated. Fuels would be reduced along the trail, but it would not be cleared to function as a fuel break and fuel accumulation along the trail would not be managed over time.

Both Alternatives D and E break up the continuity of large woody material. The main difference is that Alternative D incorporates a fuel break at the toe of the slope on the north side of the SIA.

Among the alternatives, this one would return the maximum amount of area to Fuel Model 5 (intensity) based on reduction in amount and continuity of large wood. Under certain conditions (weather, location

and size of fire, etc.) the lack of a fuel break could lead to an increase in fire size if the fire cannot be contained in the SIA along the valley floor.

Both Alternative D and E have the lowest resistance to control of all the alternatives, because large woody fuel is reduced and its continuity is broken across the landscape (see discussion in Alternative A).

Table 21. - Summary of fuel models in SIA over time by Alternative

Fuels Treatment	Fuel Model used to predict:		Years after Clark Fire					
			1		5		10-25	
	Rate of Spread	Intensity	Acres	% of Total	Acres	% of Total	Acres	% of Total
Alternative A								
Untreated	2	2	544	71%	–	–	–	–
	5	5	200	26%	326	43%	264	34%
	5	10	–	–	418	54%	480	63%
Treated			–	–	–	–	–	–
Alternative B								
Untreated	2	2	436	57%	–	–	–	–
	5	5	192	25%	309	40%	252	33%
	5	10	–	–	319	42%	376	49%
Treated	2	2	116	15%	–	–	–	–
	5	10	–	–	116	15%	116	15%
Alternative C								
Untreated	2	2	393	51%	–	–	–	–
	5	5	210	27%	313	41%	254	33%
	5	10	–	–	290	38%	349	46%
Treated	2	2	141	18%	–	–	–	–
	5	5	–	–	146	19%	146	19%
Alternative D								
Untreated	2	2	320	42%	–	–	–	–
	5	5	175	23%	283	37%	234	31%
	5	10	–	–	212	28%	261	34%
Treated	2	2	249	32%	–	–	–	–
	5	5	–	–	249	33%	249	32%
Alternative E								
Untreated	2	2	267	35%	–	–	–	–
	5	5	149	19%	244	32%	209	27%
	5	10	–	–	172	22%	207	27%
Treated	2	2	328	43%	–	–	–	–
	5	5	–	–	328	43%	328	43%
Total Acres (each alternative)			764		764		764	

Cumulative Effects

This cumulative effects analysis focuses on three of the 6th field sub-watersheds in the Fall Creek watershed because they comprise the topographic basin around the fire area: The three sub-watersheds are named Andy Creek, Portland Creek and Hehe Creek.

Risk and Role of Fire in the Watershed

Large fire events occur in the watershed when a combination of weather and fuel factors create optimum conditions for fire intensity and spread. The watershed experienced moderate to high intensity fires from 1800 to the present, resulting in the current stands with light ground fuels and vigorous second growth. Fragmentation due to management activity further reduces the risk of large fires. Fire may also have desirable effects in meadows, such as grass mosaic diversification and encroachment arrest.

The current, fragmented landscape supports various fire intensities as fuel models change. Significant fire runs may occur in stand initiation areas (Fuel Models 2 and 5), while moderate to high intensity fires would occur in stem exclusion and late successional and old growth stands (Fuel Models 5 and 10). Fuel profiles in the Fall Creek watershed are affected by three elements: silvicultural treatments, stochastic events, such as windthrow, and time. All three have played a role in the present fuels profile associated with the watershed. About 35,000 acres of the watershed have had silvicultural treatments (i.e., harvest, thinning and planting). Stochastic events (such as large wildfires) have played a major roll in this watershed, and would most likely continue to do so.

Historic Fire Suppression

In 1897 Congress and the president passed the Forest Management Act which provided for the administration of reserves. During the late nineteenth and early twentieth centuries, the primary effect of this action was emphasis on forest fire suppression. The Forest Service embarked on a ground patrol system of fire detection in the early 1900s using rangers on horseback traversing a system of trails and vantage points. Lookout sites or stations were established on Clark Butte, Little Cowhorn, Hehe Mountain, Saddleblanket Mountain, and Fawn Rock to detect fires as early as possible. Often the lookout was responsible for responding to and suppressing the detected fire, if it was small.

Past and Present Projects

Fall Creek watershed was first entered for commercial timber production in the 1940s. Clearcuts of 50-150 acres were located in lower part of the Fall Creek watershed. During the 1950's, harvest activities centered in Hehe Creek, generally related to salvage from the Hehe Fire of 1951.

An era of intensive road construction and timber harvest activity occurred across the landscape during the 1960s through the 1980s. Harvest units averaged 20 to 30 acres in size and were dispersed across the landscape to provide wildlife habitat and develop road systems. The harvest rate averaged 10% of the watershed area per decade, but has declined in recent years. To date approximately 46% of the Fall Creek Watershed has been harvested.

Past, present and foreseeable future management activities for the Fall Creek watershed are summarized in Appendix B. The fuel models for spread and intensity were estimated for stands across the landscape. There are pockets with Fuel Model 10 intensity where surface large woody debris has accumulated and would burn with a higher intensity resulting in an increased resistance to control. The Puma Fire is an example of such an area. Likewise, some areas would have little brush, with a potential fire spreading in the grass or herb component (Fuel Model 2). The Clark Fire Roadside Salvage, the Puma Fire

Restoration and Bedrock Campground Salvage projects are contiguous with the proposed actions. The spatial distances to other projects vary from one-half to four miles, further decreasing the probability of cumulative effects.

All present and proposed activities in the foreseeable future would have some measure of fuel treatment, resulting in Fuel Model 5 (both spread and intensity) after treatment. The past, present and foreseeable future projects sums to 6,984 acres of associated fuel treatments and represents 13.22% of the three 6th field sub-watersheds.

Table 22 - Percent and cumulative percent of Andy, Portland and Hehe Creek 6th field sub-watersheds treated by Alternative

Alternative	Acres of Fuel Treatment	% of Sub-watersheds	Cumulative % of Sub-watersheds
A	0	0%	13.22%
B	116	0.22%	13.44%
C	146	0.27%	13.49%
D	249	0.47%	13.69%
E	328	0.62%	13.84%

The cumulative effects of the fuels treatments in any of the proposed action alternatives would be minimal at the sub-watershed scale. As shown in Table 22, all action alternatives would treat less than one percent of the three 6th field watersheds in the cumulative effects analysis area. Over the next five decades, Alternative A – No Action would result in fuels models that increase fire intensities and are arranged in large contiguous patches which increases resistance to control within the project area. In combination with the high recreation use in the Fall Creek SIA, the No Action alternative would increase the risk of fires spreading outside the project area to private property, the LSR, and adjacent Forest Service land. The action alternatives would provide varying amounts of fuel reduction treatments which decrease fire intensities within the project area, result in varying spatial patterns of fuels, and resistance to control. All of these factors result in the lowering the risk of fires spreading outside the project area. Alternative E proposes the maximum amount of fuel treatments (328 acres) of all the alternatives, but would only add about 0.6% to the acres of fuels treatments in the sub-watersheds. Even though the percentage is very small compared to the size of the analysis area, the location of the fuel treatments in the Fall Creek SIA is an important aspect in the prevention of fires spreading outside of the project area.

Fisheries

Spring Chinook Salmon - *Significant Issue*

Fall Creek contains and provides habitat for spring chinook salmon, a federally listed (threatened) anadromous fish species. The Forest Service is required pursuant to the Endangered Species Act (ESA) of 1978, as amended, to consult with the Fisheries Division of the National Oceanic and Atmospheric Administration (NOAA- Fisheries) on the determination of effects for land management projects. ESA requires that federal agencies shall ensure that any actions they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of critical habitat. Spring chinook salmon life cycles, such as spawning and rearing, can be disrupted by the presence of excess fine sediments and increases in stream temperatures. Proposed activities in the Riparian Reserves have the potential to impact water quality and fish habitat. In addition, large woody debris in stream channels aids in creating salmon habitat. The removal of the dead trees could adversely affect the current and future recruitment of large woody debris for fish habitat.

Existing Conditions

Spring Chinook salmon and winter steelhead are the only anadromous fish species present in the Fall Creek watershed. Winter and summer steelheads were introduced into the watershed in the 1950's and 1980's respectively. At this time, only winter steelhead and spring chinook salmon are transported around Fall Creek Dam and released in Fall Creek.

Fall Creek wild spring chinook salmon populations have been severely diminished or extirpated due primarily to the construction of Fall Creek Dam. Prior to construction of Fall Creek Dam, an estimated 450-600 spring chinook salmon migrated into the upper Fall Creek area (USDI FWS, 1962, ODFW 1992). These fish spawned in Fall Creek and possibly in smaller tributaries in the surrounding areas. Following construction of Fall Creek Dam in 1965, returning adult salmon were trapped below the dam and transported by truck for release above the dam. In addition, hatchery reared fry were released in Fall Creek Reservoir. By 1969 spring chinook salmon runs increased to 4,696 fish. Subsequent returns have not been as successful, due in part to reservoir regulations implemented by the US Army Corps of Engineers. By the early 1990's, estimates on run size into Fall Creek were 200-300 spring chinook salmon and 0-10 winter steelhead.

Location of salmon spawning in Fall Creek has only recently been well documented. In 2000, the Forest Service completed a radio telemetry project to identify and map areas of Fall Creek and associated tributaries where adult salmon were spawning. Results of the survey were disappointing due to the high level of mortality in tagged fish. Half of the tagged salmon migrated downstream from the release site and entered Fall Creek Reservoir where they died before spawning. One fish was tracked up to Fall Creek Falls, approximately 19 miles upstream of the reservoir, and one was tracked to Winberry Creek, a large tributary of Fall Creek Reservoir. This fish migrated at least two miles downstream to Fall Creek Reservoir, another seven miles through the reservoir and entered Winberry Creek. Approximately 12 other adult salmon, presumably from releases in Fall Creek, were also holding in this area of Winberry Creek. Of the 200 adult salmon that were released above Fall Creek Dam in 2000, only seven redds were recorded in Fall Creek. Salmon that migrated to Winberry Creek were observed downstream of an apparent barrier and it is suspected that those fish died before they spawned. No redd surveys were completed in Fall Creek during the 2001 season.

Fall Creek offers isolated areas of excellent spawning habitat, but due to diminished run size prior to 2002, the population has become very small. Lower sections of Fall Creek, above the reservoir, contain many deep bedrock pools that adult salmon use as holding habitat. Gravel that fish utilize for spawning generally accumulates in areas associated with these pools. Middle and upper sections of Fall Creek contain more bedrock dominated areas; however, there are still many deep pools and some pockets of spawning habitat in these sections. Information on the distribution of redds in these areas can be found in the Fisheries Report in the Analysis File.

Juvenile recruitment in Fall Creek may be jeopardized by the high flows seen in spring and winter. In the spring of 2004 the US Army Corps of Engineers (USACE) operated a screw trap in the lower Fall Creek area. Trapping began in March and terminated in May. Spring chinook salmon juveniles entered the trap on only one occasion in March. This is a rather disappointing revelation as other streams in this region typically have juvenile spring chinook salmon migrating in large numbers throughout the spring and summer. The absence of juvenile salmon indicates that they are leaving the system much earlier than in other streams or that eggs are not surviving the high flows. High flows in unprotected areas are well documented in the literature to be a principle cause of redd failure and poor survival to the juvenile stage in salmonids.

The Fall Creek watershed has not been identified as bull trout critical habitat and there are no bull trout in the project area.

Large Woody Material

The amount of large woody debris in a stream channel is directly related to the frequency of salmon spawning redds in some areas (Larson 2000). The 2001 Fall Creek stream survey reported that stream reaches in the project area had an overall lack of large wood in the Fall Creek stream channel. Large wood is classified in three separate categories; small wood is at least 12 inches in diameter 25 feet from the largest end, medium wood is 24 inches in diameter 50 feet from the largest end, and large wood is 36 inches in diameter 50 feet from the largest end. Large wood was counted along approximately 90% of Fall Creek within the burn area, in the summer of 2004, one year after the fire.

The 1996 NOAA document, Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale, calls for streams that are Properly Functioning to maintain 80 pieces of wood per mile in at least the medium size category. Streams are considered to be “at risk” if they currently meet the standard for properly functioning but lack potential recruitment sources of woody debris to maintain that standard. Finally, streams considered “not properly functioning” are those that do not meet standards for woody debris and lack potential recruitment. The current assessment for Fall Creek shows that the stream falls into the “not properly functioning” category since it is below the 80 pieces of wood per mile.

Fall Creek is a large boulder and bedrock dominated channel system with deep pools and chutes between the bedrock dominated reaches. The stream channel is confined in a steep inner gorge, especially in the lower reaches, i.e., below HeHe Creek. As stated in the Watershed Analysis, this system is extremely efficient at moving what sediment comes in. Combining the large flow volumes with the bedrock chute and pool nature of the channel, much of the sediment and large woody material entering the channel is quickly moved to the reservoir. Applying NOAA’s recommendations for pieces of wood per mile uniformly in this reach of Fall Creek is questionable. The lower reaches of Fall Creek may never have had large wood levels that would meet the 80 pieces/mile standard (Bates 2004).

Stream survey data for Fall Creek and its associated tributaries shows a pattern of low large wood numbers (Table 24). The 2001 stream survey showed an increase over the 1993 stream survey in Fall Creek where it bisects the Andy Creek 6th field sub-watershed, however, the overall increase is still considerably below the recommended levels for a properly functioning stream channel. The average pieces per mile in Fall Creek within the Andy Creek sub-watershed is less than 10 pieces per mile in most reaches. Fire killed trees may provide a periodic loading of wood to the Andy Creek sub-watershed streams in the future but the potential of Fall Creek to transport large wood out of the area is widely recognized. Even if fire killed trees are recruited into the stream channels, there is a good chance that they will not remain for an extent period of time.

Table 24 - Large woody material levels in Fall Creek from 1993 to present.

Year	Small	Medium	Large	Total
1993	3.3	3.3	1.6	8.2
2001	14	3.3	0.9	18
2004 (post-fire)	61	17	2	80

Approximately 62 pieces of large wood have entered a three mile stretch of Fall Creek since the fire began. Some of the 62 pieces fell on their own while others were felled into the stream channel for safety reasons. Much of the wood has since moved downstream but is still functioning and providing beneficial habitat for salmon and other aquatic organisms.

The number of channel-width pools per mile and pieces of in-stream large woody material per mile are two parameters commonly collected during inventories to assess habitat conditions. The desired condition of these parameters varies depending on channel width, valley and channel geomorphology. Large wood and boulders enables the channel to scour out pools and provide cover habitat. The large conifer trees supply the channel with future recruitment of the needed down wood.

A large wood recruitment budget analysis was completed along Fall Creek to assess the number of dead (short-term) and live (long-term) trees that may fall into Fall Creek and function as large woody material. Trees at least 12 inches in diameter at the largest end and at least 25 feet long were counted in an area from the bank break of Fall Creek to 50 feet from the channel edge since this is where the majority of wood that enters the stream channel would come from (Figure 1). Live (> 20% green canopy) and dead (< 20% green canopy) trees were counted in four categories; 1) live trees with > 50% chance of falling into Fall Creek, 2) dead trees with > 50% chance of falling into Fall Creek, 3) live trees with <50% chance of falling into Fall Creek, and 4) dead trees with <50% chance of falling into Fall Creek (Table 24).

Figure 1. Proportion of total loading of woody debris from the riparian forest as a function of the distance from the stream edge (adapted from McDade et al. 1989).

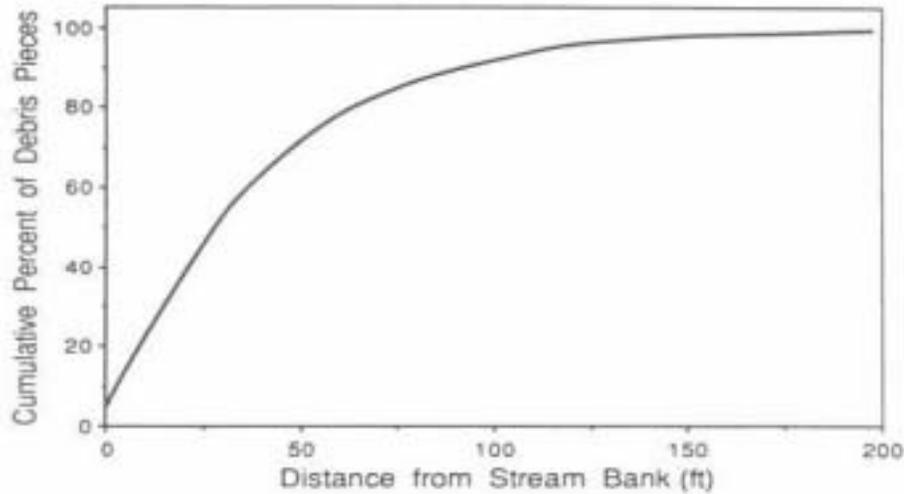


Table 24. Summary of wood budget analysis for Fall Creek SIA project area in the Clark fire area.

Fall Creek Stream Segment Descriptions (Total Length = 2 miles)	# of Green trees with > 50% chance of falling into Fall Creek	# of Dead trees with > 50% chance of falling into Fall Creek	# of Green trees with < 50% chance of falling into Fall Creek	# of Dead trees with < 50% chance of falling into Fall Creek
Timber Creek to Road 1821, north of Fall Creek	5	18	2	1
Timber Creek to Road 1821, south of Fall Creek	36	70	12	45
Road 1821 to Slick Creek, north of Fall Creek	17	106	11	52
Road 1821 to Slick Creek, south of Fall Creek	74	70	54	51
Slick Creek to Bedrock Campground, north of Fall Creek	111	188	33	93
Slick Creek to Bedrock Campground, south of Fall Creek	89	107	19	26
Bedrock Campground to private property, north of Fall Creek	72	81	24	41
Bedrock Campground to private property, south of Fall Creek	28	56	7	20
Totals	432	696	162	329

This wood recruitment budget analysis was done to assess the amount of large dead wood that may enter Fall Creek in the short-term and to record the amount of live wood that may replace the short-term wood in the distant future. The Fall Creek stream section within the project area is known to be deficit in large woody material at this time. The data above shows there are 696 dead trees that are 12 inches or greater in diameter at least 25 feet from the largest end and have a greater than 50% chance of falling directly into Fall Creek. It is important to add that the categories were set up to tally trees with either a greater than or less than 50% chance of falling into Fall Creek. However, the vast majority of trees in the

greater than 50% chance of falling into Fall Creek category had a far greater chance than 50% of falling into Fall Creek. That is, most of the trees had about a 90 to 100% chance of falling into Fall Creek.

The nature of how these dead trees fall over time is still not well understood. The dead trees will probably begin to break up on their own in the next 8 to 12 years (Marsh, 2004). Many specialists believe the burned trees may simply begin to rot and fall apart in pieces and provide little in the way of habitat enhancement structures for fish. The Watershed Analysis states that this system is extremely efficient at moving woody material due to the large flow volumes with the bedrock chute and pool nature of the channel. However, the wood budget analysis shows there is a more than adequate supply of large wood material for this reach of Fall Creek in the near future.

Water Temperature

The effects on water temperature are discussed under the Water Quality issue. Increases in water temperature may affect spawning, egg incubation, and juvenile survival of aquatic species. Any increase in Fall Creek water temperature would likely have an adverse effect on spring chinook salmon. Optimal spring chinook spawning temperatures range from 5.6°C to 13.9°C. Recommended egg incubation temperatures range from 5.0°C to 14.4°C. Adults can survive short durations of temperatures up to 23°C, but prolonged exposures to temperatures above 25.1°C are lethal (Bjornn and Reiser 1991). Within the fire area for the years 2000 and 2003, the maximum of the seven-day-average temperatures have ranged from 20.1°C to 22.6°C or from 4.1 to 6.6°C above the current standard of 16°C.

Sedimentation and Turbidity

The potential for increases in sedimentation and turbidity are also discussed under the Water Quality Issue. Excessive sedimentation is widely known to have adverse effects on juvenile salmonids and other aquatic species (Suttle et. al. 2004). Sedimentation can settle on salmon redds during the incubation period and suffocate or reduce the amount of oxygen that reaches juveniles (Chapman 1988). The ability of salmonids to locate and capture food is likely impaired at turbidity ranges of 25 to 70 Nephelometric Turbidity Units (NTU). Growth can be decreased and gill tissues damaged after 5 to 10 days of exposure to turbidity levels of 25 NTU, and some species may be displaced at 50 NTU (MacDonald et. al. 1991). Larger juvenile and adult salmonids appear to be little affected by ephemerally high concentrations of suspended sediments (Bjornn and Reiser 1991). However, adults will avoid waters with prolonged high silt loads, or cease migration until suspended sediment levels drop.

Management Direction

Spring chinook salmon are listed as threatened under the Endangered Species Act of 1978, as amended by the NOAA. The Forest Service is required, pursuant to the ESA, to consult with regulatory agencies to determine effects on land management projects. The Fall Creek SIA project occurs within the NOAA Fisheries designated Upper Willamette spring chinook salmon Evolutionarily Significant Unit (ESU). All naturally spawned populations of spring-run chinook salmon residing below impassable natural barriers are listed as part of the Upper Willamette ESU.

Section 7(a) 2 of the Endangered Species Act requires that federal agencies shall insure any actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of critical habitat.

Critical habitat for chinook salmon within the ESU was designated on February 16, 2000. On May 7, 2000 NOAA withdrew critical habitat designations for ESA listed Pacific anadromous salmonids. Therefore, at this time, there are no areas on the Willamette National Forest listed as critical habitat for spring chinook salmon.

Streams within the project area are currently considered Essential Fish Habitat (EFH) by NOAA Fisheries under the Magnuson-Stevens Fishery Conservation and Management Act. The Act requires Federal agencies to consult with NOAA Fisheries on actions that may adversely affect EFH for federally managed fisheries species, including Chinook, coho, and Puget Sound pink salmon. Each federal agency shall consult with NOAA Fisheries regarding any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken, by such agency that may adversely affect any essential fish habitat identified under this plan.

Environmental Consequences by Alternatives

Evaluation Criteria:

- Change in large woody material as measured by the number of trees to be felled into Fall Creek.

Direct and Indirect Effects

Alternative A (No Action)

There would be no direct or indirect effects to spring chinook salmon or their habitat because this alternative would not fall any dead trees into Fall Creek. All fire-killed trees including those along roads, trails, dispersed campgrounds, and Riparian Reserves would remain standing and be allowed to fall naturally over time. Hazard trees would not be felled into Fall Creek, which would create and enhance habitat for spring chinook salmon. The large woody material would not be upgraded or restored but according to the large wood recruitment budget analysis, the large wood supplies for Fall Creek and its tributaries would remain very high as dead trees begin to deteriorate and fall into the stream channels.

Alternative B

The large woody material in streams would not be adversely affected by this alternative because approximately 100 to 120 trees felled for safety would be felled towards or into Fall Creek and left in place. The direct effect of Alternative B on in channel large wood would be a short-term (5-15 years) increase in the amount of large wood in the stream channel over the No Action Alternative effects. Hazard trees along Fall Creek, especially on the western and eastern edge of the project area, would be felled to remove hazards along Road #1800, heavily used recreation areas, and valuable infrastructure, such as bridges. The falling of hazard trees into Fall Creek may create a direct effect on salmon if a felled tree were to strike a fish. The falling of the hazard trees would likely occur in the summer months when adult salmon and juveniles from prior year classes are still in the vicinity.

Alternative B proposes no commercial extraction of dead hazard trees, therefore, no trees would be subtracted from the large wood budget analyzed for Fall Creek. And as demonstrated in the wood budget analysis, the short-term (5-15 years) large wood supply to Fall Creek and its tributaries would remain very high as dead trees begin to deteriorate and fall into the stream channels.

Alternative B does not propose to replant conifer trees and would rely on natural regeneration. The re-growth of the trees which provide long-term wood supply to the stream channels would be delayed by 20-40 years compared to alternatives which propose planting.

Alternative C

Direct effects to in-stream wood in Alternative C would be slightly less than in Alternative B. The direct effect of Alternative C on large woody material in Fall Creek would be a short-term (5-15 years) increase in the amount of large wood in the stream channel. Approximately 70 to 90 hazard trees would be felled directly into or towards Fall Creek. This alternative has less of an effect than Alternative B because fewer trees would be felled along the Fall Creek National Recreation Trail. Hazard trees along Fall Creek, especially on the western and eastern edge of the project area would be felled to remove hazards along Road #1800, high use recreation areas, and valuable infrastructure, such as bridges. The falling of hazard trees into Fall Creek may create a direct effect on salmon if a felled tree were to strike a fish. The falling of the hazard trees would likely occur in the summer months when adult salmon and juveniles from prior year classes are still in the vicinity.

Alternative C proposes commercial extraction of dead hazard trees, but no hazard trees that have the potential to fall into Fall Creek would be removed. Therefore, no trees would be subtracted from the large wood recruitment budget. And as demonstrated in the wood budget analysis, the short-term (5-15 years) large wood supply to Fall Creek and its tributaries would remain very high as dead trees begin to deteriorate and fall into the stream channels.

Alternative C does propose to replant conifer trees. The recovery rate of the forest which support the long-term wood supply to the stream channels would be accelerated by 20-40 years compared to the No Action.

Commercial extraction of dead trees would be allowed further than 100 feet from Fall Creek where falling trees cannot reach Fall Creek and are in excess of wildlife habitat coarse woody debris needs. The stream environment would remain unchanged with the exception of falling approximately 70 to 90 hazard trees into Fall Creek to augment salmon spawning habitat.

Alternative C maintains standing dead trees within Riparian Reserves on tributary streams south of Road #1800. Therefore, this alternative would maintain all large woody material available to tributary streams.

Alternative D

Direct effects upon in-channel large woody material in Alternative D would be similar to those of Alternative C. The direct effects upon large woody material recruitment would be the short-term (5-15 years) increase in the amount of large wood in the stream channel. Approximately 70 to 90 hazard trees would be felled directly into or towards Fall Creek. This alternative has less effect than Alternative B because the Fall Creek National Recreation Trail would be re-located so that trail hazard tree removal would not occur within 100 feet of Fall Creek. Hazard trees along Fall Creek, especially on the western and eastern edge of the project area would be felled to remove hazards along Road #1800, high use recreation areas, and valuable infrastructure, such as bridges. The falling of hazard trees into Fall Creek may create a direct effect on salmon if a tree were to strike a fish upon falling. The falling of the hazard trees would likely occur in the summer months when adult salmon and juveniles from prior year classes are still in the vicinity.

Alternative D proposes commercial extraction of dead hazard trees, but no hazard trees that have the potential to fall into Fall Creek would be removed. Therefore, no trees would be subtracted from the large wood recruitment budget. As demonstrated in the wood budget analysis, the short-term (5-15 years) large wood supply to Fall Creek and its tributaries would remain very high as dead trees begin to deteriorate and fall into the stream channels.

Alternative D does propose to replant conifer trees. The recovery rate of the forest which would supply long-term wood to the stream channels would be accelerated by 20-40 years over the No Action.

Commercial extraction of dead trees would occur only outside of 100 feet from Fall Creek where hazards trees cannot reach Fall Creek and are in excess of riparian and wildlife habitat coarse woody debris needs. The stream environment would remain unchanged with the exception of falling approximately 70 to 90 hazard trees into Fall Creek to augment salmon spawning habitat.

A direct effect to large woody material recruitment in Alternative D would be that dead trees would be removed from the outer portion (>100 feet from the stream) of the Riparian Reserves on tributary streams to Fall Creek. These tributary streams are located south of Road #1800. These trees are potentially tall enough to reach the stream channels. If these trees were felled and removed, the stream channels would likely contain less large woody material over time. Therefore, these tributary streams would have less large woody material to reduce stream velocity and provide other beneficial aquatic characteristics.

Alternative E

Direct effects to large woody material recruitment in Alternative E are the greatest of all the alternatives. This alternative would create a short-term (5-15 years) increase in the amount of large wood in the stream channel. Approximately 150 to 170 hazard trees would be felled directly into or towards Fall Creek. This alternative would fall a greater number of trees because all hazards trees within 200 feet of the Fall Creek National Recreation Trail would be removed. The falling of these hazard trees into Fall Creek may create a direct effect on salmon if a tree were to strike a fish. The effect is slightly higher in this alternative due to the increased number of hazard trees. The falling of the hazard trees would likely occur in the summer months when adult salmon and juveniles from prior year classes are still in the vicinity.

Alternative E proposes commercial extraction of dead hazard trees, but no hazard trees that have the potential to fall into Fall Creek would be removed. Therefore, no trees would be subtracted from the large wood recruitment budget. As demonstrated in the wood budget analysis, the short-term (5-15 years) large wood supply to Fall Creek and its tributaries would remain very high as dead trees begin to deteriorate and fall into the stream channels.

Alternative E does propose to replant conifer trees. The recovery rate of the forest which would supply long-term wood to the stream channels would be accelerated by 20-40 years over the No Action.

Commercial extraction of dead trees would occur only outside of 100 feet from Fall Creek where hazards trees cannot reach Fall Creek and are in excess of riparian and wildlife habitat coarse woody debris needs. The stream environment would remain unchanged with the exception of falling approximately 150 to 170 hazard trees into Fall Creek to augment salmon spawning habitat. More large wood in the stream channel may translate to more pools formation and less bank instability. In addition, as mentioned previously, in some areas salmon redd frequency is directly related to the amount of large wood in the stream channels. However, it is important to recognize that a large amount of the available stand dead wood would eventually break up and fall into Fall Creek on its own

A direct effect to large woody material in Alternative E would be that dead trees would be removed from the outer portion (>100 feet from the stream) of the Riparian Reserves on tributary streams to Fall Creek. These tributary streams are located south of Road #1800. These trees are potentially tall enough to reach the stream channels. If these trees are removed, the stream channels would likely contain less

large woody material over time. Therefore, these tributary streams would have less large woody material to reduce stream velocity and provide other beneficial aquatic characteristics.

Cumulative Effects

Cumulative effects for the project were assessed on the 17 miles of spring chinook salmon spawning habitat in Fall Creek. Project effects from the past ten years were qualified and quantified to reach a cumulative effect conclusion for this project. See Appendix B for a summary of past, present, and foreseeable future actions. Past stream enhancement and log placement projects in Fall Creek and Portland Creek have contributed large woody structure to the streams. The effects of past timber sales on the Riparian Reserves have been documented in the Water Quality section on page 155. Figure 4 represents the amount of Riparian Reserves affected by regeneration harvest and implies how it could have affected stream temperature. The same principle applied to downstream large woody recruitment. The effects of the Clark Fire Roadside Salvage Project in 2004 that removed the first round of hazard trees along Road #1800 and the Bedrock Campground were considered when calculating large wood cumulative effects of this project. Approximately 1 to 3 percent of the trees that could have become large wood in Fall Creek over time were removed during the Clark Fire Roadside Salvage Project and the Bedrock Campground Restoration Project. The effects of Puma Fire of 1999 were also considered in the large wood budget analysis. Foreseeable future actions include the ongoing hazard tree management around recreational facilities and along roads.

Alternative A – No Action

This alternative A would have no cumulative effects because no dead hazard trees would be felled into Fall Creek. But as fire-killed trees along Fall Creek deteriorate, large woody debris would be added to the stream environment. The large woody debris would enter Fall Creek at a slower rate and in smaller chunks or bole sections, based on how the burnt trees rot and fall apart in pieces.

Alternative B

This alternative would add large wood debris into Fall Creek and would have beneficial effects to the stream environment. Fall Creek currently contains about 40 pieces of large wood per mile along the 2 mile section of stream where trees would be felled. This alternative would increase that number to approximately 90 to 100 pieces per mile. These 2 miles of Fall Creek represents about 12 percent of the habitat spring chinook salmon use within the Fall Creek watershed. The cumulative effect or overall large wood budget would average out to about the same for Fall Creek and all tributaries streams which provide habitat. The additional wood that falls into Fall Creek as fire-killed snags deteriorate and naturally break up and the large wood that continues to enter Fall Creek from the Puma Fire of 1999 would continue to maintain and provide salmon spawning habitat in Fall Creek over time.

Alternative C

This alternative would add large wood debris into Fall Creek and would have beneficial effects to the stream environment. As mentioned above, Fall Creek currently contains about 40 pieces of large wood per mile along the 2 mile section of stream where trees would be felled. This alternative would increase that number to approximately 75 to 85 pieces per mile. These 2 miles of Fall Creek represents about 12 percent of the habitat spring chinook salmon use within the Fall Creek watershed. The cumulative effect or overall large wood budget would average out to about the same for Fall Creek and all tributaries streams which provide habitat. The addition of this wood, plus the naturally deteriorating fire-killed snags, and the wood from the Puma Fire of 1999 would continue to maintain and provide salmon spawning habitat in Fall Creek over time.

Alternative D

This alternative would add large wood debris into Fall Creek and would have beneficial effects to the stream environment. The alternative would increase that number to approximately 75 to 85 pieces per mile on the 2 mile section of Fall Creek. However, by harvesting in the outer portions of the Riparian Reserves on the tributary streams to Fall Creek, some loss of large woody material would be expected. Reducing the overall wood budget in the sub-watershed would have a short and long-term negative effect. The loss of this wood and the effect it would have on salmon habitat in Fall Creek is insignificant because Road #1800 generally disrupts the natural routing of large wood to Fall Creek from these tributaries. Even though this wood may never enter Fall Creek, from a sub-watershed perspective the level of reduction would be measurable. The addition of this wood, plus the naturally deteriorating fire-killed snags, and the wood from the Puma Fire of 1999 would continue to maintain and provide salmon spawning habitat in Fall Creek over time.

Alternative E

This alternative would add large wood debris into Fall Creek and would have beneficial effects to the stream environment. The alternative would increase that number to approximately 115 to 125 pieces per mile on the 2 mile section of Fall Creek. These 2 miles of Fall Creek represents about 12 percent of the habitat spring chinook salmon use within the Fall Creek watershed. However, by harvesting in the outer portions of the Riparian reserves on the tributary streams to Fall Creek, some loss of large woody material would be expected. Reducing the overall wood budget in the sub-watershed would have a short and long-term negative effect. The loss of this wood and the effect it would have on salmon habitat in Fall Creek is insignificant because Road #1800 generally disrupts the natural routing of large wood to Fall Creek from these tributaries. Even though this wood may never enter Fall Creek, from a sub-watershed perspective the level of reduction would be measurable. Combined with large wood that is falling into Fall Creek from the Puma Fire of 1999, there would be an increase in the amount of large wood that benefits salmon over time.

Consultation with NOAA-Fisheries

A Biological Assessment (Larson, 2004) was prepared for consultation with NOAA-Fisheries in pursuant to section 7(a)(2) of the Endangered Species Act and implementing regulation, 50 CFR Part 402.

For the purposes of the consultation, the project was divided into two components. The first component of the project includes the falling and yarding of hazard trees with associated culvert replacements, road maintenance and construction. Hazard trees to be felled and removed from this portion of the project do not include trees that have the potential to fall into Fall Creek or its tributaries. The second component of the project is the restoration portion where hazard trees that make up the wood budget along Fall Creek would be felled but left on site. Trees in this part of the project are generally within 100 to 200 feet from Fall Creek but also pose a serious safety risk to Road #1800 and other recreation areas. The trees felled into or towards Fall Creek are intended to capitalize on the condition of the wood at this time and to provide habitat enhancement for spring chinook salmon and other aquatic organisms. The District has recently consulted on the first component of the project. A letter of concurrence from NOAA Fisheries is pending and should be received in January 2005. While critical habitat is not currently designated for spring chinook salmon, the implementation of these projects would not adversely modify habitat important to spring chinook salmon in the Fall Creek watershed.

Consultation for the restoration portion of the project was covered under the 2002, Northwest Oregon Programmatic Biological Opinion from NOAA - Fisheries. The effects determination for the restoration portion of the project is a “may affect, likely to adversely affect” (MA, LLA).

The analysis of effect presented in the BA indicates minimal risk of adversely affecting the matrix indicators of watershed conditions. Therefore, it is likely that the project would also have a minimal effect on EFH. It is determined that this project would not exceed the “may adversely affect” EFH threshold and is therefore not subject to EFH consultation with NOAA - Fisheries.

Vegetation

Vegetation Recovery - *Analysis Issue*

Forest Service Road #1800 is a main travel route along the Fall Creek Special Interest Area. This area receives high recreation use and is known for its scenic qualities and late-successional and old-growth forest conditions. It is the goal of the Middle Fork Ranger District to get the area affected by the fire back to its former condition as soon as possible. While recovery of this condition certainly will take a considerable amount of time, there is a concern that this recovery could take even longer than absolutely necessary. Considering that there was not a good conifer seed crop the year the fire occurred, there may be a need to plant trees to get conifers re-established and to prevent this area from going through an extended shrub and brush stage. There is also concern that recovery of the appearance of this area could be set back by several decades or more if another fire starts in the area and burned with great intensity due to a high accumulated of dead fuels.

Existing Conditions

The pre-fire vegetation condition in the project area consisted of predominantly late-successional and old-growth forest conditions. Approximately one quarter of the project area was in a timber type, ranging in ages from 80 to 150 years and represents the understory re-initiation stand development stage (see table 25). About two thirds of the project area was in the late-seral stage with stand ages greater than 200 years old and represents the old-growth stand development stage. Less than 15 percent of the project area included young plantations; representing early and young-seral conditions characterized by the stand initiation (0-30 years) and stem exclusion (30-80 years) stand development stages. There is a small percent (3%) of special habitats consisting of ash swamps, ponded areas, and seeps in the project area.

The dominant vegetation type in the project area is represented by the western hemlock forest series. This western hemlock series generally lies above the warm dry Douglas-fir and grand fir zones and below the cool Pacific silver fir zone. The western hemlock series makes up the bulk of the lower to mid-elevation of the Forest. A small percentage of the lower slopes and southern aspects of the fire area have small inclusions of Douglas-fir and grand fir forest series. The Douglas-fir series occurs widely in the low precipitation; low elevation sites, but also is common on dry micro sites, shallow or skeletal soils, or on warm aspects across a wide elevation range. The grand fir series often intermingles with the Douglas-fir series on harsh sites in those warm dry environments

A majority of the stands in the SIA project area were subject to moderate to high severity fire in July of 2003. Table 25 shows the results of the mortality assessment. Approximately 344 acres or 45% of the project area had high mortality (80-100%). About 266 acres or 35% of the project area had partial mortality ranging from 41-80% with small patches of high mortality. Approximately 154 acres or 20% either had light under burning with no crown scorch or no burning at all. Individuals and small clumps of live trees are scatter among the large patches fire-killed trees.

Table 25. Summary of the Seral Conditions and Percent Mortality in the Project Area

Stand Development Stages	Pre-fire Conditions Total Ac. (%)	Crown Mortality					Post-fire Conditions Total Ac. (%)	Change Ac.
		0-20%	21-40%	41-60%	61-80%	81-100%		
Old-growth (200+ years)	479 (63%)	65	-	198	2	214	301 (39%)	-178
Understory Re-initiation (81-200 years)	165 (22%)	57	-	36	-	72	104 (14%)	-61
Stem Exclusion (31-80 years)	38 (5%)	22	-	14	-	3	23 (3%)	-15
Stand Initiation (0-30 years)	59 (8%)	5	-	9	-	45	296 (39%)	+237
Special Habitat	23 (3%)	6	-	7	-	10	40 (5%)	+17
Totals	764	154 (20%)		264 (35%)	2 (<1%)	344 (45%)	764	

Note: The pre-fire conditions and crown mortality assessment were based on the seral conditions and stand delineations prior to the fire. After the fire, stand delineations were updated and changed based on the fire mortality. Therefore, there is an acreage discrepancy between pre and post-fire condition acreages because of the change in the delineated of special habitats.

For the Clark Fire, it was assumed that if stand mortality was greater than or equal to 80%, than the stand experienced a stand replacing fire and the year of origin for the stand was started over in 2003. The stand delineations were also remapped in the Clark Fire area as a result of the fire mortality.

Early-seral (stand initiation) successional conditions can have two different types of structure. It can have high densities of dead trees, such as after a stand-replacing fire. It can also be devoid of dead tree structure, such as in most clearcut units. The Fall Creek Watershed Analysis defined the historic range of variability for early-seral conditions (as defined by the stand initiation and stem exclusion in the table) to range from 3-30 % in the western hemlock forest series on the Middle Fork of the Willamette River sub-basin.

The Clark Fire increased the amount of early-seral conditions in the watershed, in the Late Successional Reserve, and in the project area. The Clark Fire converted 240 acres (31% of the project area) of the mature (understory re-initiation) and old-growth forest into early-seral (stand initiation) conditions with high densities of large dead trees (see Table 25). The Clark Fire converted about 1,073 acres (1.4% of the watershed) of the mature and old-growth forest into early-seral conditions with high densities of large dead trees (see Table 26). The Clark Fire converted about 914 acres (1.4% of the LSR) of the late-successional habitat into early-seral conditions with high densities of large dead trees (see Table 27).

If the range of variability is applied to the watershed or LSR level of scale, then the Clark Fire pushes the early-seral (stand initiation and stem exclusion) conditions further away from its estimated natural range.

The following table displays the seral conditions for the Fall Creek watershed before the Clark Fire and after the fire.

Table 26. – Summary of Seral Conditions in the Fall Creek Watershed

Seral Conditions	Pre-fire Conditions Acres (Percent)	Post-fire Conditions Acres (Percent)	Difference
Old-growth	27,612 ac. (36%)	26,900 ac. (35%)	-712 ac. (-0.93%)
Understory Re-initiation	12,667 ac. (17%)	12,300 ac. (16%)	-367 ac. (-0.48%)
Stem Exclusion	22,848 ac. (30%)	22,832 ac. (30%)	-16 ac. (-0.02%)
Stand Initiation	12,411 ac. (16%)	13,484 ac. (18%)	1,073 ac. (1.41%)
Non Forest	830 ac. (1%)	852 ac. (1%)	22 ac. (0.03%)
Totals	76,368 ac.	76,368 ac.	

The high intensity fire resulted in a stand-replacing disturbance killing the live, green components of these forest stands. These live components make up a large part of the forest characteristic that are used to define late-successional and old-growth forest. Western hemlock/Douglas fir old-growth characteristics include the presence of large diameter (>8 TPA and >32”DBH) Douglas-firs, shade tolerant associates species such as western hemlock and western red cedar (>12 TPA and >16”DBH), and deep multilayered canopies (Franklin, et al, 1986). It will take centuries for these live components to naturally re-establish. In addition, the fire has created abundant dead coarse woody debris; both standing snags and down woody debris. These dead components are also important characteristics of late-successional and old-growth forest. These dead components provide habitat for a multitude of species and contribute to site productivity.

The following table displays the seral conditions for the Fall Creek Late Successional Reserve before the Clark Fire and after the fire.

Table 27. - Summary of Seral Conditions in the LSR

Seral Conditions	Pre-fire Conditions Acres (Percent)	Post-fire Conditions Acres (Percent)	Difference
Old-growth	26,459 ac. (35%)	25,844 ac. (34%)	-615 ac. (-0.93%)
Understory Re-initiation	8,604 ac. (11%)	8,302 ac. (11%)	-302 ac. (-0.46%)
Stem Exclusion	17,500 ac. (23%)	17,500 ac. (23%)	0 ac. (0.00%)
Stand Initiation	10,715 ac (14%)	11,629 ac. (15%)	914 ac. (1.39%)
Non Forest	2,692 ac. (4%)	2,695 ac. (4%)	3 ac. (0.00%)
Totals	65,970 ac.	65,970 ac.	

Regeneration

In contrast to other recent fires which have occurred on the Middle Fork District, there is little evidence of natural regeneration in the SIA one year after the Clark Fire. The reconnaissance of the project area in the summer of 2004 has found very little natural regeneration of Douglas-fir or western hemlock.

One of the main reasons for the lack of natural regeneration was the low cone crop for Douglas fir in 2003. Douglas-fir (*Pseudotsuga menziesii*) flowers in mid-March to early June. Seeds develop throughout late spring and summer, reaching maturity in August or early September. Some seed is produced annually by Douglas-fir except for about 1 year in any 4 to 5 year period. But environmental factors make the crop cycle erratic, and abundant crops can occur from 2 to 11 years apart. One crop failure and two or more light to medium crops usually occur between heavy crops (USDA, 1974). The Clark Fire occurred on July 13th, 2003. In areas with high fire severity, any potential cone crop would have been destroyed. And given the poor crop in the adjacent stands of the surrounding area, there was very little seed to disperse into these high mortality areas.

How quickly reforestation occurs has great import for a number of resources, including soil stability, water quality, ecological diversity, scenic quality, spotted owls, and other various wildlife habitats. A number of factors influence how reforestation occurs, including future weather patterns, the extent of continued large scale disturbances, how and whether salvage of fire killed timber occurs, the amount of competing vegetation, and how much and when prescribed planting of trees occurs. The complexities of interaction between these factors make prediction of regeneration success difficult (Cleary, et. al. 1978)

From a scenic recovery perspective, an area would be considered adequately reforested if at least 125 fairly distributed trees per acre exist when a stand is 5 years old. This number of trees would provide for rapid diameter and height growth. The scenic standards and guidelines define the recovery of disturbed condition to be when tree heights are about 10-20 feet, depending on the scenic management area.

Past reforestation success on similar sites in the immediate project area following clearcutting method of silvicultural systems, indicate that the microclimate created by a shelterwood is not necessary for regeneration (Marsh, 2004a). The microclimate create by dead fire-killed trees would potentially provide short-term benefits to regeneration until the dead trees deteriorate and fall down, but would not be necessary for reforestation success.

Based on the site-specific conditions within proposed salvage units and review of reforestation efforts in the adjacent plantations, the analysis indicates these forest sites are suitable for timber growth and can easily be reforested within the five years as required by Section 6(g)(3)(E)(ii) of the National Forest Management Act.

Management Direction

Reforestation

The Forest and Rangeland Renewable Resources Planning Act of 1974 as amended by the National Forest Management Act of 1976 states that “it is the policy of the Congress that all forested lands in the National Forest System shall be maintained in appropriate forest cover with species of trees, degree of stocking, rate of growth, and conditions of stands designed to secure the maximum benefits of multiple use sustained yield management in accordance with land management plans.

Forest Service Manual 2479.03 provides the policy that guides the use of stocking charts that serve as a basis for determining appropriate stocking levels for forest stands with the National Forest System. Forest Service Handbook 2409.17, Chapter 9 provides the theory and concepts of the stocking levels guides developed for use on the National Forest and the applicable Westside published stocking guides.

Scenic Conditions

The Willamette Forest Plan (page IV-139, MA-5a-04) directs us to design all practices in a Special Interest Area to meet the Visual Quality Objectives (VQO) of Retention, guidelines for which are specifically expressed in Management Areas 11e and f (WNFP, pages IV-210 to 215). It goes on to say that in the event that salvage harvest is necessary, practices should be employed in a manner that seeks to achieve a VQO of Partial Retention (see WNFP, pages III-113 and 114 b). Partial Retention guidelines are covered by Management Areas 11c and d (WNFP, pages IV-205 to 209). The salvage harvest guidelines for scenic areas say nothing about why salvage harvest may need to be done.

The specific guidelines for all these Scenic Management Areas imply, but do not specifically state, that a forest of green trees constitute a visually recovered area. Harvested stands are considered recovered from a Partial Retention standpoint when the regenerated stand is 10 to 20 feet tall. (See standards and guidelines, MA-11c-07, MA-11d-15, MA-11d-17 MA-11e-10, MA-11e-12 and MA-11f-16, MA-11f-17). For Partial Retention foreground, Retention middleground and foreground allocations (MA 11d, e, and f), permitted harvest should retain at least 10 dominant or co-dominate green trees per acre to comply with scenic guidelines. (MA-11d-17, MA-11e-12, and MA-11f-17). Since some areas of the Clark fire do not have these conditions, it can be assumed that the effects of the fire do not conform to those particular scenic objectives.

Additionally, the Desired Future Condition statement for Management Areas 11e and 11f say (WNFP, pages IV-210 and 213) that important landscape elements to be retained include a variety of tree species having age class diversity, a condition that does not exist for many years in an area affected by stand replacement fire. The only direction relating to recreational activities and a Partial Retention VQO is that management practices should result in a physical setting that meets or exceeds the ROS class of Roded Natural.

The Forest Plan also contains Visual Quality Objectives for Class I trails (WNFP, page IV-54). Management activities and practices in such trail corridors are to be commensurate with the visual quality objective of Retention, and project will be designed to minimize form, line, color, and texture contrast with the character of the surrounding landscape.

Assumptions used in the Scenic Analysis

Given the inconsistencies and lack of specificity regarding fire effects in the Forest Plan direction, it is not at all clear, nor is there universal agreement, as to how a fire affects scenic quality. Landscape architects (Dole, 2004) point out that the underlying goals for scenic management (WNFP, page IV-213) is to maintain a natural or near natural setting, and to assure that any manipulations in the scenic area will repeat the form, line, color and texture of the characteristic landscape. In a general sense, wildfires have always been part of the characteristic landscape, at least until the time that concerted fire suppression began. Prescribed or natural fires that are consistent with characteristic patterns are considered to have high scenic integrity by landscape architects. It is unclear if a fire that was started through carelessness, as was the Clark fire, would be perceived differently.

If wildfires and their effects are considered to be part of the characteristic landscape, then it would follow that there would be a need to facilitate fire occurrence in the Fall Creek landscape, within which fire has essentially been excluded for approximately the last 100 years, in order to restore the original characteristic landscape. If the Forest Service were to prescribe a fire such as the Clark fire to achieve the objectives in the preceding sentence, it would be doubtful that the general public would agree with or understand such a decision, nor the perceived need to “restore” the “characteristic landscape”. This last point is mentioned only to illustrate the conundrum presented by the imprecise management direction,

and public or professional opinions regarding how to view the scenic and aesthetic impacts of a stand replacement wildfire, whatever its origin.

Whatever the cause, the Clark fire has appeared to burn with a similar pattern and intensity as had past stand replacement fires, judging by the surrounding forest age class distribution. That being the case, there is no uniformity of form, line, color, and texture in this landscape, as those characteristics vary tremendously between portions of that landscape affected by recent wildfire and those which have not, especially in terms of color and texture. So which types of form, line, color and texture do we want to see?

Implicit in all the Forest Plan Standards and Guidelines is the fact that live, more or less closed canopy forest stands are the characteristic landscape, though the Desired Future Condition given for Scenic Partial Retention areas (WNFP, pages IV-205 and 207) is to “maintain a near natural setting”. The Forest Plan provides for timber salvage of mortality from catastrophic losses within Special Interest Areas (MA-5a-05) and specifies in that event the Visual Quality Objective to be managed for would be reduced to Partial Retention. Partial Retention Scenic guidelines specify (MA-11c-05,) that created openings (e.g. harvest areas) may be no greater than 10 to 15 acres, and may need to be as small as 2 to 3 acres in foreground areas (MA-11d-08). The opening sizes are much smaller than what typical wildfires tend to create. How can we salvage mortality from a fire such as the Clark fire when prescribed created open sizes are so much smaller than those created by a typical wildfire? Such small openings are not at all part of the characteristic landscape.

Before the fire-caused mortality, the characteristics of the landscape would be a closed canopy green forest. Some may argue that a fire-killed forest is a natural setting and therefore is visually pleasing; others will argue that a fire-killed forest is inherently unattractive from a scenic perspective. From a strictly recreational perspective, the ID team assumed that the dense, green and shady forest that existed before the fire is the preferably setting. The fire has changed this condition in many places and from a scenic perspective it does not meet the desired condition, whether the area is salvaged to provide for safety and reduce fire risk or not. The fact remains that 20 years from now, if no fire-killed trees are cut and removed, the area will contain a relatively small number of still visible standing snags and likely a dense stand of young trees about 20 feet tall. In that case it would look little different than a harvested area of similar age.

Since the Forest Plan guidelines imply that partial retention or retention foreground area would need to have some green trees to remain in such a classification, it seems that the existing condition would best be characterized as Modification (See WNFP FEIS, pages III-112 to 114) as a result of the fire, and regardless of which alternative might be selected.

Environmental Consequences by Alternatives

Since there does not seem to be a consensus on how scenic resources are perceived to be affected by stand-replacement fire (see the discussion above), and because the reason the Fall Creek area was identified a Special Interest Area is recreational opportunities (WNFP, page III-163), the Fall Creek Interdisciplinary Team has determined that the fire has had a negative effect on scenic conditions that is little changed by the limited felling and/or removal of fire-killed trees proposed under any of the action alternatives. This determination was made in consideration that the Fall Creek area is renowned for its old-growth characteristics and recreational activities and general aesthetic appreciation are generally not facilitated by a forest of dead trees. While there is certainly habitat, scientific, and intellectual value in a dead forest, it does not typically meet most people’s expectations in terms of providing a closed canopy, forested recreational experience. High mortality forests are defined as those with greater than 50 percent of the overstory killed. For those Alternatives that propose to remove fire-killed trees and hence

generate money that can be used for reforestation, such planting would only occur in stands with greater than 50 percent mortality as stand with less mortality is already adequately reforested.

Scenic impacts of the proposed tree felling and/or log removal proposed in the action Alternatives would be mitigated by flush-cutting of stumps within 25 feet of roads and trails, retention of scattered dead trees for wildlife habitat if they do not pose a safety hazard within the guidelines of a given alternative, reforestation and re-vegetation of disturbed ground, and retention of green trees.

Evaluation criteria:

- Acreage of high mortality areas reforested,
- Years to establish 10’ to 20’ tall forest conditions,
- Change in acres of seral conditions,
- Change in acres of late-successional forest habitat in the LSR

Direct and Indirect Effects

There would be some short-term detrimental scenic effects in implementation of all action alternatives that remove felled trees. Tree removal would disturb the herbaceous and shrubby ground vegetation that has recovered since the fire. These effects would be short-lived; the herbaceous vegetation can be expected to return to post-activity levels within six months or less. Slash disposal would also cause some short-term effects, in particular creation and burning of piles. Alternatives that fall significant numbers of hazard trees (such as B and C) with minimum slash disposal would potentially create long-term detrimental scenic conditions to the extent that people would consider large accumulations of forest fuels and woody debris unattractive.

Hazard tree falling and more directly yarding of felled trees could potentially damage and/or kill the few natural conifer seedlings that have become established.

The following table displays the effects of the alternatives on seral conditions in the project area.

Table 28. – Summary of Seral Conditions by Alternatives

Seral Conditions	Pre-fire Conditions (acres)	Post-fire Conditions Alt A No Action (acres)	Alt B (acres)		Alt C (acres)		Alt D (acres)		Alt E (acres)	
			Area Not affected	Reduced Dead Wood						
Old-growth	479	301	255	46	242	59	212	89	167	134
Mature	165	104	97	7	98	6	86	18	73	31
Stem Exclusion	38	23	23	0	22	1	21	2	20	3
Stand Initiation	59	296	234	62	221	75	156	140	136	160
Special Habitats	23	40	40	0	40	0	40	0	40	0
Totals	764	764	649	115	623	141	515	249	436	328

Hazard tree removal and salvage operations associated with the action alternatives would not change the acreages of seral conditions within the project area. This is based on the assumption that if a stand has been converted by a high intensity (80-100% mortality) stand replacing fire to an early-seral condition and an alternative removes hazard trees or salvages dead trees, then the seral conditions does not change except for a decrease in the amount of dead wood structural components of the stand. If a stand had a

moderate intensity (40-60% mortality) partial-burn fire and an alternative removes hazardous trees and salvages dead trees from the stand, then the seral condition does not change because the stand still has approximately 50% of the green, live trees and is considered to be the original seral condition. The alternatives do not propose cutting any live, healthy, green trees and therefore, would not change the seral conditions. However, the removal of standing dead trees alters the amount of dead wood structural components associated with the seral conditions. Reducing the amount of dead wood structure may have direct impacts to wildlife that depend on this type of habitat such as primary cavity excavators. For the effects of reduced dead wood structural components on wildlife, see page 121, Snags and Coarse Woody Debris Habitat.

Alternative A – No Action

This alternative would provide for no reforestation of high mortality areas. Given the rather poor conifer seed crop the year of the Clark fire, there are very few natural conifer seedlings that have become naturally established. The forbs and hardwoods that have become established since the fire, in particular re-sprouting hardwood trees and shrubs, have formed a fairly dense understory layer of vegetation that is already competing with the few one year old conifer seedlings. Lack of managed reforestation under this alternative could delay the establishment of fully forested conditions for 30 to 50 years. Where seed trees are scarce, it may take 100 years or more for Douglas-fir to restock the extensive burned area (Spies and Franklin, 1988)

The no action alternative would have no effect to the seral conditions. This alternative would also have no effect on the amount of dead wood structural components associated with each seral condition. No removal of hazardous trees or salvage of dead trees would take place in this alternative.

The No Action alternative would have no effect to the habitat in the LSR. The no action would also have no effect on the amount of dead wood structural components associated with each seral condition. No removal of hazardous trees or salvage of dead trees would take place.

Alternative B

This alternative would not provide for reforestation of high mortality forest. This alternative was designed to rely on natural regeneration to re-establish the forest conditions. Given the uncertainty of factors that affect natural regeneration, it is estimated these areas would develop 10 to 20 foot tall trees within 30 and 50 years after the fire.

Alternative B would have no effect to seral conditions. Alternative B would reduce the dead wood structural components on 46 acres of old-growth and 7 acres of mature which had been partially burned, and 62 acres of early-seral condition which had been severely burned with a stand-replacing fire.

Alternative B would have no effect to late-successional conditions in the LSR. Alternative B would reduce the dead wood structural components on about 20 acres along the trails and dispersed recreation sites, and 8 acres along the FS Road #1800 west of the Johnny Creek Bridge.

Alternative C

This alternative would provide for reforestation of about 436 acres of high mortality forest. Once planted, these areas should develop 10 to 20 foot tall trees within 15 and 25 years after the fire.

Alternative C would have no effect on seral conditions. Alternative C would reduce the dead wood structural components on 59 acres of old-growth, 6 acres of mature, and 1 acre of young which had been partially burned, and 75 acres of early-seral condition which had been severely burned with a stand-replacing fire.

Alternative C would have no effect to late-successional conditions in the LSR. Alternative C would reduce the dead wood structural components on around 1 dispersed recreation sites, and 8 acres along the FS Road #1800 west of the Johnny Creek Bridge.

Alternative D

This alternative would provide for reforestation of about 436 acres of high mortality forest. Once planted, these areas should develop 10 to 20 foot tall trees within 15 and 25 years after the fire.

Alternative D would have no effect on seral conditions. Alternative D would reduce the dead wood structural components on 89 acres of old-growth, 18 acres of mature, and 2 acres of young which had been partially burned, and 140 acres of early-seral condition which been severely burned with a stand replacing fire.

Alternative D would have no effect to late-successional conditions in the LSR. Alternative D would reduce the dead wood structural components on about 38 acres along the trails and dispersed recreation sites, 8 acres along the FS Road #1800 west of the Johnny Creek Bridge, and 7 acres along FS Road 1800-419.

Alternative E

This alternative would provide for reforestation of about 436 acres of high mortality forest. Once planted, these areas should develop 10 to 20 foot tall trees within 15 and 25 years after the fire.

Alternative E would have no effect on seral conditions. Alternative B would reduce the dead wood structural components on 134 acres of old-growth, 31 acres of mature, and 3 acres of young which had been partially burned, and 160 acres of early-seral condition which been severely burned with a stand replacing fire.

Alternative E would have no effect to late-successional conditions in the LSR. Alternative E would reduce the dead wood structural components on about 112 acres along the trails, 4 acres around dispersed recreation sites, and 8 acres along the FS Road #1800 west of the Johnny Creek Bridge.

Cumulative Effects to Scenic Conditions

The cumulative effects were evaluated at two analysis area scales: 1) the entire Fall Creek Special Interest Area Management Area; and 2) the entire scenic viewshed in the Fall Creek watershed. All past, present, and foreseeable future actions were analyzed (see Appendix B). The analysis looked at past actions within the last twenty years because this is the time period it takes for vegetation to scenically recover. Foreseeable future actions were addressed over the next ten years, as few activities beyond that time period can be predicted or estimated.

The Special Interest Area (MA – 5A) in Fall Creek was in a completely recovered condition as defined by Visual Quality Objective of Retention before the Clark Fire and Puma Fire. No past harvest activities have occurred in the SIA. Approximately 167 acres (17 percent) of the Special Interest Area (981) acre area is now considered to be visually un-recovered as a result of the Clark and Puma fires. There would be no cumulatively effects to the scenic conditions of the Special Interest Area because the four proposed action alternatives would not change the status of the visually un-recovered area in the project area, and there are no foreseeable future actions that would change the scenic conditions of this area.

The entire scenic viewshed for the Fall Creek watershed (including all management areas occurring within the area potentially seen from Fall Creek and Road #1800 currently has 7 percent of its area in scenically un-recovered lands, primarily as a result of past wildfire occurrence. Prior to the Clark fire, the viewshed had 2 percent of its area in scenically un-recovered lands, primarily as a result of even-aged timber harvest. There would be no cumulatively effects to the scenic conditions of the viewshed

because the four proposed action alternatives would not affect the percentage of scenically un-recovered lands, and there are no foreseeable future actions that would change the scenic conditions of this area.

Forest Plan Standards and Guidelines for amount of scenic un-recovered lands range from ten to 20 percent of the viewshed, depending upon the specific scenic allocations within the area (MA-11c-08, MA-11d-16, MA-11e-11, MA-11f-16; WNFPP pages IV-206, 209, 212, and 215). All of the alternatives would meet these Standards and Guidelines.

Future management actions, or more likely natural occurrences (as in wildfire) could have an effect on conifer seedling establishment times, but these are not reasonable foreseeable (in that it is unknown how large an area, or exactly where such occurrences would be).

Cumulative Effects to Seral Conditions in the Fall Creek Watershed

The cumulative effects analysis for seral conditions evaluated the past, present and foreseeable future actions for the entire 5th field Fall Creek watershed. Appendix B provides a complete listing of the past, present and foreseeable future actions for the watershed. The last six decades of timber management and the harvest practice of clearcutting has converted over 46% of the late-successional forest to young plantations in the stand initiation and stem exclusion seral conditions. Present and foreseeable future actions in the watershed are focused on stand density management and commercial thinning of these young managed plantations. Stand density management and commercial thinning do not change the status of seral conditions, but accelerates the growth of stand characteristics which moves the stands along successional pathways.

The alternatives would have no cumulative effect to seral conditions in the watershed because the proposed treatments do not convert stands to another seral condition. The alternatives would affect the rate of recovery. The alternatives would also affect the amount of dead wood structural components of these seral conditions (refer to Snags and Coarse Woody Debris Habitat cumulative effects). Alternative A – No Action and Alternative B would delay the rate of recovery by relying on natural regeneration. Alternative C, D and E would plant 436 acres of conifer seedlings to speed the recovery. Alternative B would fall and leave dead hazard trees of 115 acres which represents 0.15% of the watershed. Alternative C would fall dead hazard trees and salvages a proportion of the dead wood structural components on 146 acres which represents 0.18% of the watershed. Alternative D would fall dead hazard trees and salvages a proportion of the dead wood structural components on 249 acres which represents 0.33% of the watershed. Alternative E would fall dead hazard trees and salvages a proportion of the dead wood structural components on 328 acres which represents 0.43% of the watershed.

Cumulative Effects to the Fall Creek Late Successional Reserve

The cumulative effects analysis for late-successional conditions was evaluated at the LSR analysis area. Appendix B provides a listing of the past, present and foreseeable future actions for the LSR in the watershed. Similar conditions exist in the LSR as in the watershed. Over the last six decades, past timber management and the harvest practice of clearcutting has converted over 51% of the late-successional forest to young plantations in the stand initiation and stem exclusion seral conditions. Present and foreseeable future actions in the watershed are focused on stand density management and commercial thinning of these young managed plantations. Stand density management and commercial thinning do not change the status of seral conditions, but accelerates the growth of stand characteristics which moves the stands along successional pathways.

The alternatives would have no cumulative effect to late-successional conditions in the LSR because the proposed treatments do not convert stands to another seral condition. The alternatives do affect the rate of recovery and the amount of dead wood structural components of these conditions (refer to Snags and

Coarse Woody Debris Habitat cumulative effects). All of the alternatives would not plant conifer seedlings in the LSR and would delay the rate of recovery by relying on natural regeneration. Alternative B would treat hazard trees on 25 acres in the LSR which represents 0.04% of the LSR. Alternative C would treat hazard trees on about 6 acres which represents 0.01% of the LSR. Alternative D treats hazards trees on about 50 acres which represents 0.08% of the LSR. Alternative E would treat hazards trees on about 121 acres which represents 0.19% of the LSR.

Threatened, Endangered and Sensitive Plant Species _____

Existing Condition

There are no plant species listed by the US Fish and Wildlife Service as Threatened or Endangered which occur in the project area or the Willamette National Forest.

A pre-field review was conducted to determine which sensitive species have historically been documented from within the Fall Creek watershed. Two extant and one historic population of *Cimicifuga elata*, tall bugbane, are known to occur within the Fall Creek corridor. A population of *Corydalis aqua-gelidae* is found at the headwaters of Saddleblanket Mountain, within the watershed but significantly upstream from the project area. Several populations of *Leptogium cyanescens*, a leafy lichen, are documented on bigleaf maples located in the vicinity of Gibraltar Mountain, northwest of the project area. *Romanzoffia thompsonii* is documented in several rock garden habitats north and east of the project area. And finally, a population of the sensitive lichen, *Usnea longissima*, is documented from the Regional Survey and Manage surveys conducted in the winter of 2002. And finally, *Ramaria largentii*, a coral fungus, is documented from a Current Vegetation Survey (CVS) plot located in the upper part of the Hehe sub-watershed, north of the project area.

Several special habitats that provide potential habitat for sensitive plant species occur within the project area. A large ash swamp occurs west of Road #1821. A ponded area occurs associated with old meandering channels from Fall Creek east of Road #1821. And two rock gardens occur in the project area, both north of Fall Creek. One is east of Slick Creek and the other is east of the rock quarry on Road #1800-419.

Table 29 displays the results of pre-field review, the level of field survey performed (if applicable), and the results of the surveys

Table 29: Summary of Survey Results of Botanical Species with Potential Habitat in Project Area

Species	Pre-field Review	Field Recon.	Survey Results
<i>Asplenium septentrionale</i>	habitat present	Rock gardens	Not found
<i>Boletus pulcherrimus</i>	habitat present	No survey	MIIH
<i>Botrychium minganense</i>	habitat present	Cedar forested wetlands	Not found
<i>Botrychium montanum</i>	habitat present	Cedar forested wetlands	Not found
<i>Carex livida</i>	habitat present	Ash swamp	Not found
<i>Chaenotheca subroscida</i>	habitat present	Old conifer boles	Not found

Species	Pre-field Review	Field Recon.	Survey Results
<i>Cimicifuga elata</i>	habitat present	North facing slopes with maple/POMU	Not found
<i>Cordyceps capitata</i>	habitat present	No survey	MIIH
<i>Cortinarius barlowensis</i>	habitat present	No survey	MIIH
<i>Corydalis aqua-gelidae</i>	habitat present	Riparian	Not found
<i>Cudonia monticola</i>	habitat present	No survey	
<i>Dermatocarpon luridum</i>	habitat present	Riparian	Not found
<i>Eucephalis(Aster) vialis</i>	habitat present	Rock gardens	Not found
<i>Gyromitra californica</i>	habitat present	No survey	
<i>Hypogymnia duplicata</i>	habitat present	Bark and wood of conifers	Not found
<i>Iliamna latibracteata</i>	habitat present	Forest and streams	Not found
<i>Leptogium burnetiae</i> var. <i>hirsutum</i>	Habitat present	Forest	Not found
<i>Leptogium cyanescens</i>	habitat present	Forest, esp. bigleaf maple	Not found
<i>Leucogaster citrinus</i>	habitat present	No survey	
<i>Lewisia columbiana</i> var. <i>columbiana</i>	habitat present	Rock gardens	Not found
<i>Lobaria linita</i>	habitat present	Rock gardens	Not found
<i>Lupinus sulphureus</i> var. <i>kincaidii</i>	habitat present	Dry rock gardens	Not found
<i>Montia howellii</i>	habitat present	Riparian, parking areas	Not found
<i>Nephroma occultum</i>	habitat present	Live forested stands	Not found
<i>Ophioglossum pusillum</i>	habitat present	Pond	Not found
<i>Pannaria rubiginosa</i>	habitat present	Forest	Not found
<i>Pellaea andromedaefolia</i>	habitat present	Rock gardens	Not found
<i>Peltigera neckeri</i>	habitat present	Forest	Not found
<i>Peltigera pacifica</i>	habitat present	Forest	Not found
<i>Phaeocollybia attenuata</i>	habitat present	No survey	
<i>Phaeocollybia dissiliens</i>	habitat present	No survey	
<i>Phaeocollybia pseudofestiva</i>	habitat present	No survey	
<i>Phaeocollybia sipei</i>	habitat present	No survey	

Species	Pre-field Review	Field Recon.	Survey Results
<i>Polystichum californicum</i>	habitat present	Rock gardens	Not found
<i>Pseudocyphellaria rainierensis</i>	habitat present	Forest	Not found
<i>Ramalina pollinaria</i>	habitat present	Ash swamp, forest	Not found
<i>Ramaria amyloidea</i>	habitat present	No survey	
<i>Ramaria aurantiisiccescens</i>	habitat present	No survey	
<i>Ramaria gelatiniaurantia</i>	habitat present	No survey	
<i>Ramaria largentii</i>	habitat present	No survey	
<i>Romanzoffia thompsonii</i>	habitat present	Rock gardens	Not found
<i>Scirpus subterminalis</i>	habitat present	Pond	Not found
<i>Sowerbyella rhenana</i>	habitat present	No survey	
<i>Tetraphis geniculata</i>	habitat present	Forest	Not found
<i>Usnea longissima</i>	habitat present	Forest	Documented NE of quarry in LSR
<i>Wolffia borealis</i>	habitat present	Pond	Not found
<i>Wolffia columbiana</i>	habitat present	Pond	Not found

MIIH = May impact individuals or habitat but will not lead to a trend toward listing.

A Biological Evaluations (BE) (Lippert, 2004) was conducted for all TE&S plants within the projects area. In areas where pre-field review identified potential habitat, intuitive controlled field surveys were conducted throughout the project area in the summer of 2004. Surveys were conducted for lichens, bryophytes, and vascular plants. No additional sensitive species were documented during surveys in the project area. The BE includes the complete list of TE&S species reviewed including those species determined not to have habitat within the project area.

Surveys were not conducted for fungi because single pre-disturbance surveys for these species have been deemed impractical (USDA, USDI, 1998b; USDA, USDI, 2000b; USDA, USDI, 2004a). All fungi except *Bridgeoporus nobilissimus*, which is a perennial conk, were formerly Category B Survey and Manage Species (rare but pre-disturbance surveys impractical). According to the 2004 Record of Decision to Remove or Modify the Survey and Manage Mitigation Measures Standards and Guidelines, “if pre-disturbance surveys are not practical under the Survey and Manage Standards and Guidelines... then field surveys are not likely to occur for special status (sensitive) species either.”

In general, the fungi species on the Willamette National Forest sensitive species list that have come from Survey and Manage are limited in distribution and their habitats are poorly understood (i.e. there are very general habitat characteristics listed in the literature). Therefore, the table above includes the majority of fungi as having potential habitat within the project area.

Management Direction

The standards and guidelines (FW-156 and FW-157) of the Forest Plan as amended reiterate the legal requirements for the completion of Biological Evaluations to determine the possible effects the proposed activities would have on threatened, endangered, or sensitive species and the consultation requirements

of the Endangered Species Act (ESA)(Public Law 93-205) if any of the species are found in the project area.

The recent Record of Decision to Remove or Modify the Survey and Manage Mitigation Measure Standards and Guidelines (USDA and USDI, 2004a) directed review and inclusion of former survey and manage species in the Special Status Species Program. The ROD further directs the Forest to conduct pre-project clearances for these species prior to habitat-disturbing activities. Assumptions were made that “if pre-project surveys were not practical under Survey and Manage Standards and Guidelines (most Category B and D species), then field surveys are not likely to occur for Special Status Species either” (p. 6). Therefore, the ROD directs us that habitat evaluation for presence of suitable or potential habitat and habitat examinations may suffice for pre-project clearances for species where single year surveys are impractical (for the Willamette this means fungi).

To comply with the 2004 ROD, a new Regional Forester’s Sensitive Plant list was issued in July 2004. The lists includes both vascular plant species from the 1999 Regional Forester’s Sensitive Plant list and nonvascular former survey and manage species that meet the criteria for sensitive species. The latter list includes fungi, bryophytes and lichens.

Environmental Consequences by Alternatives

Direct and Indirect Effects

There would be no hazard tree reduction or fire salvage, in any of the alternatives, which would be in the area near the rock gardens on the north side of the project area or near the *Usnea longissima* population. Therefore, there would be no effect to this species.

No lichens, bryophytes or vascular plants were detected during surveys, so there would be no known effects to those species that were surveyed.

The impacts to fungi are described in terms of fungus functional group (mycorrhizal, saprophytic on litter, saprophytic on wood). Since the parasitic *Cordyceps* is dependent on a mycorrhizal fungus for its survival, effects for parasitic fungi will be lumped with mycorrhizal.

For the mycorrhizal and saprophytic wood fungi, effects were categorized as may impact individuals or habitat (MIIH) but would not lead to a trend toward listing for all alternatives. Although both Alternative A- No Action and B propose no salvage activities, they lack significant amounts of fuel reduction activities. According to fuels models, this would lead to much higher fire intensities on the forest floor in the future. This could translate into a direct adverse effect on soil mycelia (adverse effect on mycorrhizal fungi) and downed wood that could be a refuge for wood saprophytes, especially those located where fuel concentrations are heavy. A lack of broad scale fuels treatments could mean that there are greater amounts of substrate for saprophytes on litter, so there could be a beneficial short-term impact for these species.

The three action alternatives C, D, and E propose yarding that disturbs the ground, may impact individual or habitat but would not cause a trend toward listing for all fungus groups. Alternatives C, D and E call for 64, 78 and 76 acres of loader yarding and building 300 feet of temporary spur that could result in short term adverse effects on mycorrhizal, saprophytic or parasitic fungi. The direct effect would be disruption of mycelia network or substrate (wood, litter) where machinery used to harvest and build the road would churn up the soil. There may also be some localized direct effects to mycelia or wood/litter substrate from pile burning. Because salvage would be of dead trees only, there should be no indirect effect of host-tree connection disruption.

On the south side of Fall Creek, all action alternatives (B, C, D, and E) would buffer the pond and ash swale on either side of Road #1821. Under Alternatives B and C, the Riparian Reserves would not be salvaged so these special habitats would be buffered by a no cut 200' zone. These buffers would meet the recommendations outlined in the Special Habitat Management Guide (Dimling and McCain, 1996). Under Alternatives D and E, these special habitats would be partially buffered with a no cut 100 feet zone, as some salvage is prescribed in the Riparian Reserves under these alternatives. These buffers are smaller than recommended, but since the trees are dead, their function in maintaining hydrology, solar exposure and humidity (the functions of a buffer) is compromised.

Table 30 – Summary of Effects Determination

Species/Functional Group	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
<i>Asplenium septentrionale</i>	NI	NI	NI	NI	NI
<i>Botrychium minganense</i>	NI	NI	NI	NI	NI
<i>Botrychium montanum</i>	NI	NI	NI	NI	NI
<i>Cimicifuga elata</i>	NI	NI	NI	NI	NI
<i>Corydalis aqua-gelidae</i>	NI	NI	NI	NI	NI
<i>Dermatocarpon luridum</i>	NI	NI	NI	NI	NI
<i>Eucephalis(Aster) vialis</i>	NI	NI	NI	NI	NI
<i>Frasera umpquaensis</i>	NI	NI	NI	NI	NI
<i>Gentiana newberryi</i>	NI	NI	NI	NI	NI
<i>Hypogymnia duplicata</i>	NI	NI	NI	NI	NI
<i>Iliamna latibracteata</i>	NI	NI	NI	NI	NI
<i>Lewisia columbiana</i> not present var. <i>columbiana</i>	NI	NI	NI	NI	NI
<i>Leptogium cyanescens</i>	NI	NI	NI	NI	NI
<i>Leptogium burnetiae</i>	NI	NI	NI	NI	NI
<i>Lupinus sulphureus</i> var. <i>kincaidii</i>	NI	NI	NI	NI	NI
Mycorrhizal Fungi	NI	MIIH	MIIH	MIIH	MIIH
<i>Nephroma occultum</i>	NI	NI	NI	NI	NI
<i>Montia howellii</i>	NI	NI	NI	NI	NI
<i>Ophioglossum pusillum</i>	NI	NI	NI	NI	NI
<i>Pannaria rubiginosa</i>	NI	NI	NI	NI	NI
<i>Pellaea andromedaefolia</i>	NI	NI	NI	NI	NI
<i>Polystichum californicum</i>	NI	NI	NI	NI	NI
<i>Peltigera neckeri</i>	NI	NI	NI	NI	NI
<i>Peltigera pacifica</i>	NI	NI	NI	NI	NI
<i>Pseudocyphellaria rainierensis</i>	NI	NI	NI	NI	NI

Species/Functional Group	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
<i>Rhizomnium nudum</i>	NI	NI	NI	NI	NI
<i>Romanzoffia thompsonii</i>	NI	NI	NI	NI	NI
Saprophytic on Litter	NI	BI	BI	MIIH	MIIH
Saprophytic on Wood	NI	MIIH	MIIH	MIIH	MIIH
<i>Scouleria marginata</i>	NI	NI	NI	NI	NI
<i>Tetraphis geniculate</i>	NI	NI	NI	NI	NI
<i>Usnea longissima</i>	NI	NI	NI	NI	NI

NI = No Impact

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

BI = Beneficial Impact

Cumulative Effects

Cumulative effects were analyzed at the Fall Creek 5th field watershed scale. Past, present, and foreseeable future action for the watershed are summarized in Appendix B.

Cumulative impacts to the fungi in the Fall Creek watershed come from several past, present, and future foreseeable projects: Puma Hazard Tree Removal Project, Bedrock Campground Restoration Project, Clark Fire Roadside Salvage, Boundary Thin Project EA, Clark Project, and the Hehe Thin Project. The effects of Clark and Puma wildfires can be considered an integral part of fungi ecology. The salvage projects have occurred to keep hazard trees from falling on to roads or in campgrounds. These projects have localized impacts, and again only remove dead trees (no longer hosts for mycorrhizal fungi). The thinning sales that are taking place would retain some suitable host trees for mycorrhizal fungi and litter saprobes, and are required to maintain coarse woody debris to Northwest Forest Plan standards to provide long-term hosts for wood saprophytes.

The scale of the cumulative impacts of the proposed alternatives is small (representing < 0.5% ranging from 0 acre in Alternative A to 328 acre in Alternative E) in relation to the Fall Creek watershed. The upper 2/3 of the watershed is covered by the 65,928 acre Fall Creek Late Successional Reserve (LSR). This LSR contains abundant suitable habitat for sensitive species, especially those associated with old-growth. LSR habitat has been also disturbed by the Clark Fire. The Clark Fire disturbed about 8% of the LSR habitat. Alternative A and B propose no removal of dead trees in the LSR, so would have no cumulative effect to LSR habitat. Alternative C, D, and E would disturb and effect an additional <0.2% of LSR habitat from the removal of isolated dead hazard trees along the Fall Creek Trail and dispersed recreation sites for public safety.

Thus, there is no alternative that would cause any of the sensitive species with the potential to occur in the project area to cause a loss in viability or contribute to a trend toward listing.

Noxious Weeds

Noxious Weeds - *Analysis Issue*

Fire restoration activities (including falling and removal of hazard trees, timber haul, project-related access, and road work) have the potential to spread noxious weeds that occur throughout the area. One aggressive non-native grass, false brome (*Brachypodium sylvaticum*), is located in the vicinity of the fire area. This perennial grass has the potential to invade the fire area and form large colonies and may choke out tree seedlings and native plant communities. Established species such as evergreen and Himalayan blackberries (*Rubus laciniatus* and *R. discolor*) and Scot's broom (*Cytisus scoparius*) are also a concern with abundant populations present within the watershed. Continued vehicle access, project activities, and ground disturbance in the fire area may contribute to the spread of these and other noxious weeds. The spread of noxious weeds displaces native plants that may affect biotic communities.

Existing Conditions

False brome is found throughout the watershed, mainly along road ditches and shoulders according to the noxious weed surveys completed in 2003 and 2004. Large populations are found by the Fall Creek Reservoir, along Road #1800, on Army Corps of Engineers and Lane County land. Isolated patches have been documented along Road #1800 on Forest Service land, during the surveys in 2003 for an adjacent planning area (Hehe Thin). Those populations were sprayed in the summer of 2004. By late summer, no evidence of green plants of this former population existed. Surveys are scheduled in 2005 to continue monitoring the effectiveness of the treatment.

A very dense population of false brome is found on the Road #1800-190 and current haul from the Borderline Thin timber sale units located uphill from the project area is likely contributing to its spread. Field surveys in August 2004 documented movement of this species from the road shoulder up cutbanks into thinned timber stands. Several small clumps were also found along the Road #1821 road.

As previously mentioned, many new invader species are found along road shoulders within the project area. Several other invasive species of concern are found along the roads including wild carrot (*Daucus carota*), foxglove (*Digitalis purpurea*), wild lettuce (*Lactuca muralis*), plantago (*Plantago lanceolata*) and dandelion (*Hypochaeris radicata*).

Management Direction

The policy for noxious weed management is encompassed in several standards and guidelines from the Willamette Forest Plan and the Integrated weeds Management Environmental Assessment written in 1999. The priority for treatment is new invaders and, depending on relationship to riparian areas and high human use areas, many treatments are allowed along roads including manual control, mowing, chemical control, competitive planting. By and large, biological controls are used on established weed infestations unless they are threatening a unique feature such as Wilderness, Riparian Reserves or meadow habitats.

Environmental Consequences by Alternatives

Evaluation Criteria

- Acres of ground disturbance

Direct and Indirect Effects

Alternatives A

The No Action alternative would have no direct, indirect effects on noxious weed populations because no additional ground disturbing activities are proposed (Table 30). Appropriated noxious weed program dollars would be used to treat the incidental introductions of *Brachypodium* in this corridor because it is a high priority for the Forest.

Alternative B

This alternative proposes to conduct some ground-disturbing activities: routine maintenance on roads and replacement of six culverts (Table 30). Direct effects would be movement of weed seed up and down road systems by road maintenance equipment. Indirect effects would include opening up optimal habitat for weeds to move in. Mitigation measures (see Chapter 2 – Mitigation Common to All Alternatives – Noxious Weeds) would help limit the spread of false brome (as well as other weed species).

Alternatives C, D and E

Similar amounts of ground disturbance are proposed in each of these alternatives (Table 30). A portion of felled hazard trees would be ground based yarded with a loader adjacent to Road #1800 and slash would be piled with a grapple machine. Direct effects would be movement of seed in the soil by equipment. Indirect effects would be opening up large areas of bare soil for weeds to colonize.

Table 30 - Noxious Weed Disturbance by Alternative

Alternative	Disturbance
A- No Action	No new roads or improvements
B	No new roads 0.1 miles of brush, blade, ditch cleaning 6 culverts replaced 18 acres grapple piling
C	300' temp spur 64 acres loader yarding 3.8 miles of road work 6 culverts replaced 33 acres grapple piling
D	300' temp spur 78 acres loader yarding 4.2 miles of road work 6 culverts replaced 44 acres grapple piling
E	300' temp spur 76 acres loader yarding 4.2 miles of road work 6 culverts replaced 44 acres of grapple piling

Cumulative Effects

The cumulative effect of noxious weeds was analyzed on the Fall Creek 5th field watershed because the Forest Service Road #1800 system which serves the watershed is the route along which infestations are moving. Past, present, and foreseeable future action for the watershed are summarized in Appendix B. There have been several roadside projects along Road #1800 in the recent past which include the Clark Fire Roadside Salvage, Bedrock Campground Restoration Project, and the Puma Hazard Tree Removal Project. These projects included mitigation measures such as seeding with native blue wildrye grass following tree removal and monitoring of infestations following treatments. As mentioned above, *Brachypodium* (false brome) in the Fall Creek drainage is a priority for Forest appropriated noxious weed treatment dollars, so spraying of weed infestations has continued when monitoring documents new localized populations.

No additional cumulative effects are anticipated under Alternative A – No Action because no ground disturbing activities are proposed. For Alternative B, the cumulative effect on weeds would be to increase potential habitat in the grapple piling and culvert pulling areas. Because these would be very small (< 0.06% of the watershed), site-specific disturbances, increases in weed densities are not predicted, given the mitigating measures.

The amount of disturbance in Alternative C, D, and E would be greater than Alternative B. These three alternatives include ground-disturbing activities (road maintenance, culvert replacement, yarding, grapple piling and temporary spur road construction) which would increase the overall amount of area infested because more area would be disturbed. Of particular concern are road systems that would be used for transport that contain false brome as it has been theorized that vehicular traffic facilitates movement of weed seed up and down road systems by moving seed caught in mud on vehicle undercarriages. The use of loader yarding in these three alternatives means that there would be a lot more traffic along infested roads. Along with opening soil to weed seed, the new temporary spur proposed under these three alternatives could potentially bring in new weeds with contaminated gravel.

With the use of mitigating measures, including a thorough post-treatment monitoring (at least 2 years) and program of spot-spraying of new, localized infestations should enable the Forest to maintain its desired future condition of eradication of false brome within the Forest Service boundary, mitigating cumulative effects.

Wildlife

Snags and CWD Habitat - *Analysis Issue*

The ecological significance of dead and decaying wood is becoming more and more evident in conifer forests of the Pacific Northwest. Large accumulations of snag and CWD provide wildlife habitat and influence basic ecosystem processes such as soil development and productivity, nutrient recycling, providing within stream structure. The Clark fire burned with various intensities but left a fairly significant area of higher mortality within the planning area boundary. Removal or treatment of a portion of this burned material may impact availability of snag and CWD habitat for species dependent on these habitat components.

Existing Condition

In the Westside lowlands conifer-hardwood forest, western Oregon Cascades habitat type 65 bird and mammal species are known to use snags for nesting or shelter and 65 vertebrate species make use of downed logs (Mellen et. al, 2003). Primary cavity excavators, such as woodpeckers, sapsuckers, and flickers are forest dwelling birds that are specialized for nesting and foraging in decayed wood. They require trees with rotted heartwood for excavating nest holes and use both snags and down logs for foraging.

The Forest Plan identifies the Pileated Woodpecker and the primary cavity excavator group as management indicator species (MIS) for the availability and quality of dead and defective wood habitat. The primary cavity excavators identified in the Forest Plan include Lewis' woodpecker, downy Woodpecker, hairy Woodpecker, northern three-toed woodpecker, black-backed woodpecker, Northern Flicker, red-breasted sapsuckers, and red-breasted nuthatch. Northern three-toed and black-backed woodpeckers are not likely to be found in the project area; they prefer forests especially burned areas over 4000' in elevation. Red-breasted nuthatches are fairly common in coniferous forests, but likely make little use of burned areas. By providing habitat for the other primary cavity excavators, habitat is provided for many other dead wood dependent species as well.

Primary cavity excavators use burned forest habitats and green forest habitats differently. Tree canopy cover, understory shrub and grass cover, and snag numbers and qualities are all different. Snag habitats in post-fire environments are unique for several reasons: 1) early post-fire forests and associated insect outbreaks result in a rapid increase in nest sites and food supplies, 2) initially, most of the new snags are "hard" snags consisting of sound sapwood that may delay use by species that prefer "soft" snags, 3) many woodpecker species appear to respond positively to burned habitats, with some species using them as source habitats, and 4) fires leave few or no green trees for future snag replacements.

Among the management indicator species, the hairy woodpecker, Lewis' woodpecker and northern flicker are strongly associated with post-fire habitats whereas the pileated woodpecker, downy woodpecker, and red-breasted sapsucker have much lower associations (Saab & Dudley, 1997; Hutto, 1995; Sallabanks, 1995). Pileated woodpeckers are capable of utilize snag patches created by fire but need green forest for nesting. Little information is available concerning the use of burned areas by chickadees; it is likely that they would only use lightly burned areas since they are foliage feeders (Hutto, 1995).

The large numbers of snags created by a fire provide relatively unlimited nesting and foraging sites and probably contribute to good nest success and high productivity. Species are likely only limited by other

habitat components such as territory size, canopy cover, and snag properties (i.e. hard snags versus soft snags).

Fire-hardened snags and non-fire hardened snags or soft snags provide different niches for various woodpecker species. Some opportunistic birds, such as hairy woodpeckers, are capable of excavating nests in harder trees; other species, such as Lewis’ woodpecker and the northern flicker, require softer snags for excavating nest sites (Raphael & White, 1984). Initially in burned areas, snags are primarily fire-hardened snags. Eventually, fire-killed trees that were previously sound soften with decay introduced by the multitude of insects that colonize dead and dying trees following a burn. Consequently, various woodpecker species may re-invade post-fire habitats in a series of waves, although there is certainly considerable overlap in use periods.

A key to understanding snag dynamics following fire is to know something about the longevity of snags. Many variables factor into the longevity of snags: condition of the tree before it died, cause of death, soil type, climate, extreme weather conditions, protection of snags by topography or other vegetation, tree species, snag height, and snag diameter. Morrison & Raphael (1993) found that snags created by fire decayed rapidly and fell quicker than those on unburned forests, and that large snags had greater longevity than smaller snags.

In an unburned forest, enough snags are left to provide for 100 percent potential populations, and enough live trees, of various sizes, are left to become snags in the future, ensuring that snag habitat is provided over time. In areas where fire burned severely and killed all or nearly all trees, there are few live, green trees left to become snags in the future. Few snags would be available again until a new forest develops, trees reach sizes useful for woodpeckers, and these trees begin to die.

The Fall Creek WA did a rough analysis on estimated snag levels within the 5th field watershed as well as the various 6th field sub-watersheds. The Clark Fire occurred mostly within the Lower Fall Creek (Andy Creek) 6th field sub-watershed. This information was developed using local knowledge of stands in the watershed, past harvest history of managed stands, and recent wildlife tree retention requirements. The current estimated level in the Lower Fall Creek (Andy Creek) sub-watershed averages 1.7 snags per acre. The median snag level for the entire Fall Creek watershed averages 2.06 snags per acre. However, with approximately 63% of the watershed within the LSR should approximate snag densities closer to the levels that are recommended in the Willamette LSR Assessment (Tables 5 and 6).

The estimated snag levels from the WA show that the snag levels for the sub-watershed and the watershed are at the lower end of the scale compared to the snag densities from the Current Vegetation Survey (CVS) plots (Table: 31) and below the densities recommended by the LSRA and by DecAID (Table 34).

Table 31: Snag ranges by vegetation series. (LSRA, 1998; Data from CVS plots on Willamette NF.)

Western Hemlock Vegetation Series	Small (9-21’)	Medium (21-32’)	Large (32’’+)	Big snags (>20’’)
Mature	31-107	0-11	0-5	5-21
Old-Growth	25-57	5-16	5-27	13-42

Rose et. al. (2001) recommended that caution be exercised in using the regional plot data or inventory data to describe the estimated historical range of conditions in dead wood because it is a sample of only

current conditions and lack data on site history. Even if the plots in a 'natural' forest could be identified, snags and down wood have been altered to an unknown degree by fire suppression and other human influences (Rose et. al. 2001).

DecAID (Mellen et. al. 2003) cautions against using inventory data of post-fire conditions, because the plots sample conditions arising from a variety of disturbances, including but not limited to fire. The sample plots of older forest might represent at least some post-fire conditions; however, young forest stands originating after recent wildfire are not well represented because they are an extremely small portion of the current landscape. Conditions of stand origin, especially post-fire conditions, are pertinent for interpreting conditions for wildlife species such as black-backed woodpecker that use and select for dense clumps of snags in recent post-fire situations.

Additionally, recent research and published literature has shown that wildlife needs for snag and down wood habitat are significantly higher than what was suspected in the past (as displayed in Table 34).

Landscapes with long fire return intervals tend to experience stand replacing fires; creating pulses of snags in high densities over large areas. These variations in densities ranging from a few snags per acre to many snags per acre are to be expected (Mellen et al., 2003). Areas with high snag densities such as those created by this fire are important to such primary cavity excavators as black-backed woodpeckers. Large snag patches such as this one helps raise the overall snag levels of the watershed and the LSR. In order to maintain the higher level of snags it is important to retain as many snags as possible even where there are potential opportunities for salvage logging.

The Clark fire burned with various intensities but left a fairly significant area of higher mortality within the planning area boundary. Based on photographic analysis of crown mortality, a total of 1731 acres (35%) of the burned area has 60-100% crown mortality at the present time.

Vegetation plots were done in the LSR and SIA portions of the Clark Fire. Plots in upper Slick Creek of the LSR portion of the fire recorded snag densities ranging from 0-25 Douglas-fir snags per acre (spa) greater than 20" dbh, and 0-45 snags per acre (all species) greater than 10" dbh. Plots done in the SIA found snag densities averaging 58 per acre of the dominant conifers, Douglas-fir, western hemlock, and western red cedar. The mean diameter of the snags was 22.5". Overall, the fire area appears to have snags and down wood well in excess of Forest Plan standards.

The portion of the fire area that is not part of this project (approximately 4,200 acres) would have varying levels of snag densities that would provide habitat for the range of primary cavity excavators.

Stand exams done elsewhere in the watershed in stands similar to those in the SIA found an average of 4 snags per acre with a range of 0-15. These were conifer snags primarily Douglas-fir with some western hemlock and generally greater than 10" dbh.

Management Direction

The dominant goal for species management on federal land is to maintain at least viable populations of native species. One goal of the direction from resource management plans is to provide for the needs of species dependent upon snags or down wood, while meeting guidelines and management direction for reducing fuel hazards and the risk of large-scale, high intensity wildland fires, consistent with the natural role of fire and protection standards.

The following Standards and Guidelines in the Willamette Forest Plan provide direction for snags and down woody habitat:

- FW-122- Habitat capability for primary cavity excavators shall be maintained to provide for at least 40% or greater potential populations. Habitat shall be provided and monitored at the subdrainage level.
- FW-125- All timber harvest units shall provide snag habitat capable of supporting at least 20% or greater potential populations of cavity-nesting species.
- FW-128- Dead, defective, and live green trees retained for current snag habitat and future replacement snag habitat shall be greater than 18" DBH or the largest size available within the stand being treated.
- FW-130- Only snags in decay classes I, II or III and greater than 20' tall shall be counted toward meeting habitat requirements for cavity nesting species.
- FW-212- Prescriptions should be developed prior to timber harvest to identify the amount and distribution of downed wood to be left on site following timber harvest and fuel treatment. The amount prescribed should follow amounts shown in Table IV-29 in the Forest Plan Amendments.
- FW-212a- Individual pieces making up the total amount of lineal feet of downed wood prescribed for a site should be
 - 1) > 16" dia. (outside bark) on the small end
 - 2) > 10' long with at least 75% of total lineal feet > 20' long.
- FW-213- At least 50% of the total lineal feet should be in decay class 1. Remainder of material may be in decay classes 2 & 3. All decay class 4 & 5 material shall be left.
- FW-213a- At least one standing tree should be left as a potential source of downed wood.

The Northwest Forest Plan recognizes salvage as an acceptable management practice to avoid excessive amounts of coarse woody debris or reduce high risk of future stand replacement events (USFS, 1994b). The priority is to salvage where it would help attain late-successional characteristics, e.g. to speed stand regeneration (LSRA, p.132-7).

The Northwest Forest Plan provides additional direction on CWD and salvage activities in LSRs:

- Salvage should only occur in stands where disturbance has reduced canopy closure to less than 40%.
- Following stand replacement disturbance, management should focus on retaining snags that are likely to persist until late-successional conditions have developed and the new stand is again producing large snags.
- All standing live trees should be retained, including those injured but likely to survive.
- Following a stand replacing disturbance, management should retain adequate CWD quantities in the new stand so that in the future it would still contain amounts similar to naturally regenerated stands. Province level plans will establish appropriate levels of CWD and decay rates to be used.
- Where green trees, snags and logs are present following disturbance, the green-tree and snag guidelines will be applied first, and completely satisfied where possible. The biomass left in snags can be credited toward the amount of CWD biomass needed to achieve management goals.

Willamette Late Successional Reserve Assessment makes the following recommendations:

- Utilize the 4-step process for determining CWD retention levels in LSRs.
- In stands originally in the mature or old growth stages, leave hard CWD to within the ranges of similar stands.
- Fire risk at landscape and local scales will determine which end of the CWD ranges is appropriate. Table IV-7 in the LSRA shows fire risk criteria for CWD in salvage prescriptions.
- Table 32 and 33 below displays the LSRA CWD levels based of Table IV-7 in the LSRA.

Table 32: CWD Retention Levels recommended in the LSRA

	Mature		Old-Growth	
	Low Range	High Range	Low Range	High Range
Snags	15-35 ccf/ac	35-65 ccf/ac	40-55 ccf/ac	55-95 ccf/ac
Down Wood	10-20 ccf/ac	20-40 ccf/ac	20-30 ccf/ac	30-50 ccf/ac
Totals ccf/ac	25-55 ccf/ac	55-105 ccf/ac	60-85 ccf/ac	85-145 ccf/ac
Totals mbf/ac	13-29 mbf/ac	29-55 mbf/ac	31-44 mbf/ac	44-75 mbf/ac

Table 33: Number of snags and down logs needed to meet the levels recommended by LSRA.

	Low			Medium			High		
	CCF	Pieces ¹	TPA	CCF	Pieces ¹	TPA	CCF	Pieces ¹	TPA
Mature									
Snags²	15	7	3.5	40	19	9.5	65	31	15.5
Down Wood	10	5	2.5	25	12	6	40	19	9.5
Total	25	12	6	65	31	15.5	105	50	25
Old Growth									
Snags²	40	19	9.5	67.5	32	16	95	45	22.5
Down Wood	20	10	5	35	16	8	50	24	12
Total	60	29	14.5	102.5	48	24	145	69	34.5

1- Piece size = 30" diameter at large end and 60' long.

2- Snag size = 30" dbh and 120' tall.

To convert ccf to pieces divide by 213.17; the cubic feet in a log 30" diameter at large end and 60' long (Mid-Willamette LSR Assessment, Appendix F, p.5).

- Snags and logs must be in the large size class (for logs, >21" dia. large end; for snags, >21" dbh, > 16' height).
- All standing live trees are to be retained.
- Snags and down logs must be in size and decay classes likely to persist until the new stand is contributing large CWD.

- Biomass (cubic volume) left in snags can be credited as part of the total CWD levels.
- Note that for salvage prescriptions, soft CWD should not be removed.
- A mix of clumps and dispersed snags is desirable. If snag levels present following the disturbance do not meet the ranges, equivalent volumes of hard down wood will be added to the down wood retention levels to meet overall CWD needs.

Table 34: Comparison of Standards and Guidelines and Recommendations from Various Guidance Documents.

	Willamette Forest Plan & Northwest Forest Plan (Matrix S&G's)	Willamette LSRA		DecAID 80% Tolerance Level
		Mature Growth	... Old	
Snags	40 % Potential = 2 snags/ac ¹ .42 ccf/ac	4 - 16 tpa ⁵ 15-65 ccf/ac	10 - 22 tpa 40-95 ccf/ac	19-36 tpa > 10'' dbh 10-14 tpa > 20'' dbh ³ 10.3-15.3 ccf/ac
Down wood	240 lineal ft./ac 4 pieces/ac ² 3.8 ccf/ac	2.5 – 9.5 tpa ⁵ 10-40 ccf/ac	5 – 12 tpa ⁵ 20-50 ccf/ac	5-19% cover ⁴ 24.7-96.5 ccf/ac 26-102 pieces/ac
Total	4.22 ccf/ac	6 – 25 tpa ⁵ 25-105 ccf/ac 13-55 mbf/ac	14 – 44 tpa ⁵ 60-145 ccf/ac 31-75 mbf/ac	35.0-111.8 ccf/ac 18.2mbf/ac- 58.2mbf/ac
1- Snag size = 16''/20' 2- Piece size = 20''/60' 3- Snag size = 10''/20' and 20''/60' 4- % cover converted to cubic foot volumes based on % cover of a piece size of 20''/60'. 5- Snag size = 30''/120'				

DecAID Tool

DecAID (Mellen et. al, 2003) is an advisory tool to help managers evaluate effects, of forest conditions and existing or proposed management activities on organisms that use snags and down wood. DecAID can help managers decide on snag and down wood sizes and levels needed to help meet wildlife management objectives. DecAID can help managers articulate those objectives in specific, quantitative terms that could be tested in the field. The tool synthesizes published literature, research data, wildlife databases, and expert judgment and experience. For more information on the background, assumptions, and applicability of the model refer to the Wildlife Report in the Analysis File.

It should be noted that DecAID does not model biological potential or population viability. There is no direct relationship between tolerances, snag densities and sizes used in DecAID and snag densities and sizes that measure potential population levels (Mellen 2003, Thomas, 1979).

The DecAID model was consulted in the analysis of species needs. Table 34 illustrates snag and down woody material recommended levels of retention from the DecAID tool in comparison with direction from the Willamette Forest Plan as amended and the LSRA. The numbers presented from DecAID

reflect the general number of snags and down wood that would be expected to occur in this area based on plant association and stand structure.

Environmental Consequences

Evaluation Criteria:

- quantity, size and distribution of snags and CWD remaining after treatments

Direct and Indirect Effects

The prescribed snag and down wood retention would vary depending on the location of treatment unit through the project area. The following snag and down wood retention ranges are proposed in all the action alternatives:

Table 35. Proposed Snag and Down Wood Retention Levels.

Range	Snags Per Acre*	Pieces Down Wood**
Low	4	4
Medium	8-10	6
High	12-14	10

*Snag: dbh >20”.

**Piece Down wood: >20” diameter of small end, 60’ in length, minimum piece length 20’.

Alternative A – No Action

The No Action Alternative would not affect the numbers or distribution of snags or down wood within the project area. This alternative would not fall or remove any currently existing snags or down wood. Over time snags in the area would deteriorate and depending on location may need to be felled for the purpose of maintaining public safety. As these snags fall or are felled a large accumulation of down wood would develop. The down wood accumulation in combination with new growth may increase the potential for as well as the severity of a reburn (Rasler and Ashcraft, 2004).

Under this alternative there would be no replanting of the burned area; which could delay the re-establishment of the mature forest that was removed by the fire. Planting the burned area should speed up the re-development late-successional conditions in the area by 20-40 years (Marsh, 2004).

Alternative B

This alternative would decrease the number of snags remaining on approximately 15% of the area but would not decrease the amount of coarse woody debris since none of the felled trees or existing down wood would be removed from the area. Snag levels would vary depending on the number of moderate to high risk hazard trees and their location. A variety of snag densities would result with the fewest along roads and parking areas. Areas further than 200’ from roads and parking areas would have the highest snag densities.

This alternative also proposes fuel treatment on approximately 15% of the area by hand piling and grapple piling, and burning of material 0-3” in diameter. The removal of this small material would not impact coarse wood debris levels. Material of this size is not considered to be of importance to species associated with down wood.

This alternative would continue to provide habitat for most primary cavity excavators. A range of snag densities would remain providing habitat for species such as hairy woodpecker and northern flicker that

prefer high snag densities. Areas where hazard trees are felled would provide habitat for species such as Lewis' woodpecker which prefers fire modified stands with low snag densities.

Species that do not have strong fire associations such as red-breasted sapsucker, downy woodpecker, and pileated woodpecker may utilize portions of the burned area that have low mortality and residual green canopy. The project area has little of this habitat available, what there is would not be affected by this alternative with the exception of hazard trees needed to be felled for public safety.

This alternative also does not propose replanting of the burned area; which could delay the re-establishment of the old-growth forest. Planting the burned area should speed up the re-development late-successional conditions in the area by 20-40 years (Marsh, 2004)

Alternative C

This alternative would modify the numbers and distribution of snags and down wood within the project area. Snag densities would vary across the project area. The low range would be retained along roads and parking areas (91ac. 12% of area). Low to moderate levels would be retained along trails and in salvage areas (55 ac., 7% of area).

While this alternative proposes salvage harvest, and hazard tree falling and removal on 19% of the project area, the remaining 81% of the project area would have near natural densities of snags. High densities of snags would be available for species such as hairy woodpecker, and northern flicker. Treated areas (except fuel treatments) would retain lower levels of snags which are preferred by Lewis' woodpecker.

Fuels treatment would not directly affect the snag densities in the project area since it removes only material of 0-3" in diameter. This size of down material is below the size useful to species that require down wood habitat.

Planting would occur under this alternative. Without planting it may take 20-40 years longer for forest to develop in the burned area. Planting would shorten the overall time it would take for mature forest to develop which would then be able to provide the larger snags that primary cavity excavators depend on.

Alternative D – Proposed Action

This alternative proposes activities affect snag and down wood levels on 249 ac. (33% of area). Activities in the various areas would retain different levels of snag and down wood retention. The low range would be retained along roads and parking areas (91ac. 12% of area). Low to moderate levels would be retained along trails and in salvage areas (143 ac., 19% of area). Moderate levels of snags and down wood would be retained in the outer 100' of riparian reserves associated with salvage areas.

This alternative alters the densities of snags on 249 ac. (33%) of the project area as with the other alternatives a range of snag densities would be retained from 0-14 snags per acre on treated acres and up to 60+ snags per acre on untreated acres. This range of snag densities should provide habitat for most primary cavity excavators that utilize burned areas such as Lewis' woodpecker, hairy woodpecker and northern flicker.

Fuels treatment would not directly affect the snag densities in the project area since it removes only material of 0-3" in diameter. This size of down material is below the size useful to species that require down wood habitat.

Planting would occur under this alternative. Without planting it may take 20-40 years longer for forest to develop in the burned area. Planting would shorten the overall time it would take for mature forest to develop which would then be able to provide the larger snags that primary cavity excavators depend on.

Alternative E

This alternative proposes activities that would affect snag and down wood levels on 237ac. (31% of area). Activities in the various areas would retain different levels of snag and down wood retention. The low range would be retained along roads and parking areas (91ac. 12% of area). Low to moderate levels would be retained along trails and in salvage areas (226 ac., 30% of area). Moderate levels of snags and down wood would be retained in the outer 100' of riparian reserves associated with salvage areas.

This alternative also proposes fuel treatment on approximately 43% (328ac.) of the area by hand piling, grapple piling and strip cover, and burning of material 0-3" in diameter. The removal of this small material would not impact coarse wood debris levels. Material of this size is not considered to be of importance to species associated with down wood.

While treating the greatest number of acres this alternative should still provide a range of snag densities. Habitat would be available for those species that prefer low densities of snags such as Lewis's woodpecker and those that have a preference for higher snag densities such as the hairy woodpecker and northern flicker.

Planting would occur under this alternative. Without planting it may take 20-40 years longer for forest to develop in the burned area. Planting would shorten the overall time it would take for mature forest to develop which would then be able to provide the larger snags that primary cavity excavators depend on.

Cumulative Effects

The cumulative effects analysis was based on past, present, and foreseeable future actions in the 5th field Fall Creek watershed. See Appendix B for a summary of the activities considered in the analysis within the watershed. Various events, natural and man-made, have modified forest conditions in the Fall Creek watershed. The events that most affected snag and down wood levels were fires and fire salvage. Fires, especially large stand replacement fires provide pulses of large acres with high densities of snags.

The Clark Fire in 2003 burned a total of 4973 ac. with varying and somewhat patchy mortality. Approximately 1500 ac. (31%) burned with >60% crown mortality. These patches provide high densities of snags up to 60 snags per acre. One of the largest patches with greater than 80% mortality occurred within the SIA. No salvage is planned within the LSR portion of the Clark Fire so these large acres with high snag densities are available for primary cavity excavator species. Salvage and hazard tree removal planned in the Fall Creek SIA at most would affect approximately 22% of the high density snag acres created by the fire.

The Puma Fire in 1999 burned 197 ac. and was partially re-burned by the Clark Fire. Approximately 50 ac. of the fire area was treated to reduce hazard trees and logs in excess of coarse wood needs were removed for use in fisheries projects. The remaining acres still provide high snag densities.

Past timber management that occurred prior to 1990 left few if any snags within harvest units, leaving 34,093 acres with essentially no snags. Timber management since 1990 retained snags to support "at least 20% or greater potential populations of cavity-nesting species" (FW -125) within harvest units and the retained enough snags at the sub-drainage to maintain 40% potential populations (FW-121), or 1.6 snags per acre. The Northwest Forest Plan amended the Willamette Forest Plan and specifies that snags

are to be retained in harvest units and throughout the matrix at the 40% potential population level with per-acre requirements met on average areas no larger than 40 acres (C-42). The Northwest Forest Plan also requires green-tree retention areas of 15% of the total unit area, incorporating the retained snags. Future timber sales in the watershed are designed to meet these Standards and Guidelines and would have little impact on overall snag availability. Thinning and regeneration harvests are generally able to retain existing snags thereby not effectively affecting snag distributions. The future program of hazard tree abatement around recreational facilities and along road would continue to have an adverse affect on snags habitat.

The actions alternatives B, C, D, and E would reduce snag densities in the short term. The number of acres affected is relatively small compared to the overall acreage of high density snags that was created by the Clark Fire. The Clark Fire created high densities of snags on approximately 2600 acres; the Fall Creek SIA project treats from 115 acres (4.4%) to 328 acres (12.6%) of the fire area. The small percentage of acres proposed for treatment translates to a minimum cumulative effect on available snag habitat. Snag densities on untreated acres would remain high for the first 10-20 years to about 75 years when substantial numbers of snags would have deteriorated and fallen. Until that time, the Fall Creek SIA project area and the general Clark Fire area would provide habitat for primary cavity excavators that require high densities of snags such as the hairy woodpecker and northern flicker and primary cavity excavators that prefer low densities of snags with open canopy such as the Lewis' woodpecker. Snag densities would meet or exceed Willamette Forest Plan Standards and Guidelines within the project area.

Threatened and Endangered Species

Terrestrial Threatened and Endangered Species - *Analysis Issue*

Known sites for certain terrestrial threatened, endangered, and sensitive (TE&S) species do occur within or immediately adjacent to the project area and potential habitat exists for other species that are suspected to occur. Designated critical habitat for the spotted owls is included in the project area. Salvage associated activities could affect TE&S species and their habitats within the project area.

Existing Conditions

A Biological Evaluations (Gebben, 2004) was conducted for all terrestrial TE&S bird and animal species within the projects area. For a complete discussion of these species, refer to the BE located in the Appendix C. The BE provides the documentation of pre-field reviews, field reconnaissance, surveys, and complete list of TES species reviewed including those species determined not to have habitat within the project area.

The following tables summaries the list of terrestrial threatened, endangered, or sensitive species which have habitat present within the project area and the ESA effects determinations by alternative:

Table 36. Terrestrial TE&S Species with Habitat in Project Area and ESA Effects Determination

Species	Alt. A (No Action)	Alt. B	Alt. C	Alt. D	Alt. E
Threatened and Endangered					
Northern spotted owls <i>Strix occidentalis caurina</i>	NE	NE	NE	NE	NE
Sensitive					
Harlequin Duck <i>Histrionicus histrionicus</i>	NI	NI	NI	NI	NI
Baird’s Shrew <i>Sorex bairdii permiliensis</i>	NI	NI	NI	NI	NI
Pacific Shrew <i>Sorex pacificus cascadenis</i>	NI	NI	NI	NI	NI
Foothill Yellow-legged frog <i>Rana boylei</i>	NI	NI	NI	NI	NI

NE = No Effect

NI = No Impact

Management Direction

The standards and guidelines (FW-156 and FW-157) of the Forest Plan as amended reiterate the legal requirements for the completion of Biological Evaluations to determine the possible effects the proposed activities would have on threatened, endangered, or sensitive (TES) species and the consultation requirements of the Endangered Species Act (ESA)(Public Law 93-205) if any of the species are found in the project area.

Environmental Consequences by Alternatives

Evaluation Criteria:

- acres of suitable spotted owl habitat removed or degraded.
- acres of suitable spotted owl habitat removed or degraded within proposed critical habitat.
- acres disturbed within 0.25 miles of the main stem of Fall Creek.

Direct and Indirect Effects

Northern Spotted Owl (*Strix occidentalis*)

In general, spotted owl activity is expected to occur primarily in the interior of older timber stands. These habitats provide the structural characteristics required by the owls for food, cover, nest sites, and protection from weather and predation. Nesting habitat is characterized as forest with canopy closure of 60 – 80%; multi-layered, multi-species canopy dominated by large overstory trees (> 30”dbh); abundant large trees w/deformities (e.g. large cavities, broken tops, dwarf-mistletoe infections, decadence); abundant large snags/down logs; and sufficient open flying space below the canopy. Foraging habitat is characterized as forest with > 2 canopy layers; overstory trees > 21" DBH; abundant snags/down wood;

and a 60-80% canopy closure. Dispersal habitat = forest w/ > 11" DBH trees and > 40% canopy closure.

Table 37 – Comparison of Pre and Post Clark Fire Acres of northern spotted owls Habitat in the Fall Creek Watershed.

Owl Habitat Types	Pre-Fire Habitat Conditions	Post-Fire Habitat Conditions
Non-Habitat	32,894 (42%)	35,593 (45%)
Dispersal	3,411 (4%)	2,660 (3%)
Nesting	42,438 (54%)	40,490 (52%)

Approximately 94% of the Clark fire burned within the Fall Creek LSR (RO-219). All of the fire area is located within designated critical habitat (CHU OR-18). The Forest Service portion of the Fall Creek watershed is home to approximately 44 known and documented activity centers for spotted owls. Of these, approximately 30 occur within the LSR RO-219 portion of the watershed and 14 occur in other land allocations. Within the fire perimeter, approximately 90.7% (4504 acres) existed as suitable habitat prior to this fire. Of that, approximately 43% (1948 acres) have been rendered unsuitable due to high fire intensity and conifer mortality. These estimates are based on current visible mortality and do not include future mortality that is not evident at this time. The major portion of the fire burned in an un-roaded area consisting of the Slick Creek, Bedrock Creek and Jones Creek drainages, a high percentage of which was contiguous suitable spotted owl nesting, roosting and foraging habitat.

Table 38 – Comparison of Pre and Post Clark Fire Acres of Northern Spotted Owls Habitat by Home Range.

Owl ID #	Habitat Types	Pre-Fire Habitat Conditions (ac.)	Post-Fire Habitat Conditions (ac.)
1008	Dispersal	600	432
	Nesting/Roosting/Foraging	1109	1109
1015	Dispersal	134	134
	Nesting/Roosting/Foraging	1920	1822
2890	Dispersal	676	498
	Nesting/Roosting/Foraging	1495	1447
4082	Dispersal	326	326
	Nesting/Roosting/Foraging	1765	1765
4549	Dispersal	16	16
	Nesting/Roosting/Foraging	2190	1590

Five known spotted owl activity centers 1008, 1015, 2890, 4082, and 4549 have portions of their home ranges (1.2 mi. radius) overlapping the project area. Of the five activity centers, the core natal area of one of the activity centers was impacted with fairly heavy overstory conifer mortality. Owls from this activity center may have relocated to areas with adequate habitat in the natal core area for reproduction.

Four of the five activity centers are monitored annually by H. J. Andrew’s Experimental Forest personnel as part of ongoing demographic studies. The fifth activity center was surveyed in 2004 by

District personnel. The surveys will provide updated information on owl locations within and adjacent to the planning area and will provide needed information for analyzing impacts from disturbance or habitat modification activities. It is anticipated that 2nd year protocol work will be completed in July of 2005 prior to project implementation.

- Owl #1008 Suitable habitat, 1109 ac. – site located approximately 1 mile south of project boundary. Small portion of home range burned. No nesting activity found during surveys in 2004.
- Owl #1015 Suitable habitat, 1822 ac. - approximately 1 mile from west boundary of fire. Small loss of habitat from fire. In 2004 this site was occupied by a Hybrid male and Barred Owl female.
- Owl #2890 Suitable habitat, 1447 ac. - this site is south of Fall Creek in matrix lands. Loss of habitat in distal area of it's home range. Surveys in 2004 did not detect nesting activity.
- Owl #4082 Suitable habitat, 1765 ac. - this site is located to the east of the project area. This site was unoccupied in 2004. 49 acres of this site were removed by the Puma fire in 1999.
- Owl #4549 Suitable habitat, 1590 ac. - this site was documented as a hybrid pair (Spotted Owl X Barred Owl) in 2000. The activity center was located within the fire perimeter, habitat within it's natal core area and home range was significantly impacted by the fire. Post-fire habitat may fall below 1182 ac. within it's home range.

Critical Habitat

The Fall Creek SIA project area is entirely within Critical Habitat Unit (CHU) OR-19. CHUs were established when the northern spotted owl was listed as “Threatened” under the Endangered Species Act. Critical habitat is essential to the conservation of a species and may require special management considerations or protection.

Consultation with US Fish and Wildlife Service

The Middle Fork Ranger District sent a letter to USFWS on November 8, 2004 submitting the Fall Creek SIA Fire Recovery Project for informal consultation. A USFWS letter of concurrence is pending. The FS Wildlife Biologist has made a preliminary effects determination of “may affect, not likely to adversely affect” northern spotted owls or their habitat because the project is located within CHU OR-19. The disturbance of owls from noise would be mitigated with a seasonal restriction resulting in a ‘no effect’ determination from disturbance.

Direct and Indirect Effects

Alternative A - No Action

This alternative proposes no activities within the Fall Creek SIA. There would be no direct effects on the spotted owls or their habitat.

This alternative would not negatively impact suitable habitat within the CHU or LSR since no suitable habitat is being modified or removed. No planting would occur under this alternative which could slow the redevelopment of suitable habitat within the project area. Planting should speed up the development

of mature forest by 20-40 years as opposed to natural regeneration. Natural regeneration can take longer depending on availability and proximity of conifer seed sources.

Even though this alternative proposes “No Action” the snags that are currently remaining would continue to deteriorate and either fall on their own or have to be felled to provide for public safety. The largest snags may persist until the new stand reaches maturity and begins developing large (>20” dbh) snags. Most of the material that falls naturally or is felled and is outside the road prism would likely be left on site.

Effects Common to Action Alternatives B, C, D, and E

Habitat within the Fall Creek SIA project area that are proposed for hazard tree removal and fire salvage no longer meet the definition of suitable habitat for Spotted owls. The proposed treatments would not reduce the amount of suitable habitat in the home ranges that overlap the Fall Creek SIA area. The action alternatives would not modify suitable habitat for northern spotted owls.

Falling snags as proposed in these alternatives is not likely to affect the number of snags that would survive until the stands in the project area reach the mature or old-growth stage. The snags that would be retained in the salvage harvest areas would be the largest available provide the longest lasting snags. In areas where snags are felled for the purpose of public safety the choice of snags that are left would depend on soundness, lean, and location. Planting that is associated with alternatives C, D, and E should speed up the development of new stands by 20-40 years. Alternative B proposes no planting and would rely on natural regeneration to produce new stands. While natural regeneration is occurring in some areas it is dependant on the proximity of seed sources; areas farther from live trees would take longer to regenerate. However, since this project is located within a CHU, the project ESA effects determination is a “may affect, not likely to adversely affect” northern spotted owls or their habitat.

Treatment activities within 0.25 miles (0.5 for helicopter yarding) have the potential to disturb nesting spotted owl. Disturbance in the early part of the nesting season (1 March to 15 July) has the potential to cause nesting failure. Seasonal restrictions would be needed on all harvest activities to avoid disturbing nesting owls. The first year of a two-year protocol Northern Spotted owl survey were conducted in 2004 and no nesting spotted owls were found. The second year of surveys would be conducted during the spring of 2005. If no owls are found to be nesting during these surveys then the seasonal restriction on activities could be lifted. A seasonal restriction on the proposed disturbance producing activities or unoccupied adjacent suitable habitat would result in all action alternatives having no direct or indirect effect on spotted owl from disturbance.

All alternatives prescribe various levels of snag and coarse wood depending on location and proposed treatment (see Snags and Down Wood section of the Wildlife Report). Snags and down wood primarily provide habitat for prey species of spotted owl. Spotted owls can utilize cavities in large snags as nesting locations.

Another proposed activity of the action alternative is the falling of hazard trees into Fall Creek for fish habitat improvement. This activity would not likely disturb northern spotted owls. There are no known activity centers or un-surveyed suitable habitat within 0.25 miles of Fall Creek.

Cumulative Effects

The cumulative effects analysis area for the northern spotted owl is defined by the five 1.2 mile radius home range circles around the spotted owl activity centers that overlap the project area. All past, present, and foreseeable future actions were considered in the analysis. These activities include past

regeneration harvest which occurred over the last six decades (See Appendix B) and the present Clark Timber Sale which affects suitable spotted owl habitat. The effects of the Puma Fire and the Clark Fire on suitable habitat have also been considered in the analysis.

Alternative A – No Action

Alternative A would not result in any cumulative effects on spotted owl because no suitable habitat would be affected.

Alternative B

Alternative B would not result in any cumulative effects on spotted owl because no suitable habitat would be affected.

Alternatives C, D, and E

No suitable spotted owl habitat would be affected by hazard tree removal or fire salvage or other activities proposed with this project. All spotted owl home ranges that overlap with the Fall Creek SIA project area have experienced reductions in the amount of suitable habitat (see Table 38).

One spotted owl home range (#1015) habitat would be decreased by 6 acres of the Clark Timber Sale (Table 39). The habitat within this home range would still be above the threshold of 1,182 acres of suitable habitat with 1,822 acres. The activities proposed by this project would not further reduce the amount of suitable habitat.

The home range of spotted owl #1008 is currently below the threshold of 1,182 acres. This home range was below the threshold prior to the Clark Fire likely as a result of previous harvest activity. The proposed Fall Creek SIA project would not modify suitable habitat further reducing the amount within this home range.

Table 39 – Comparison of Acres of northern spotted owl Habitat Post-Fire vs. Habitat Modification due to Cumulative Effects of Other Projects by Home Range.

Owl ID #	Habitat Types	Post-Fire Habitat Conditions	Habitat Conditions Cumulative Effects
1008	Dispersal	432	432
	Nesting/Roosting/Foraging	1109	1109
1015	Dispersal	134	134
	Nesting/Roosting/Foraging	1822	1816
2890	Dispersal	498	498
	Nesting/Roosting/Foraging	1447	1447
4082	Dispersal	326	326
	Nesting/Roosting/Foraging	1765	17657
4549	Dispersal	16	16
	Nesting/Roosting/Foraging	1590	1590

Since this project would not further reduce the amount of suitable habitat within the home ranges that overlap the area; or within the LSR or CHU as a whole there would be no cumulative effects to northern spotted owls or their habitat from this project.

Harlequin Duck (*Histrionicus histrionicus*)

In the past, the riparian area of Fall Creek has provided nesting habitat for these ducks. The Clark Fire burned through the area with high intensity removing the canopy and undergrowth. This lack of cover for nesting has reduced the suitability of the area for nesting by Harlequin ducks. Surveys this past June did not find any nesting ducks. It would be several more years before the shrub/brush layer has grown back sufficiently to provide the needed cover. Most of the project area is heavily used for recreation. Harlequin ducks prefer to nest in areas that are removed from human disturbance.

Direct Effects

All Alternatives

None of the alternatives would reduce the amount of structure (down wood) that these ducks would utilize to below an adequate level. The lack of vegetation cover would be the limiting factor until the ducks return.

There would be no indirect effects on this species from this project. Project activities would be completed before the vegetation re-grows to the point that it would provide the cover ducks need.

This project would not impact individual harlequin ducks and would not likely contribute to a trend towards Federal Listing or a loss of viability to the population or species.

Cumulative Effects

All Alternatives

The cumulative effects analysis area for the Harlequin duck is the Fall Creek Riparian Reserve. Past, present and foreseeable future actions in this Riparian Reserve were considered in the analysis. The Clark Fire Roadside Salvage Project, Puma Hazard Tree Removal Project, and Bedrock Campground Restoration Project fell and removed hazard trees from within the Riparian Reserve of Fall Creek. The Fall Creek SIA projects would not cumulatively impact harlequin duck riparian habitat because CWD prescriptions have retained enough CWD to provide for current and future habitat needs of the harlequin duck.

Pacific Shrew (*Sorex pacificus Canadensis*) and Baird's Shrew (*Sorex bairdii permiliensis*)

The Pacific shrew is endemic to Oregon and occurs throughout the Cascade Range from northeast Linn County to southern Jackson County. Habitat is characterized as moist wooded areas with fallen decaying logs and brushy vegetation. The shrew is generally found in wet or marshy areas along class III-IV streams with abundant down material and red alder, salmonberry, or skunk cabbage. It is also occasionally found in adjacent conifer forest with moist abundant decaying logs and brush. The nests are made of grasses, mosses, lichens, or leaves. Shrew feed on slugs, snails, insects, and sometimes vegetation.

The Baird's shrew is endemic to Oregon, occurring from the Coast Range to Benton County and along the west slope of the Cascade Range from the Columbia River to central Lane County. Little is known

about its habitat needs, but it appears to be associated with coniferous forests. In 1986, 2 specimens were trapped from an open Douglas-fir forested area with numerous rotting logs in Polk County.

Direct and Indirect Effects

Alternative A

There would be no effects from this alternative on this species. This alternative would not fall or remove any hazard trees or dead fire-killed timber.

Alternatives B, C, D, and E

None of the action alternatives would have a direct effect on this shrew. The portion of riparian areas that this species are likely to use would not be impacted by proposed treatments. Marshy areas, as well as the inner portions of riparian reserves would not have hazard trees or dead fire killed trees felled or removed. Alternatives B and C leave all the CWD material in place in the Riparian Reserves. Alternatives D, and E propose the removal of a proportion of this CWD material from the outer zones of the Riparian Reserves. Sufficient quantities of CWD material would be retained to maintain shrew habitat needs.

Alternative B and C falls hazard trees in the Riparian Reserves but would not remove any of the CWD material. This would create an abundant supply of CWD material in these riparian areas. Alternatives D and E protects the inner zone of the Riparian Reserves adjacent to the stream and fall and leaves hazard trees in place. Alternative D and E falls and remove hazard trees and fire-killed timber from the outer zones of the Riparian Reserves while retaining sufficient numbers of CWD material to provide for needs of wildlife.

These alternatives would not impact individuals and would not likely contribute to a trend towards Federal Listing or a loss of viability to the population or species.

Cumulative Effects

The cumulative effects analysis area for the shrews is the Riparian Reserve network throughout the sub-watershed. Past, present and foreseeable future actions in this Riparian Reserve were considered in the analysis (See Appendix B for a summary of activities). The Clark Fire Roadside Salvage Project, Puma Hazard Tree Removal Project, and Bedrock Campground Restoration Project fell and removed hazard trees from within the riparian area of Fall Creek. The Fall Creek SIA projects would not cumulatively impact these two shrews because CWD prescriptions have retained enough CWD to provide for current and future habitat needs of the shrews. The additional removal of CWD would not reduce the ability of this area to support this shrew.

Foothill Yellow-legged Frog (*Rana boylei*)

The project area has several low gradient streams on the flat to the south of Fall Creek which are potential habitat for this species. Riparian Reserves would buffer these streams and protect this potential habitat. There is no documented foothill yellow-legged frog habitat or sightings on the Middle Fork RD.

Direct Effects

Alternatives A

This alternative would not impact the yellow-legged frogs because there would be no felling or removal of snags associated with their habitat.

Alternative B, and C,

Alternatives B and C would not impact these frogs due to the fact that their habitat would be buffered with Riparian Reserves. Hazard trees may be felled in these Riparian Reserves where hazard trees may reach the road, trails, and dispersed recreational sites. All CWD would be left in place in the Riparian Reserves.

These alternatives would have no impact on individual's frogs and would not likely contribute to a trend towards Federal Listing or a loss of viability to the population or species.

Alternative D, and E

Alternatives D and E would not impact these frogs due to the fact that their habitat would be protected in the riparian reserves by not cutting dead fire-killed trees within 100-200 feet of streams depending on stream class. Hazard trees and fire salvage trees would be removed from the outer portion (100-200 feet) of the Riparian Reserves. Adequate CWD would be retained by prescription to provide for current and future habitat needs for frogs in these areas.

These alternatives would have no impact on individual's frogs and would not likely contribute to a trend towards Federal Listing or a loss of viability to the population or species.

Cumulative Effects

Previously implemented projects in this watershed may have impacted the riparian habitats that this species is associated with. Projects that have been implemented since the 1994 Northwest Forest Plan or have yet to be implemented would be designed with sufficient buffers to protect the integrity of their habitat.

Survey and Manage

The 2001 Record of Decision for the Supplemental Environmental Impact Statement for Amendment to the Survey & Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines amended the Northwest Forest Plan by adopting new standards and guidelines. The amendment retains the major elements of Survey and Manage, restructuring them for clarity, describing criteria and processes for changing species assignments in the future, and removing 72 species in all or part of their range because new information indicates they are secure or otherwise do not meet the basic criteria for Survey and Manage.

The Record of Decision for the 2004 Final Supplemental Environmental Impact Statement (SEIS) to Remove or Modify the Survey and Manage Mitigation Measure Standards and Guidelines amended a portion of the Northwest Forest Plan by removing the Survey and Manage Mitigation Measure Standards and Guidelines. The SEIS shifted the Survey & Manage species to the Agency's (USDA-Forest Service and USDI-Bureau of Land Management) Special Status Species Programs. Those species that were formerly Survey and Manage and now managed under the Sensitive Species Program are addressed in the Biological Evaluations.

Management Indicator Species

The Willamette Forest Plan, as amended, identifies 7 Management Indicator Species (MIS) and their associated habitat requirements. MIS habitat requirements are presumed to represent those of a larger group of wildlife species, and act as a barometer for the health of their various habitats. The northern spotted owl (*Strix occidentalis*), bald eagle (*Haliaeetus leucocephalus*), pine marten (*Martes pennanti*),

and pileated woodpecker (*Dryocopus pileatus*) represent old growth habitats, Roosevelt elk (*Cervus elaphus*) and deer (*Odocoileus hemionus*) represent Winter Range, and primary cavity excavators represent dead wood habitats.

The northern spotted owl, bald eagle, and peregrine falcon are addressed in the Biological Evaluation.

Deer and elk are discussed in the Big Game section.

The primary cavity excavators identified in the Forest Plan include Lewis' woodpecker, downy Woodpecker, hairy Woodpecker, northern three-toed woodpecker, black-backed woodpecker, Northern Flicker, red-breasted sapsuckers, and red-breasted nuthatch. Northern three-toed and black-backed woodpeckers are not likely to be found in the project area; they prefer forests especially burned areas over 4000' in elevation. Red-breasted nuthatches are fairly common in coniferous forests, but likely make little use of burned areas. Primary cavity excavators including pileated woodpeckers are discussed in the Snags and CWD habitat section.

Anadromous fish, such as spring chinook salmon and resident salmonids (rainbow and cutthroat trout) are Management Indicator Species (MIS) in the Willamette Forest Plan (FEIS, page III-69). As MIS, federal projects need to ensure the viability of these species when conducting activities on National Forest System lands. Spring chinook salmon are addressed in the Biological Assessment and under the spring chinook salmon issue and the resident salmonids are covered under the water quality issue which addresses beneficial uses. The implementation of Willamette Forest Plan and Northwest Forest Plan standards and guidelines, mitigation measures and BMPs would insure the protection of water quality and beneficial uses under all action alternatives.

Landbirds Including Neotropical Migratory Birds) ---

Existing Condition

Neotropical migratory birds (NTMB) breed in temperate North America and spend the winter primarily south of the United States-Mexico border. Of the 225 migratory birds that are known to occur in the western hemisphere, about 102 are known to breed in Oregon. They include a large group of species, including many raptors, cavity excavators, warblers and other songbirds, with diverse habitat needs spanning nearly all plant community types and successional stages. Long-term population data on many of these birds indicate downward population trends although not all species populations are declining (Sharp 1996, Saab and Rich 1997, Altman 1999, USFWS 2002). Habitat loss is considered the primary factor in decline of neotropical migratory birds.

Table 40 lists those priority habitats (Western Hemlock, Riparian, and Unique Habitat) and associated focal species that would be expected in the project area. The table identifies each focal species, their primary breeding habitat, and whether the Clark Fire positively or negatively affected them.

Some neotropical migratory birds respond positively to fire, while others respond negatively in burned areas. However, generally, species richness and overall species abundance tends to decrease. The following sections summarize the effects of the Clark fire on the high priority habitats listed above. Discussions will only focus on those habitats that exist in the project area now or that existed prior to the fire.

Table 40. - Neotropical Migratory Birds – Focal Species found in the Project Area by Habitat Type, Including Fire Effects.

Focal Species	Primary Breeding Habitat	Initial Clark Fire Effects to Species
Western Hemlock		
Vaux’s swift	large snags	positive
Red crossbill	conifer cones	neutral
Pileated Woodpecker	large snags	positive
Hermit Warbler	canopy closure	negative
Hammond’s flycatcher	Open subcanopy	positive
Riparian		
Varied thrush	mid-story tree layers	negative
Pacific-slope flycatcher	deciduous canopy trees	negative
Wilson’s warbler	deciduous understory	negative
Winter wren	ferns	negative
Olive-sided flycatcher	residual canopy trees	neutral
Unique Habitats		
Band-tailed pigeon	mineral springs	neutral
Rufous hummingbird	nectar producing plants	negative

Table 41 - List of species from Bird Conservation Region 5 - Northern Pacific Forest Region (U.S. portions only). Their status as present or absent from the Project Area, and reasons for absence. (Only those species whose range includes the project area are displayed).*

Species	Presence /Absence	Reason for Absence/Where Addressed If Present
Northern Goshawk (resident <i>laingi</i> ssp. only)	Present	Habitat Not Affected by Proposed Activities
Peregrine Falcon (including resident <i>pealei</i> ssp. in Alaska)	Absent	No Suitable Habitat
Black Swift	Absent	No Suitable Habitat
Rufous Hummingbird	Present	Landbird Discussion
Lewis’ Woodpecker	Present	Landbird Discussion/Severe Fire MIS
White-Headed Woodpecker	Present	Low fire Severity MIS
Olive-sided Flycatcher	Present	Habitat Not Affected By Proposed Activities
Horned Lark (<i>strigata</i> ssp. only)**	Absent	No Suitable Habitat
Vesper Sparrow	Absent	No Suitable Habitat

* - Table developed from USFWS's Birds of Conservation Concern (USFWS 2002)

** - ESA Candidate Species

Table 41 lists species identified in the US Fish and Wildlife Service (USFWS) Birds of Conservation Concern (USFWS 2002) and the Bird Conservation Region (BCR) 5 which have habitat present in the project area. The BCR 5 - Northern Pacific Forest Region (U.S. portions only) best characterizes the Fall Creek SIA project Area. The projects effects on species listed in Table 41 will be analyzed along with the species listed in Table 40 by their priority habitats.

Western Hemlock

This is the dominant forest series found in the Fall Creek watershed. The western hemlock series represents warm, moist conditions. Douglas-fir is the dominant species found with western hemlock and western red cedar.

The Conservation Strategy (Altman, 1999) identifies four habitat components of the warm moist forest types that are important to landbirds:

- Large snags
- Canopy closure
- Open subcanopy
- Conifer cones

Prior to the fire, burned old forest was lacking, as fire suppression had all but eliminated the influence of this disturbance factor in the project area. Bird species associated with warm moist conifer forest have been adversely impacted primarily by the loss and reduction of late-seral conditions and structural elements such as snags (Altman, 1999).

The fire converted a significant portion of the mature and old growth stands to early successional stages. Dense understory thickets burned extensively, although patches remain scattered throughout the area. Overstory nesting species and foliage or crown feeders have likely disappeared within the severely burned areas, and decreased in the moderate severity burn areas. Local species adversely affected may include the Red crossbill, Hermit Warbler, Varied thrush, Pacific-slope flycatcher, Wilson's warbler, Winter wren, and Rufous hummingbird.

Flycatchers, ground feeders, and cavity nesters are expected to increase as a result of the fire. Local species that may benefit include the Lewis' woodpecker, olive-side flycatcher, Vaux's swift, Pileated Woodpecker, and Hammond's flycatcher. The Primary Cavity Excavator Section describes woodpecker, sapsucker and flicker species in more detail; most of these species are expected to respond positively to the fire.

Riparian

The riparian habitat type is typified by the presence of hardwood tree and shrub species, along with associated wetland herbaceous species. Water is obviously an important component of these habitats, whether it is in the form of standing wetlands, springs and seeps, or flowing water (rivers and streams). Although these habitats generally comprise only a small portion of the landscape, they usually have a disproportionately high level of avian diversity and density when compared to surrounding upland habitats.

The Conservation Strategy (Altman, 1999) identifies five habitat components within this habitat type that are important to land birds.

- mid-story tree layers
- deciduous canopy trees
- deciduous understory
- ferns
- residual canopy trees

Within the project area this habitat type is found associated with all four stream classes as well as perennially wet areas. Priority hardwood habitats include willow, alder, big-leaf maple, and vine maple; other hardwood species are present but at lower levels. The riparian areas are conifer dominated multi and single storied, with an understory of hardwood shrubs or grasses.

Riparian habitat within the Clark Fire area and the project were well functioning prior to the fire. Fire severity in riparian areas was variable from unburned to 100% mortality. In the project area, the riparian area associated with Fall Creek was the most heavily impacted. The grasses and forbs were sprouting within weeks and shrubs are starting to re-grow. Snag habitat is now more abundant.

Generally, the fire killed most of the trees in the riparian uplands. The fire likely improved habitats for species that use riparian snags, such as the Lewis woodpecker and flycatchers. Initially, the fire likely reduced habitat for species such as the varied thrush, Pacific-slope flycatcher, Wilson's warbler, and winter wren; however, species are expected to recover rapidly as hardwood shrubs recover.

Unique Habitats

The Conservation Strategy (Altman, 1999) identifies two unique habitat components that are important to some landbirds:

- mineral springs
- nectar producing plants

There are no known mineral springs within the project area or the fire area in general. This habitat component would be unaffected by the fire or the proposed project. Vegetation adjacent to a spring may be affected potentially affecting the use of a spring by some species. In this area the species most likely associated with mineral springs are band-tailed pigeons.

Nectar producing plants are found throughout the fire and project area. These plants were likely impacted by the Clark fire regardless of the crown mortality. Areas with low crown mortality underburned removing the shrubs and herbaceous plants that bear nectar producing flowers. The shrubs and herbaceous plants have begun re-sprouting and would reestablish as a significant component of the understory within a few years. Species such as the rufous hummingbird likely stopped utilizing the area after the fire. As the understory reestablishes itself this species as well as other species that utilize understory shrubs for foraging such as olive-sided flycatcher would return to the area.

Management Direction

Nationwide declines in population trends for the migratory landbirds has developed into an international concern and has led to the creation of an International Partners in Flight (PIF) network and program. In 1992, an Oregon-Washington Chapter of PIF formed, with a separate Oregon subcommittee for assessing conservation needs at the state level. In 1994, the Forest Service, Region 6, signed a Memorandum of Agreement with 14 other agencies and non-agency entities to develop a program for the conservation, management, inventory, and monitoring of neotropical migratory birds.

Current Forest Service policy regarding bird conservation and the Migratory Bird Treaty Act (MBTA) is:

- Permits must be obtained from the U.S. Fish and Wildlife Service (USFWS) for banding, capturing, or any other activity where there is intentional killing of birds, including control of depredating birds.
- The Forest Service must analyze the effects of actions on migratory birds and document such effects in a NEPA document.
- Negative effects to birds should be mitigated to the extent possible and where possible, plans to benefit birds should be incorporated in project or activity design.
- There currently is no process for reviewing projects with USFWS or applying for a permit for “unintentional” take. The USFWS will be providing additional guidance regarding the Federal Agencies through the formation of an interagency working group.

In 1999, the Oregon-Washington Chapter of Partners in Flight published its Northern Pacific Rainforest Bird Conservation Plan (Altman 1999). The Plan provides conservation recommendations for the various species of landbirds that occupy the Oregon and Washington portions of the Interior Columbia Basin. The Plan identified the following priority habitats for landbird conservation: old-growth dry forest, old growth moist forest, riparian woodland and shrub land, and unique habitats including alpine and subalpine forests, shrub-steppe, montane meadow and aspen habitats. The Conservation Plan also identified burned old forest as a limited habitat due to fire suppression; the Clark Fire has obviously created a large amount of burn habitat that could provide for various landbird species. Many of the avian species/habitats identified in the Northern Pacific Rainforest Bird Conservation Plan (Altman 1999), are also addressed in the USFWS’s Birds of Conservation Concern (USFWS 2002).

Environmental Consequences

Direct and Indirect Effects

Alternative A – No Action

Western Hemlock

The fire removed large expanses of forest, including nearly all the mature and old growth habitat. Bird species that are foliage or crown feeders and overstory nesting species, likely disappeared within the severely burned areas, but may still be using the moderate and low burn areas. Delays in reforestation under the No Action alternative would delay recovery of forest canopy, with adverse effects to landbird species that feed and nest in forest canopies. The No Action alternative removes no snags or downed logs. Habitat would be maximized for species that use post-fire conditions such as the olive flycatcher and the Lewis’ woodpecker. (The Snags and CWD habitat section describes effects to cavity excavators in detail.)

Riparian

The fire burned with varying intensity through riparian areas. Some riparian areas such as Fall Creek’s burned with 60% or greater mortality. Initially, landbirds associated with these habitats likely declined; however, effects are likely to be short-lived. The expected flush of ground vegetation, particularly shrub species, may elevate the amount and distribution of riparian hardwoods to levels higher than existed

prior to the fire. Grasses and forbs are expected to reestablish naturally in 2 to 5 years; shrubs are expected to reestablish in 2 to 15 years. Population numbers for grass and shrub nesting neotropical migratory birds is expected to remain stable or increase due to recovery of ground vegetation, both inside and outside riparian areas. Species such as the olive-sided flycatcher, rufous hummingbird, Wilson's warbler, and winter wren, would likely respond positively.

This alternative would not plant riparian vegetation in any riparian areas. Natural regeneration would be relied upon to re-vegetate the riparian areas, potentially slowing the development riparian vegetation. Natural re-vegetation is occurring, even in the severally burned riparian areas, with shrubs and forbs showing the most recovery, hardwoods are re-sprouting, but there appears to be a lack of conifer regeneration.

Alternatives B, C, D, and E

Salvage logging is known to further reduce species richness in burn areas. Raphael & White (1984) reported that in their studies species richness declined only in the most severely salvaged burns, although even partial salvaging altered species composition.

Salvage logging between May and August, the primary nesting season, would present the highest risk to any neotropical migratory birds nesting in the area. Some individual birds could be directly affected, but this should not be a significant number and should not affect populations or viability.

The risk of an intense reburn is highest with Alternative B. Although risks do not increase for 10 to 20 years, which is the amount of time, expected for snags to fall to the ground and elevate fuel loads. Another stand replacement fire would delay recovery of vegetation.

Western Hemlock

At a minimum, it is expected that removal of snags would have a negative effect on population numbers of cavity nesting landbirds including neotropical migratory species (see Snags and CWD habitat section). Direct effects would primarily be displacement from nests by removal or destruction of nest structures (snags, ground nests) during salvage operations. Alternatives B proposes felling of medium to high hazard rated trees with no removal of material from 116 acres; there is no conifer planting under this alternative. Alternatives C, D, and E propose felling and partial removal of medium to high hazard rated trees and salvage harvest on 146 acres (19% of area), 249 acres (33% of area), and 328 acres (43% of area) respectively. All Alternatives retain essentially the same snag levels; each alternative impacts progressively higher numbers of acres.

Alternatives C, D, and E would accelerate reforestation of the project area through planting conifers. Reforestation would reestablish trees in the burn area within 5 years. Many neotropical migratory species require high tree canopy closure levels for nesting and foraging, and it would likely take at least 30 to 50 years before overstory canopies are restored to levels that even remotely mimic pre-fire conditions. Habitat for species that require mature or old growth conditions may take 75 to 150 years to develop. The young stands that would result from reforestation would provide habitat for those landbirds that rely on younger aged forests. Most of the focal species prefer older forests with more complex structure.

All Action Alternatives propose fuels treatments on progressively increasing acreage. Fuels treatments would remove 0-3" material by hand piling, grapple piling, or strip cover, and burning which should decrease the risk of a reburn. The fuels treatment produces minimal negative impacts compared to the felling and salvage proposed by removing only small diameter material.

Riparian

Minimally, the removal of snags would have a negative effect on population numbers of cavity nesting landbirds including neotropical migratory species (see Snags and CWD habitat section). Direct effects would primarily be displacement from nests by removal or destruction of nest structures (snags, ground nests) during activities.

Alternatives C, D, and E propose various amounts of salvage in riparian reserves. Alternative C proposes the smallest amount (82 ac.) along Rd. 18 for public safety due to its high use by the public. Alternatives D, and E propose falling and removal or salvage harvest on 152 acres and 214 acres respectively. Each alternative results in progressively greater impact on neotropical migratory birds. These effects should be short lived as the hardwoods and shrubs recover from damage from operations.

Planting of conifers and shrub species would occur in burned riparian areas speeding up the recovery of vegetation in the areas. Direct effects to riparian landbirds, including neotropical migratory species, are likely to be at least minimally positive. Indirectly, riparian landbirds may experience increases in population levels as a result of the fire. Population numbers for grass and shrub nesting species is expected to remain stable or increase due to recovery of grass, forbs and shrub vegetation as described in the No Action section.

Unique Habitats

The effects of all alternatives on mineral springs and nectar producing plants are essentially the same. Hazard tree felling and removal or salvage harvest may temporarily reduce the vegetation by mechanical damage. The vegetation is likely to recover within one or two growing seasons. Planting of conifers and shrubs may minimally speed the process.

Cumulative Effects

The cumulative effects analysis for neotropical migratory birds and their habitat considered all past, present, and foreseeable future actions in the 5th field Fall Creek watershed. See Appendix B for a summary of the activities. The following discussion focuses on those past, present, and reasonable foreseeable future activities that may contribute negative or positive effects.

Habitat loss is considered the primary factor in decline of neotropical migratory birds. Previous sections identified high priority habitats for conservation of neotropical migratory birds: the western hemlock forest type including burned habitats, riparian habitats and unique habitats.

Cumulative effects to snag and related post-fire habitat were discussed in the Snags and CWD habitat section. Snag habitat would be reduced under alternatives B, C, D, and E.

The No Action Alternative would not contribute to further degradation of riparian vegetation because no salvage activity would be conducted in riparian reserves.

Future projects considered in the cumulative effects analysis would have to abide by direction to maintain or enhance mature and old growth habitat, to protect or enhance riparian areas, and should consider potential direct effects to neotropical migratory birds; therefore, they are not expected to contribute to cumulative effects.

Big Game – Deer and Elk

Existing Condition

Roosevelt elk, black-tailed deer, and mule deer are the big game species of concern due to their high public value. These species are considered widely distributed across the District, Forest and the Cascades.

The Clark Fire altered cover and forage in three Big Game Emphasis Areas (BGEAs): Alder, Andy, and Boundary (formerly Timber BGEA). The fire area and the project area are entirely within big game winter range. The fire burned 4,973 acres; burned areas no longer provide useful cover for big game. The bulk of the fire occurred in the Alder BGEA (4,515ac.), with 143 acres burned in the Andy BGEA and 286 acres in the Boundary BGEA.

Whether crown mortality was high or minimal the shrub understory was essentially removed; eliminating a major component of cover (hiding or optimal). Even areas that were only underburned (<20% mortality) the loss of the shrub understory significantly reduces a stand's suitability as hiding cover, tree boles provide minimal cover (Thomas et al., 1979).

The open road density for Alder BGEA is 2.9 mi./mi.², for Andy BGEA 5.0 mi./mi.², and for Boundary 4.8 mi./mi.². All of which are above Forest Plan Standards and Guidelines for open road densities

.Wisdom et, al. (1986), developed a Habitat Effectiveness Index (HEI) model for estimating elk habitat effectiveness on the landscape in western Oregon. Overall habitat effectiveness (HEI) incorporates four variables or indices: cover quality (HE_c), size and spacing of cover (HE_s), forage quality (HE_f), and open road density (HE_r). The Forest Plan establishes minimum standards for these indices (see Table 42). Table 42 also displays Habitat Effectiveness values for pre Clark Fire conditions in the BGEAs.

Pre-fire the Alder BGEA exceeded Forest Plan Standards and Guidelines in HE_c and HE_s, but not in HE_r, HE_f, and HEI. Andy BGEA exceeded Standards and Guidelines in HE_c and HE_s. Forage is limiting in all of the BGEAs. The Andy BGEA was the least effected by the Clark Fire. The fire affected more acres in the Boundary BGEA than the Andy BGEA, and the Alder BGEA had the most acres impacted.

None of the BGEAs meet Forest Plan standards and guidelines for road density prior to the Clark Fire. Roads opened for fire suppression activities have been decommissioned and re-closed as part of the Clark Fire rehabilitation efforts as well as the Fall Creek ATM process.

Table 42. HEI Values Pre Clark Fire.

BGEA (Emphasis)	HE _f	HE _c	HE _r	HE _s	HEI
Forest Plan Mod/High	>0.5/ >0.6	>0.5/ >0.6	>0.5/ >0.6	>0.5/ >0.6	>0.5/ >0.6
Alder (Mod.)	.27	.66	.40	.54	.44
Andy (Mod.)	.39	.53	.20	.82	.43

BGEA (Emphasis)	HE_f	HE_c	HE_r	HE_s	HEI
Boundary (Mod.)	.38	.50	.23	.77	.43
<p>HEI = Habitat Effectiveness Index HE_f = habitat effectiveness derived from quality of forage HE_c = habitat effectiveness derived from the quality of cover HE_s = habitat effectiveness derived from the size and spacing of cover HE_r = habitat effectiveness derived from the density or roads open to vehicular traffic *Open road densities in this table do not reflect seasonal closures. These closures would temporarily reduce open road density and increase HE_r and HEI values.</p>					

Post Clark Fire conditions are displayed in Table 43. The Clark Fire affected the Alder BGEA more than the other BGEAs. The fire changed approximately 2600 acres from hiding or optimal cover to forage. HEI runs for pre and post-fire conditions do not demonstrate a change in HE values. While the fire, primarily in the Alder BGEA, changed a large number of acres the proportion of the BGEA that was modified by the fire is small compared to the entire BGEA. Due to the small proportion changed no change is seen in HE values.

Table 43. HEI Values Post Clark Fire.

BGEA (Emphasis)	HE_f	HE_c	HE_r	HE_s	HEI
Forest Plan Mod/High	>0.5/ >0.6	>0.5/ >0.6	>0.5/ >0.6	>0.5/ >0.6	>0.5/ >0.6
Alder (Mod.)	.27	.66	.40	.54	.44
Andy (Mod.)	.39	.53	.20	.82	.43
Boundary (Mod.)	.38	.50	.23	.77	.43
<p>HEI = Habitat Effectiveness Index HE_f = habitat effectiveness derived from quality of forage HE_c = habitat effectiveness derived from the quality of cover HE_s = habitat effectiveness derived from the size and spacing of cover HE_r = habitat effectiveness derived from the density or roads open to vehicular traffic *Open road densities in this table do not reflect seasonal closures. These closures would temporarily reduce open road density and increase HE_r and HEI values.</p>					

The Fall Creek Watershed Analysis reports a total of 483 miles of road in the watershed (4.03 miles/square mile). 42 of these miles had been decommissioned at the time of the analysis resulting in a road density of 3.68 miles/square mile. Additional miles have been decommissioned since that time

reducing the density even further. If all recommendations for closure from the Middle Fork ATM Plan were implemented in this watershed the road density would be reduced to 1.84 miles/square mile.

The greatest impact on big game in this area is from human activity, primarily recreational use including hunting. The Fall Creek watershed is easily accessible from Springfield and Eugene, the third largest population center in Oregon. The Fall Creek corridor is utilized for camping, fishing, water play (swimming, tubing), kayaking (minor), birding, and hunting. The heaviest use period is from May into September during warmer weather, and is centered on the creek. Hunting in the fall tends to be more spread out throughout the watershed.

Fall Creek is an important winter range area. Snow rarely occurs in the lower portions of valley and rarely persists. Winter is the time of year where recreational use is at its lowest.

Seasonal restriction periods on roads in the area reduce traffic in the fall and correspond to general deer hunting season and elk hunting season. Open road densities in Table 43 do not reflect seasonal closures. These closures would further reduce open road density and increase HER and HEI values. Seasonal closures provide an increased level of security for the portion of the year that the closure is in effect.

Perhaps more important than the impacts of road densities upon elk habitat use and selection is the spatial relationships of those roads. Rowland et. al, (2000) and Wisdom et. al, (1999) analyzed the impact of road distribution and its impact and predictive aspects of elk habitat use. They found strong correlations between the distance from a road and the likelihood of selection of habitat. Road influences were found out beyond 1,000 meters. Elk were increasingly found in areas further and further away from roads, while those areas with many roads and limited distances between roads received very limited use. In the Fall Creek SIA project area, the existing road network provides very few of these locales. This provides very few areas of security where deer and elk can select habitats free from road influences. The presence of these roads likely adversely impacts the habitat effectiveness of cover and forage habitats to a substantial degree, and perhaps more so than a simple road density model would indicate.

Slick Creek, Jones Creek, and Bedrock Creek north of the project area are a large area that is virtually un-roaded. This area would provide security areas for big game to use to escape human activity. The Clark Fire, particularly Slick Creek, impacted these drainages. The conversion of hiding and thermal cover to forage in this area should not reduce its suitability for use by big game. The increase in forage should be beneficial. Forage may be more important to big game survival than thermal cover. Cook et al. (1998) suggest that while thermal cover may be important quality forage may be even more important for elk survival through the winter.

The impact that elk distribution has on deer distribution is related to the influence of road spatial arrangement on habitat selection. Wisdom et al., (1999) looked not only at elk distribution relative to road influences, but at mule deer distribution as well. Essentially, the interaction was the inverse of what the elk were doing. While elk presence and distribution increased the further away from open roads one got, the exact opposite occurred with mule deer. Habitat selection by mule deer was highest near roads and fell off quickly as distance from roads increased. Additional work by Wisdom et al., (1999) strongly suggest that this is the result of intra-specific competition and resulting displacement by the presence of elk in habitats further from those open roads. It is important to note that mule deer did select specific habitats and habitat patterns relative to their close proximity to open roads. As would be expected, mule deer selected strongly towards high quality cover habitats and forage habitats closely associated with cover (Wisdom et al. 1999). Like elk, the mule deer's response to the spatial context of open roads (and their interaction with elk) is significant, and is much better explained with a spatial analysis rather than a simple road density analysis.

Management Direction

Roosevelt elk and deer (black-tailed and mule) are identified in the Forest Plan as a management indicator species; habitat quality is evaluated in terms of forest cover, forage quality, size and spacing of cover and forage, and open road density. The Willamette Forest Plan (IV-pages 67-70) also established Standards and Guidelines for the indices used to evaluate habitat quality. The management objectives are based on Big Game Emphasis Areas (BGEAs) that were established in cooperation with Oregon Department of Fish and Wildlife. Emphasis levels were also assigned to each BGEA depending on its importance to big game.

Environmental Consequences

Direct and Indirect Effects

Alternatives A and B

Elk and deer are already using the burn area (Gebben, 2004b). Forage is expected to recover rapidly. Plants tend to sprout vigorously from the roots if the above ground portions are killed by fire, although it might take 2 to 5 years for grasses, sedges and forbs to return to their pre-fire abundance and volume. Shrub recovery may take 2 to 15 years. Fire can also increase nutrient content and palatability of forage, although the increased quantity of forage after a fire may be more significant than the increased quality of that forage (Cook et al, 1998). As stated in the existing condition section, elk and deer would likely forage in the burn area during the night and retreat to security areas during the day.

Alternative A – No Action

Alternative A would not fall any dead trees. Most of the large diameter fire-killed trees are expected to remain standing for more than 50 years. The smaller (<20" dbh) would start to fall sooner and the majority would be on the ground within 50 years. Large concentrations of down woody material could impede big game movements (Thomas et. al, 1979; Thomas & Toweill, 2002). Consequently, the highest use of the area may be in the first 20-30 years, after forage has redeveloped and before many of the trees have fallen.

Alternative B

Alternative B would fall and leave medium to high hazard rated trees. High concentrations of down wood would occur sooner in the project area potentially restricting movement by big game and reducing their use of the area.

The fire destroyed most of the cover within the project area. Alternatives A and B would not further reduce cover. Development of cover would depend on natural regeneration, no planting would occur under these alternatives. In the severely burned areas, recovery of hiding cover may take 25 to 50 years. Marginal cover would take 60 to 90 years to develop; satisfactory cover would likely take 90 to 120 years. Dead tree boles might offer some hiding cover, but only where snag densities are very high, and even then it is of limited value compared to a similar live, green tree with a shrub understory situation. Most of the small diameter dead trees would be on the ground in 10 years, so what does exist is short-lived. Lack of fuel treatment under alternative A would create a high risk for an intense reburn of the area; such a fire could further delay development of cover.

Alternative B would treat fuels on 15% (116 ac.). Treatment of fuels around high use areas should reduce the risk of a re-burn occurring and further delaying the development of cover.

Overall, deer and elk use in the area would likely increase in the first 10-20 years in response to the flush in forage. After 20 years, use would decrease as increasing concentrations of downed trees limits big game movement and natural regeneration delays development of hiding/thermal cover. Habitat effectiveness would remain better in adjacent unburned areas. Population numbers are expected to remain stable; distribution and use may change initially as a result of improved forage and then change again due to the subsequent build up of fuels as snags fall.

Alternatives C, D, and E

As described under the No Action Alternative, deer and elk use would increase as grasses, forbs and shrubs recover. Elk and deer would likely forage in the burn area during the night and retreat to security areas during the day. By removing trees, hazard tree removal and salvage harvest would limit the future build up of ground fuels. In Alternatives C, D, and E much of the burn area would be available for high quality forage until tree canopy recovers and begins to limit the development of ground vegetation.

Salvage of dead and dying trees would not directly impact remaining marginal and satisfactory cover, as only fire-killed trees would be salvaged, while leaving green trees expected to survive. Salvage logging would not have a significant effect on hiding cover. Dead tree boles offer little security and what little cover they provide would decrease as the snags fall. It is likely that many individual animals have already been displaced by the fire and are using surrounding areas with better habitat.

Planting would accelerate reforestation, allowing hiding cover and thermal cover to develop sooner than under a natural reforestation scenario. In the severe burn areas, recovery of hiding cover would take 15 to 25 years versus 25 to 50 years under the No Action Alternative or Alternative B. Marginal cover would develop in about 50 years versus 60 to 90 years under the No Action Alternative or Alternative B. Satisfactory cover would likely take 80 years to develop versus 90 to 120 years under the No Action alternative.

Open road densities would increase negligibly during the logging operations. In addition, Alternatives C, D, and E would construct a temporary road of about 300'. The amount of temporary road construction is insignificant compared to the total miles of road in each sub-watershed. The amount of temporary road construction is insignificant compared to the total miles of roads in the watershed. The temporary road would not significantly impact big game by increasing access into the area.

The temporary road construction associated with proposed salvage operations would have no net long-term effect on road densities. This road would be decommissioned upon completion of this project.

The alternatives would close 2.2 miles of road after the project is completed using KV funds. The proposed closures occur within the Andy BGEA and would bring the road density down to 4.8 mi/mi².

Impacts to deer and elk, from salvage operations, are expected to last only 1 to 3 years. Disturbance during logging is expected to be minimal as animals are already expected to move out of much of the fire area during the day due to the lack of hiding cover.

Overall, habitat effectiveness for deer and elk would be expected to improve over time. Road closures have the most immediate effect by reducing the potential for disturbance and improving habitat effectiveness. Salvage would reduce the future build-up of down logs that could impede big game movements. Tree planting would accelerate development of hiding and thermal cover.

Cumulative Effects

The cumulative effects analysis areas for big game are the BGEAs which overlap the project area. All of the activities listed in Appendix B have been considered for their cumulative effects on big game habitat. The following discussion focuses on those past, ongoing and reasonable foreseeable future activities that may contribute negative or positive effects.

The existing condition section describes cover, forage, and open road density conditions immediately following the fire. In Table 42, cover, road density, and habitat effectiveness values reflect all past and ongoing timber management and access management activities. Table 43 displays habitat effectiveness values following the Clark Fire and all foreseeable closures or timber management. Additional planned projects are not expected to change these values in the short-term.

None of the alternatives would immediately contribute any adverse cumulative effects to big game habitat. No thermal or hiding cover is removed. Alternatives C, D and E would contribute positively to cumulative effects by accelerating the development of hiding cover and thermal cover by planting.

Under Alternative A and B the elevated fuel loads expected in 15 to 30 years increase the risk of an intense re-burn; another stand replacement fire could further delay development of cover. Alternative B treats fuels on 116 ac. in and adjacent to high use areas somewhat reducing the risk of a re-burn. Alternatives C, D, and E also leave some burn areas untreated, but salvage logging and fuels treatments would reduce fuel loads overall and break up the continuity of fuels remaining.

There may be adverse effects from the elevated road use that is expected. One potential source would be from log haul during salvage operations. Although this should be minor due to expected decrease in use by big game of most of the area during the day due to the reduction of hiding cover. Firewood cutting is also expected to increase as a result of the fire.

Road densities in the watershed would continue to decrease as the Fall Creek Access Management Plan is more fully implemented.

In burned riparian areas, hardwood and conifer planting is being planned. Cumulatively, restoration activities, such as planting, would improve forage, hiding cover, and fawning and calving habitat. Reforestation is required where commercial timber harvest has occurred and the land is left under-stocked.

Future timber management and access management activities have been proposed for other areas within the Fall Creek watersheds. Since the Fall Creek SIA Recovery Project is expected to have little to no effect on big game habitat in the short term, and since future nearby activities would be designed with recognition of habitat losses due to the fire, cumulative adverse effects to big game are expected to be incidental regardless of the alternative selected.

Water Quality

Water Quality - *Analysis Issue*

Riparian area vegetation was killed by the fire along approximately 2 miles of Fall Creek and within the riparian area of several tributaries. The loss of stream-side vegetation would adversely affect water quality due to a reduction in vegetative shade during the summer season leading in an increase in water temperature. In portions of the fire area, soil stabilizing vegetation and organic matter on the ground surface were consumed. These effects could result in an increase in soil erosion and an adverse impact on water quality due to an increase in sediment delivery to streams.

Existing Conditions

Stream Temperature

Stream temperatures vary through the year and typically reach their maximum in July or August. Stream temperature data collected in Fall Creek downstream of and within the fire area indicates that Fall Creek consistently does not meet the State water quality standard for temperature during the summer season. Since 1998, the portion of Fall Creek flowing through the fire area has been listed by the Oregon Department of Environmental Quality (DEQ) as water quality limited due to high temperatures during the summer season. Within the fire area for the years 2000 and 2003, the maximum of the seven-day-average temperatures have ranged from 20.1°C to 22.6°C or from 4.1 to 6.6°C above the current standard. Further downstream, at the boundary of the Willamette National Forest, monitoring data for every summer from 1996 through 2003 indicates water temperatures higher than the standard.

The temperature of water is an expression of the heat energy per unit volume (Boyd and Sturdevant 1997). Important factors that affect stream temperatures include climate, riparian vegetation, quantity of water, and channel form and structure. The most important source of energy contributing to stream heating is from direct solar radiation (USDA/USDI 2004). As a source of stream water heating, energy from the air is conducted to the stream at a very slow rate (Boyd and Sturdevant 1997). Vegetation adjacent to streams that shade the channel can reduce the potential for direct solar radiation to increase water temperature. Streams that carry large quantities of water are more resistant to heating and cooling. The shape of the channel also influences the susceptibility of the channel to heating. Channels that are deep and narrow are less susceptible to increases in temperature than shallow wide channels.

Within the main stem of Fall Creek, pre-Clark Fire stream monitoring showed a general warming trend in the downstream direction from the headwaters to the lower reaches. However, over the entire stream course, there are short reaches where the temperature may drop due a combination of factors including riparian vegetation, groundwater input, topographic shade, or relatively cool tributary water. Streams cool by three primary processes: evaporation, back radiation, and when the stream is warmer than the air convection (Boyd and Sturdevant 1997). There is debate among investigators regarding the mechanism of heat accumulation in streams as the water flows downstream. Some studies have suggested that little of the heat that is added to small headwater streams is transferred downstream and that short reaches of functional riparian areas prevent the accumulation of heat in streams. Heat added to streams will dissipate in the downstream

direction under conditions that favor dissipation of heat, however heat that is not dissipated will be transported downstream (Poole et al. 2001).

Due to the mortality of riparian area vegetation by the Clark Fire, summer stream temperatures in Fall Creek within and downstream of the project area are likely to be higher than pre-fire temperatures until the vegetation recovers to a condition that provides shade similar to levels that existed before the fire. Within the Riparian Reserves inside the Special Interest Area project boundary, approximately 254 acres (67 percent of the total Riparian Reserve acres) were estimated to have greater than 80 percent mortality of the tree crowns. An increase in the volume of summer low flows due to a decrease in evapotranspiration from the fire affected area may to some extent decrease the potential for stream heating due to the loss of shading vegetation.

The effect of vegetation on stream shade is a function of the sun angle, vegetation height, stream orientation, and side slope. As the sun changes its position over the course of a day, the shade provided by the vegetation changes. When the sun is in its highest position in the sky vegetation closest to the stream is providing the greatest amount of shade. When the sun is at a lower angle, vegetation farther from the stream begins to provide shade to the stream. At some point, however, the shade from one tree falls on another tree and so those trees farther from the stream do not provide additional shade.

During summer season the daily period of greatest radiation occurs between 10:00 am and 2:00 pm. This period of time provides 58 percent of the total daily solar radiation (Figure 2). Because the sun is at a relatively high angle during this portion of the day, only those trees closest to the stream channel provide shade to the channel. The effective shade zone is composed of primary and secondary shade trees. Secondary shade trees contribute to stream shading only when the sun is lower in the sky. Primary shade trees provide shade throughout the day (Figure 3). Table 44 presents a general guide of the relationship between primary shade distance and vegetation height and slope angle.

Figure 2. Percent total solar radiation on August 1 by time of day (43° to 49° N Lat) (USDA/USDI 2004).

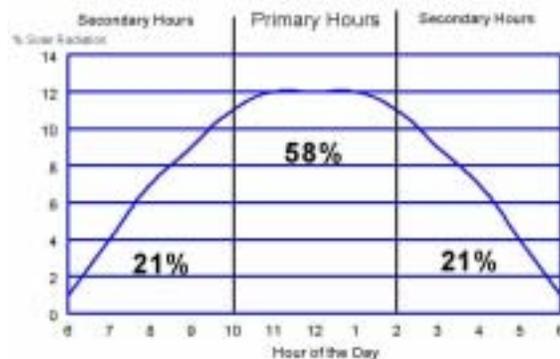


Figure 3. Primary and secondary shade tree distances (USDA/USDI 2004)

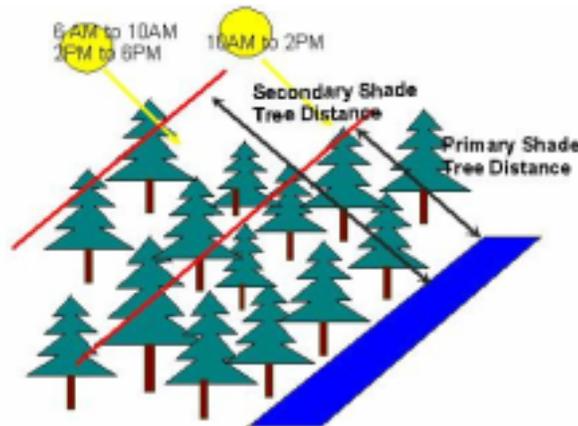


Table 44. - Primary shade distance (feet) (USDA/USDI 2004).

Height of Tree	Hillslope <30%	Hillslope 30 to 60%	Hillslope >60%
<20 feet	12	14	15
20 to 60 feet	28	33	55
>60 to 100 feet	50	55	60

The remaining green trees in the primary and secondary shade zone of Fall Creek (including hardwood species) will continue to provide shade to the channel during the critical summer season. Although the amount of shade produced by a dead tree is dramatically lower than shade provide by a live tree with a green canopy, dead trees can provide an important source of shade for streams (USDA 2003). However, the amount of shade provided by a dead tree will be reduced over time as the tree deteriorates. Generally the small branches in the canopy of a dead tree will fall to the ground within a few years after the tree dies, and as further deterioration occurs, the top portion of the tree will break off. Field reconnaissance of fires similar to the Clark Fire (e.g. the Warner Creek Fire of 1991 on the Middle Fork Ranger District) has shown that the tops of many Douglas-fir trees will begin to break off after approximately 10 years and for other tree species such as western hemlock, the tops may break off sooner.

Within the project area, Fall Creek generally flows from east to west. Due to this orientation, during the critical summer season only those trees located on the south side of Fall Creek provide a significant source of shading vegetation. Post-fire field reconnaissance determined that south of Fall Creek, from 0 to 50 feet from the edge of the active channel, there are approximately 445 trees killed by the fire that have a diameter of at least 12 inches at 25 feet in height.

The steep banks of the inner gorge of Fall Creek in the project area (generally ranging from 60 percent to greater than 100 percent slope) provide a source of topographic shade to the channel. Trees boarding Fall Creek on the upper edge of the inner gorge or on the terrace immediately adjacent to the steep slope above the stream channel attain a maximum height of approximately 200 feet and average approximately 130 feet in height. In general, the largest trees were the ones most likely to survive the effects of the fire. For the purposes of analysis, it was assumed that

the average fire killed tree was 130 feet tall with a primary shade zone of 0 to 60 feet and a secondary shade zone of 60 to 100 feet.

There is a wide variation in vegetative shade within burned areas corresponding to the degree tree crowns and undergrowth were killed by the fire. Within the primary and secondary shade tree zone along Fall Creek, many conifer trees survived the fire and currently have greater than 20 percent live crowns. In addition to these conifers there are many live hardwoods, primarily bigleaf maple and red alder and to a lesser extent, black cottonwood. Many of these hardwood crowns survived the fire and many others whose crowns were scorched have sprouted during the spring and summer of 2004 and have begun to provide some degree of shade. The tops of some hardwoods within the primary shade tree zone within the fire area experienced severe scorching or burning during the fire. Although the tops of many of these trees died, the developed root system of the trees has supported the development of rapidly growing sprouts from the lower portions of these trees (see Photos 6-8).

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Photo 6. Post Clark Fire hardwood sprouts in primary shade zone of Fall Creek.



Photo 7.- Post-fire bigleaf maple basal sprouts in primary shade zone of Fall Creek.



Photo 8. Post Clark Fire branch sprouts in canopy in primary shade zone of Fall Creek



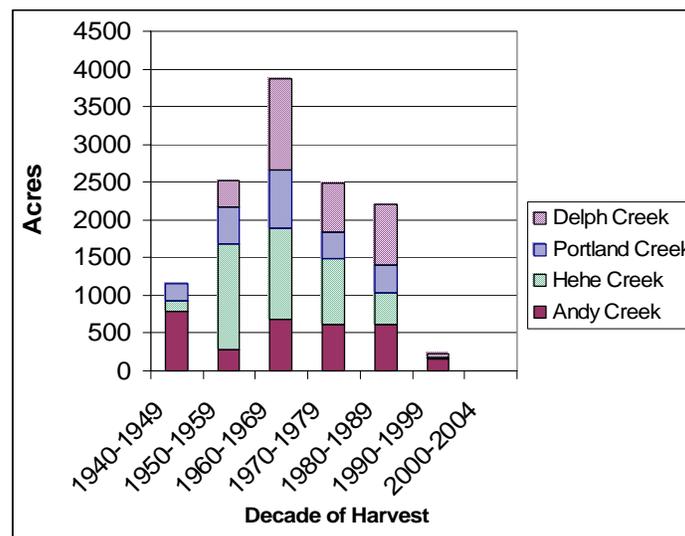
After only one growing season many of these hardwood sprouts are greater than 10 feet in height. By the mid-to late summer season of 2005, it is reasonable to expect many of these hardwood sprouts will be 15 to 20 feet in height or greater. To a limited degree, dead trees that are left standing and even fallen dead trees along the banks of Fall Creek can provide a small amount of shade to the stream channel.

A comparison of field measured shade values along Fall Creek inside and outside of the fire area indicates vegetative shade along Fall Creek was initially reduced by approximately 32 percent as a result of the fire. The majority of the area burned by the Clark Fire occurred in the drainages north of Fall Creek. Based on estimated crown mortality by drainage, the highest loss of potential vegetative shade within Riparian Reserves due to the effects of the fire occurred within the Slick Creek and Bedrock Creek drainages. In the Slick Creek drainage, crown mortality exceeding 80 percent is estimated to have occurred on approximately 206 acres of Riparian Reserve, which comprise approximately 30 percent of the all Riparian Reserves within the drainage. Within the Bedrock Creek drainage, crown mortality exceeded 80 percent on approximately 128 acres (35 percent of the total Riparian Reserves in the drainage). A comparison of field measured values of shade along tributaries inside and outside of the fire area indicates that stream shading vegetation has been reduced by approximately 23 percent by the fire. Overall, the tributary area of Fall Creek which experienced a high degree of crown mortality is a small percentage of the entire watershed, and contributes a small percentage of the summer low flow volume to Fall Creek

Historic Riparian Reserve Harvest

Throughout a large portion of the Fall Creek watershed streamside vegetation was removed during timber harvest activities primarily from the 1940's through the 1980's. Figure 4 displays the acres of regeneration timber harvest in Riparian Reserves within the Fall Creek watershed as a whole and by 6th field sub-watershed. Stand replacement harvest in Riparian Reserves peaked during the 1960's, dropped to very low levels by the 1990's. No stand replacement harvest in Riparian Reserves has occurred in recent years. On a watershed scale, stream side vegetation affected by past timber harvest activities is recovering and as trees and understory vegetation gain height this vegetation will provide high quality shade contributing to cooler stream water temperatures in the future.

Figure 4. Acres of regeneration timber harvest in Riparian Reserves by 6th field sub-watershed and decade



Peak Stream Flow

Fire effects within the project area include the potential for changes in base and peak stream flows. Reduced rates of evapotranspiration due to the high percentage of fire killed vegetation will contribute to a small increase in water yield, including an increase in summer base flows. The reduction in canopy closure due to the effects of the fire has the potential to influence peak stream flows. The vegetative condition of an area as it relates to management effects on snow accumulation and melt is termed hydrologic recovery. The Aggregate Recovery Percent (ARP) methodology can be used to quantify hydrologic recovery. For planning purposes, the Willamette Forest Plan describes the sensitivity of planning subdrainages based on the overall slope of the drainage and the percent of the area in the transient snow zone. The planning sub-drainages (PSUB) were assigned a mid-point ARP value as a reference for assessment purposes. The mid-point ARP values provide a relative measure of drainage sensitivity. These may be viewed as thresholds of concern below which there would be a greater risk of increased peak flows and associated adverse effects such as stream bank or channel bed erosion.

The majority of streams tributary to Fall Creek in the Clark Fire area are located outside of the SIA project area. However since these tributary streams and the contributing source area for in-stream flows are partially within the SIA project area or affect water quantity and quality within the planning area, changes in peak flows due to management actions within areas tributary to Fall Creek within the SIA planning area are considered as part of the cumulative effects.

The Fall Creek WA (USDA, 1995) states that all Fall Creek 6th field sub-watersheds are currently below their respective weighted Forest Plan mid-point ARP values, conditions vary considerably between different planning subdrainages, and management activities over time have increased the potential for increased runoff during rain-on-snow events in some areas. ARP calculations based on pre-Clark Fire (2003) data, including past timber harvest and other fire events, indicate that all 6th field sub-watersheds that were impacted by the Clark Fire were at or above weighted Forest Plan mid-point values and are considerably higher than values reported in the 1995 watershed analysis (see Table 45). Due to the high tree mortality within portions of the fire area, there is an increased potential for an increase in peak stream flows during rain-on-snow events in some drainages. ARP values for post-fire conditions by planning sub-drainage (PSUB) are presented in Table 47. The Slick/Bedrock PSUB is currently below Forest Plan mid-point levels due the effects of the fire. All other PSUBs remain above mid-point values. By the year 2024, the Slick/Bedrock PSUB would be expected to have recovered above the mid-point ARP value.

The Slick Creek drainage ARP is the lowest (68 percent) due to the effects of the fire (see Table 46). Although the ARP value for the Bedrock Creek drainage is higher (75 percent), it is still below the mid-point value.

Preliminary reconnaissance of the Slick and Bedrock Creek stream channels indicates that these streams are currently functioning at an acceptable level given the effects of the fire. These streams were found to have sufficient quantities of in-stream large woody material to provide for channel stability in the event of elevated peak flows and a high potential for future recruitment. Only minor areas of stream bank erosion were observed. Current information indicates that no adverse effects to stream channel conditions are likely to occur in any drainage due in increases in peak stream-flow.

Table 45 - Pre-fire ARP values and Forest Plan weighted Mid-point ARP values for 6th field sub-watersheds that contain portions of the Fall Creek SIA project area.

New 6th Field Name	Old 6th Field Name	New 6th Field Number	Old 6th Field Number	Pre-fire ARP (2004)	Watershed Analysis ARP (1995)	Forest Plan Weighted Mid-point ARP
Andy Creek	Lower Fall Creek	09-04	15 1	74	72	74
Hehe Creek	Hehe Creek	09-02	15 4	90	76	79

Table 46 - Post fire ARP values by Drainage.

Drainage Name	Drainage Number	ARP Year 2004	ARP Year 2014	ARP Year 2024
Slick	09-04.04	68	70	79
Bedrock	09-04.05	75	75	83
Jones	09-02.01	87	89	92
South Fall Tributaries	09-04.08	62	73	83

Table 47 - Post Fire ARP values by Planning Sub drainages.

PSUB Name	PSUB Number	Forest Plan Mid-Point ARP	ARP Year 2004	ARP Year 2014	ARP Year 2024
North Fork Fall	15B	75	85	94	96
Slick/Bedrock	15D	80	73	74	82
Jones	15E	75	89	92	94
Andy	15X	75	78	91	96
South Fall Tributaries	15Y	65	67	77	86
Timber	15Z	70	78	91	97

Suspended Sediment, Turbidity, and Nutrients

The Fall Creek WA (USDA, 1995) states that turbidity and suspended sediment levels in streams are generally low except during high runoff events. Forest management activities were found to have increased sediment delivery to streams particularly where roads and harvest units have impacted the greatest percentage of fine-grained soils. Potential source areas of fine sediment were identified by planning sub-drainage as follows; Timber Creek, Boundary Creek, South Fall Tributaries, Andy Creek,

and Alder Creek. All of these planning subdrainages are in the Andy Creek sub-watershed (6th Field) except Alder, which is in the Hehe Creek sub-watershed.

Soil erosion can be considered to originate from either mass soil movement (mass wasting or debris slides) or surface erosion. Within the project area, the potential for soil erosion has increased due to the effects of the fire. The Soils Report (Murdough, 2004) for the project area states that the area has a low probability of failure occurring from road related management activities. A mild winter with relatively low intensity rainfall and low storm duration, highly permeable soils, a high percentage of remaining effective ground cover, residual surface coarse fragments, and the re-growth of ground vegetation, has contributed to minimizing soil erosion from the area.

Since the time of the Clark Fire, visual observations of Fall Creek have noted elevated suspended sediment and turbidity during high runoff events. As documented in the Soils Report for the project, the effects of the Clark Fire have elevated the soil erosion potential. However, field reconnaissance found that no major sedimentation occurred during the first winter period following the fire (Murdough, 2004). Field reconnaissance of soil conditions has documented bare soil areas along the steep stream banks of Fall Creek in the fire area, with these areas rated as having severe soil erosion potential. The erosion potential within the project area is much lower on the valley bottom than the surrounding hill slopes ((Murdough, 2004). Levels of suspended sediment and turbidity have likely increased in Fall Creek and some tributaries during high runoff events as a result of the fire. Following the peak runoff periods, turbidity levels appear to return rapidly to the usual seasonal condition. Potential erosion in all areas of the Clark Fire is expected to decrease as soil stabilizing vegetation recovers. The Soils Report for this project estimates that potential soil erosion due to the effects of the fire will decrease over approximately a 4-year period as the vegetation of the area moves toward a shrub dominated community. Field surveys noted that soil surface roughness, effective ground cover, and gentle slopes are key factors reducing the erosion potential for the majority of the project area (Murdough, 2004).

The effects of fire on water quality depend upon how the fire interacts with watershed characteristics. Important aspects that can result in measurable effects to water quality from fire include; whether the fire was severe enough to consume a large quantity of organic matter, if a large rainstorm occurred following the fire, and if the watershed area burned is composed of steep slopes (Ranalli 2004). In addition to potential increases in sediment and turbidity, fire effects have the potential to increase essential plant nutrients in streams including nitrogen and phosphorus. These nutrients can contribute to downstream eutrophication. In a review of the scientific literature, Ranalli (2004) reported that in general the highest concentrations of nitrates in stream water occur in the weeks to months immediately following the fire. Also Ranalli found that phosphorus in surface water can increase after a fire, however, generally little phosphorus reaches surface water due to the up-take by plants and the formation of insoluble phosphorus compounds. Overall elevated concentrations of phosphorus tend to decline 1 to 2 years after a fire and elevated levels of nitrogen, especially nitrate decline 3 to 5 years after a fire. The increased concentrations of nutrients in surface water have the potential to increase eutrophication of affected streams and downstream lakes and reservoirs. Measurable effects to lakes and reservoirs are most likely to occur when the trophic status is oligotrophic to mesotrophic (Ranalli 2004).

Timber salvage, particularly those activities that occur within Riparian Reserves, have the potential to increase sediment and nutrient delivery to stream during high runoff events. Specific activities of concern include; road culvert replacement, road maintenance, temporary road construction, log yarding, and log hauling. For analysis purposes, it is assumed that activities that have the potential to generate sediment and turbidity would have a similar effect on the potential to alter nutrient delivery to stream channels.

Best Management Practices

Soils and water effects mitigation measures are recommended to eliminate or minimize the potential water quality effects of timber harvest and road reconstruction and use. Logging system restrictions, seasonal operation restrictions, and large woody material retention requirements are designed to mitigate adverse effects to the soils resource and a potential loss of productivity. These measures are also implemented to reduce the potential for adverse effects to water quality. Potential adverse impacts to water quality and stream channel condition are mitigated in part by designation of Riparian Reserves, erosion control requirements, yarding restrictions and road drainage improvements.

Appendix H of the Willamette Forest Plan describes how Best Management Practices (BMPs) are the primary mechanism that enables achievement of water quality standards. BMPs are selected and tailored for site specific conditions.

General water quality BMPs have been developed for the protection of water quality in the Pacific Northwest Region (USDA 1988). These general BMPs will be utilized as necessary on a site specific basis to mitigate potential adverse impacts.

Photo 9 - Revegetation following initial post-fire roadside salvage.



Examples of the effectiveness of BMPs implemented from recent past actions are evident within the Fall Creek SIA project area. Fire suppression rehabilitation activities in the fall of 2003 included roadside seeding of annual rye grass. In the early summer of 2004, hazard trees were cut and removed within approximately 50 feet of Road #1800. Log removal was accomplished while keeping equipment on the

road surface. Subsequent field reconnaissance of these roadside areas showed minimal soil disturbance (Photo 9) and low erosion potential. During and following salvage activities, the majority of the area maintained a dense growth of grass minimizing the potential for runoff to delivery sediment to stream channels.

Water Quality Standards

Pursuant to Memoranda of Agreement with the U.S. Forest Service and the Bureau of Land Management, water quality standards are to be met through the development and implementation of water quality restoration plans, BMPs and aquatic conservation strategies. Implementation of these plans, practices and strategies has been deemed to be in compliance with water quality rules (OAR 340-041-0028(12)(g)). Currently a watershed restoration plan for the Fall Creek watershed has not been completed.

The state of Oregon has established water quality standards set out in Chapter 340, Division 41 of the Oregon Administrative Rules. Water bodies that do not meet state water quality standards are termed “water quality limited” and are placed on a list in accordance with Section 303(d) of the federal Clean Water Act (303(d) list). The main stem of Fall Creek within and downstream of the project boundary is currently designated as water quality limited on the 303(d) list for high summer water temperatures.

Temperature - On March 2, 2004, the U.S. Environmental Protection Agency announced approval of a revised Oregon Water Quality Standards for temperature. Under the new standard, Fall Creek is considered “core cold water habitat” and the applicable standard states that the seven-day-average maximum temperature may not exceed 16.0°C (60.8 F)(OAR 340-041-0028(4)(b)).

Turbidity - Oregon’s turbidity standard was first adopted by the DEQ in the 1970’s and last revised in 1990. The current standard states:

OAR 340-41-(Basin)(2)(C): No more than a ten percent cumulative increase in natural stream turbidities shall be allowed, as measured relative to a control point immediately upstream of the turbidity causing activity. However, limited duration activities necessary to address an emergency or to accommodate essential dredging, construction or other legitimate activities and which cause the standard to be exceeded may be authorized provided all practicable turbidity control techniques have been applied...

A draft revised turbidity standard is currently being reviewed by the U.S. Environmental Protection Agency (EPA). The draft new criteria are intended to better address effects on beneficial uses, clarify that criteria apply to ponded systems, and describe requirements for applying criteria. The new turbidity criteria will become effective upon EPA approval.

Beneficial Uses

The Oregon Department of Environmental Quality has identified beneficial uses for Willamette River tributaries in Oregon Administrative Rules 340-41-340 Table 340A. Beneficial uses within the watershed include:

- Public Domestic Water Supply
- Potential Anadromous Fish Passage
- Salmonid Fish Rearing
- Salmonid Fish Spawning

- Resident Fish and Aquatic Life
- Recreational Fishing
- Water Contact Recreation
- Aesthetic Quality

Management Direction

The Willamette Forest Plan requires that the potential for cumulative effects of proposed projects on beneficial uses and stream channel conditions be considered in project design (FW-093). This assessment should consider the effects of management practices on riparian conditions, mass movements, and hydrologic recovery.

An integral part of the Northwest Forest Plan is the Aquatic Conservation Strategy (ACS). The ACS is intended to maintain and restore the ecological health of the watersheds and ecosystems within the Northwest Forest Plan area. The Northwest Forest Plan was amended in March, 2004 to clarify provisions relating to the ACS. The objectives of the ACS are intended to apply only at the fifth-field watershed analysis area scale. Attainment of these objectives at these large scales will take decades or longer in some cases and the effectiveness of the strategy can only be assessed over the long-term. Although application of the standard and guidelines in the Northwest Forest Plan limit the potential for adverse effects to occur from the implementation of individual projects, the ACS objectives are not intended to be interpreted as standard and guidelines for individual projects. Compliance with the ACS in regard to ongoing and potential future salvage activities within the Riparian Reserve of Fall Creek should be evaluated at the fifth-field watershed scale. The Clark Fire area is a small percentage (6%) of the Fall Creek fifth-field watershed. Compliance with current standards and guidelines, and implementation of appropriate BMPs, should insure compliance with ACS objectives at the fifth-field scale.

Under the ACS of the Northwest Forest Plan, Riparian Reserves are used to maintain and restore riparian structures and functions of streams, confer benefits to riparian dependent and associated species other than fish, enhance habitat conservation for organism that are dependent on the transition zones between upslope and riparian areas, improve travel and dispersal corridors for many terrestrial animals and plants, and provide for greater connectivity within the watershed. The Riparian Reserves will also serve as connectivity corridors among the Late Successional Reserves. (NWFP, B-13)

Complying with the ACS objectives means that an agency must manage the riparian-dependent resources to maintain the existing conditions or implement actions to restore conditions (NWFP, B-10).

The Fall Creek WA (USDA, 1995) provides a listing of recommendations specific to Fall Creek for riparian vegetation and aquatic habitats restoration projects.

Environmental Consequences by Alternatives

Evaluation Criteria:

- potential change in water temperature in Fall Creek during July and August (as measured by number of trees cut in the primary shade zone and the percent change in shade),
- potential change in peak stream flow due to vegetative condition (as measured by change in ARP),
- potential change in suspended sediment and turbidity by Alternative (as measured by acres potentially disturbed within unit boundaries, road culverts replaced, miles of road maintained, and log haul over aggregate surface roads).

Direct and Indirect Effects

Stream Temperature

Alternative A (No Action)

Over time the tops of fire killed trees would decay and fall, resulting in a loss of the small amount of shade they are capable of providing to the stream. Because this alternative would not plant conifers in the riparian areas of perennial streams, there would be a delayed in establishment of stream side shading vegetation resulting in a delay of recovery to the pre-fire shade condition. Because no management actions would occur under this alternative, there would be no direct or indirect effects from proposed management activities. Water temperature in Fall Creek within and downstream of the project area would likely remain elevated for a period of decades as vegetation recovered from the effects of the fire.

Alternative B

This alternative would result in the falling of some hazardous trees in the primary and secondary shade zone of Fall Creek. A large percentage of the standing dead trees and all green trees within the primary and secondary shade zone would be retained and would provide some shade to the stream until these dead trees naturally fall from decay. Approximately 35 to 45 dead trees would be felled in the primary and secondary shade zone on the south side of Fall Creek under this alternative. The majority of the dead trees in the primary and secondary shade zones that would be cut under this alternative are located along the Road 18 corridor on the eastern and western sides of the fire affected area. Field reconnaissance determined that within 0 to 50 feet of the edge of the active channel south of Fall Creek there are approximately 445 dead trees and 227 live trees that are at least 12 inches in diameter at 25 feet in height. Assuming a similar number of dead trees from 50 to 100 feet from the edge of the active channel of Fall Creek, there are approximately 1,344 dead and live large trees within the effective shade zone on the south side of Fall Creek. The 45 trees that potentially would be cut are approximately 3 percent of the total number of large trees within the effective shade zone. Overall these dead trees have a lower ability to provide shade than green trees. Generally the largest and tallest trees that are capable of providing the most shade survived the fire at a higher rate than the small more vulnerable trees. A portion of the trees cut under this alternative would be felled toward the stream channel and would potentially continue to provide a limited amount of shade to the stream.

Because some of the trees proposed to be cut are close to the outside margin of the 0 to 100 foot zone (away from Fall Creek), not all of the potential shade provided by the dead trees would fall on the summer wetted channel. Generally the trees to be cut to provide for public safety are located closer to the road than the stream channel. Data from a stream survey of Fall Creek indicate an average riffle width of 49 feet within the approximately 2 miles of the severe fire affect reach (USDA 2002). Assuming this width for the entire fire affected reach results in a wetted channel area of approximately 258,720 square feet. Assuming each dead tree would be capable of providing 40 square feet of shade to the wetted channel, falling of 45 trees would have the direct effect of reducing the potential shade in the fire affected reach by a total of approximately 0.7 percent. The loss of this small percent of potential shade would not result in a measurable increase in stream temperature over the stream reach. This negligible effect could be viewed as short-term because as the dead trees naturally deteriorate, particularly over the next 10 years, the amount of shade they are capable of producing will decline. A compensating factor to any potential loss of shade in the short-term would be the rapid recovery of hardwood tree species in the primary and secondary shade zone of Fall Creek. The recovery of stream shade from this source has already begun in the project area and is expected increase in the short-term as the height and width of the green hardwood canopy expands (see Figures 6-8).

The estimation of a 0.7 percent reduction in shade should not have an effect on spring chinook salmon or the aquatic environment. As stated above, the reduction in shade would not result in a measurable increase in stream temperature. Salmon spawn throughout the entire 17 mile section of available habitat in Fall Creek and the 0.7 percent reduction in shade only applies to about 0.25 mile of Fall Creek.

Because this alternative would not plant conifers in the riparian areas of perennial streams, there would be a delayed time period when stream shading vegetation would be established, resulting in a delay of streams returning to the pre-fire shade condition. Under this alternative there would be a potential for higher summer stream temperatures to persist for an extended period of time compared to other action alternatives.

Alternatives C and D

These alternatives would result in the falling of hazard trees in the primary and secondary shade zone of Fall Creek and other perennial streams. Similar to Alternative B, under these alternatives 35 to 45 dead trees would be felled on the south side of Fall Creek within the primary and secondary shade zone. A difference between these alternatives and Alternative B is that beyond 100 feet from the edge of the active stream channel some removal of trees would occur however removal of these trees would not be expected to significantly alter stream shade. The effects on stream shade and potential changes in water temperature from the cutting of dead trees would be the same as described for Alternative B. These alternatives do propose planting conifers in areas of high tree mortality resulting in an accelerated rate of vegetative shade recovery compared to Alternatives A and B. Stream temperatures during July and August would not be expected to increase measurably during July and August due to the cutting of the estimated number hazardous trees within the primary and secondary shade zone of Fall Creek. In the long-term, planting of trees in the effective shade zone should provide for lower summer stream temperatures at an earlier point in time compared to Alternatives A and B.

The direct effect of reducing the shaded area of Fall Creek by removing the 35 to 45 trees on the south side of Fall Creek is the same as Alternative B. That is, reductions of approximately 0.7 percent of the shaded area of the Fall Creek stream channel. As mentioned in the discussion for Alternative B, the effect of this potential loss in shade would not be measurable and would not result in an increase in stream temperature. Even this negligible effect could be viewed as a short-term change since if the trees are not felled they would naturally deteriorate, particularly over the next 10 years, and the amount of shade they are capable of producing will decline. Also, as in Alternative B, the corresponding effect on spring chinook salmon and the aquatic environment would be negligible. Salmon spawn throughout the entire 17 mile section of available habitat in Fall Creek and the 0.7 percent reduction in shade only applies to about 0.25 mile of Fall Creek.

Alternative D differs from Alternative C in the treatments of the outer portion of the Riparian Reserves on several intermittent and perennial tributary streams to Fall Creek south of Road #1800. No harvest would occur within 100-200 feet of the streams. The upslope half of the Riparian Reserves would be partially harvest to meet a balance of resource objective while maintaining CWD habitat. Water temperature and stream shade would likely not be affected by removing the outer 100-200 feet of the Riparian Reserves because a 200 foot tall tree only cast about 72.8 feet of shade. This is based on the angle of the sun during June 21, where the sun is at its highest point in the year (approximately 70 degrees). By calculating the opposite side of the right triangle formed from the angle of the sun ($\text{Tangent } 20 \text{ degrees } (200) = 72.8 \text{ feet}$) it can be assumed that trees outside of 72.8 feet from a stream channel can not effectively shade that stream channel.

Alternative E

Similar to Alternatives B, C, and D, this alternative would result in limited cutting of hazard trees in the primary and secondary shade zone of Fall Creek. Under this alternative, however, some additional trees within the effective shade zone would be felled to provide for a greater degree of safety for the dispersed recreation sites in the project area. The number of dead trees expected to be cut within 0 to 100 feet from the edge of the active channel on the south side of Fall Creek is estimated to be from 50 to 60 trees. Assuming the same level of potential shade per tree and the same wetted channel area as described under Alternative B, cutting of 60 dead trees would potentially have a direct effect of reducing stream shade by approximately 0.9 percent. Stream temperatures during July and August would not be expected to increase measurably during July and August due to the cutting of the estimated number hazardous trees within the effective shade zone of Fall Creek. Similar to Alternatives C, and D, this alternative proposes to plant conifers in areas of high tree mortality resulting in an accelerated rate of vegetative shade recovery compared to Alternatives A and B. In the long-term, planting of these trees should provide for lower summer stream temperatures at an earlier point in time compared to Alternatives A and B.

Alternative E also proposes to partially harvest dead trees in the upslope portion of Riparian Reserves of stream tributaries to Fall Creek. As in Alternative D, the change in water temperature and stream shade would likely not be affected by removing the outer 100-200 feet of the Riparian Reserve because a 200 foot tall tree can only cast about 72.8 feet of shade.

This overall small reduction in shade would pose an immeasurable change in stream temperature. Salmon spawn throughout the entire 17 mile section of available habitat in Fall Creek and the 0.9 percent reduction in shade only applies to about 0.25 mile of Fall Creek. This immeasurable change in water temperature as a result of Alternative E would not affect spring chinook salmon or the aquatic environment.

Peak Stream flow

Alternative A (No Action)

Under this alternative, no actions are proposed so there would be no direct or indirect effects. There is no change in peak stream flow (as quantified by the ARP methodology).

Alternatives B, C, D, and E

Under all action alternatives, all green trees would be retained and therefore canopy closure would not be affected in the short-term. The change in canopy closure that would result from falling and/or removing dead trees under these alternatives would not result in changes in peak stream flows or ARP values.

Alternative B

Under this alternative, no conifer tree planting would occur. High rated hazard trees would be cut to provide for public safety and the activity areas would be allowed to re-vegetate naturally. Based on field observations from areas of high mortality of mature trees in portions of the SIA planning area, it is believed many of these areas would experience a delay in developing a closed forest canopy condition without tree planting. In areas where the forest canopy was consumed by the fire, there was a reduction in the seed source for a new generation of trees. Since the potential for increases in peak stream flow associated with rain-on-snow events in the future would be associated with the degree of canopy closure (as quantified by the ARP methodology), under Alternative B there would be a small potential for the

SIA planning area to contribute to increased peak stream flows during high runoff events for an extended period of time compared to the other action alternatives that do include conifer tree planting. The extended period of time that vegetative recovery would be delayed in the high mortality areas of the SIA is estimated to be 20 to 40 years.

Alternatives C, D, and E

Under these alternatives some dead trees would be cut and all green, healthy trees would be retained. Since dead trees do not contribute substantially to canopy closure, no effects on peak stream flow would be anticipated. These alternatives would include tree planting in portions of the SIA planning area where high mature tree mortality occurred. Tree planting would accelerate establishment of a forest canopy compared to alternatives that rely on natural regeneration. It is estimated that vegetative recovery would occur approximately 20 to 40 years earlier in portions of the SIA that experienced high tree mortality. The earlier establishment of a forest canopy would to a small degree contribute to a lower risk of increased peak stream flows during high runoff events within and downstream of the SIA planning area. However, even under these alternatives, the degree planting would reduce potential peak stream flow in the future would be small. Alternatives C, D, and E all include 436 acres of proposed conifer planting. All of the planting would occur within the Andy Creek sub-watershed. The acres of proposed planting would comprise less than 2 percent of this sub-watershed. Although gaining canopy closure at an earlier point in time would potentially contribute to a reduction in management related increases in peak stream flow in the future, due to the small watershed area affected the potential change in peak stream flow from planting this relatively small area would not be measurable.

Suspended Sediment and Turbidity

Differences between proposed alternatives in terms of sediment generation and impact upon water quality were assessed through soil erosion modeling and an evaluation of the effects of culvert replacement, log haul over aggregate surface roads, and road maintenance by alternative. These indicators of potential activity generated sediment are only intended as an indication of relative risk between alternatives and should not be viewed as a predicted quantity of sediment that would be expected to be delivered to stream channels.

The potential for sediment to be delivered to a stream depends to some extent on the severity of high runoff storm events in the future. In the event of a high magnitude, low frequency runoff event, the potential for sediment delivery to streams would increase. However, in the case of a large storm event, potential sediment delivery to streams would increase for both management and natural sources and any increase in sediment from the project area would most likely be dominantly associated with the effects of the fire rather than proposed management activities.

Alternative A (No Action)

No management actions are proposed and as a result there would be no management related sediment input from proposed project activities. For comparison purposes, modeling of potential soil erosion resulted in an estimated 1,008 tons of potential sediment under this alternative from natural, fire-related sources (refer to Soil section, Table 52) (Murdough, 2004).

Alternative B

There would be little risk to no risk of sedimentation from this alternative because there is no commercial extraction of fallen timber. No trees (with the possible exception of a few trees to be moved to protect the Road#1800 bridge) would be removed (no yarding of logs) and no road maintenance or log truck hauling. For comparison purposes, post-management erosion modeling estimated the

potential for 1,008 tons of sediment (refer to Soil section, Table 52) (Murdough, 2004). Under this alternative, 6 culverts would be replaced on Road 1800 and there would be very limited to no log hauling. Culvert replacement work would occur during dry weather periods when there is no surface water flow, thus minimizing the potential for sediment to be delivered to surface water at the time the project is implemented. However, for a brief period of time during the first storm related runoff event following culvert installation, a minor amount of sediment could be delivered to streams as a result of soil disturbance from the culvert installation. This minor amount of sediment would be delivered to streams at a time when flows are elevated during a time when there is an increased ability of the stream to dilute incoming sediment. Additionally, during high runoff events sediment levels from all sources are higher including natural background rates. In the long-term, culvert replacement would reduce the potential for road failure to deliver large quantities of sediment to stream channels.

Alternative B would fall a total of about 100-120 hazard trees into Fall Creek. These trees may dislodge minor amounts of sediment when they impact the stream channel of the adjacent stream bank. From past experiences with this type of enhancement project, the amount of sediments dislodged is extremely low. Furthermore, due to high flows in Fall Creek, sediments and large organic material entering the channel is quickly moved to the reservoir (Bates, 2004).

Alternatives C, D, and E

The quantity of sediment delivered to stream channels would not be expected to vary to a large degree between these alternatives. However, differences in potential sediment by alternative could be viewed in terms of relative risk and be used for purposes of alternative comparison (Murdough, 2004). Post-management potential erosion is estimated to be 1119, 1208, and 1204 tons for Alternatives C, D, and E respectively (refer to Soil section, Table 52) (Murdough, 2004). These differences largely reflect the size of proposed timber salvage activity areas by alternative. Alternatives C, D, and E would yard dead trees on 146 acres, 249 acres, and 328 acres, respectively. These alternatives propose using logging systems which provide full to partial suspension of the logs to minimize soil disturbance. Given implementation of required BMPs, negligible additional delivery of sediment to stream channels by salvage of dead trees would be anticipated under any of the action alternatives. As previously stated, modeled erosion values of potential sediment are presented for the purpose of alternative comparison and not intended to be viewed as predicted sediment delivered to streams. Most sediment would be re-deposited on site (Murdough, 2004).

Implementation of BMPs would result in minimal delivery of sediment to streams from management activities under any action alternative. Only limited numbers of trees would be removed from within 100 feet of perennial stream channels minimizing the potential for sediment delivery to streams. Equipment used to move trees would remain on roads where possible, the majority of hauling would occur on paved roads, and where necessary, grass seed and mulch would be applied to disturbed soil to minimize the potential for soil erosion including temporary roads.

Under Alternatives C, D, and E, six culverts would be replaced on Road #1800. This work would occur during dry weather periods when there is no surface water flow, thus minimizing the potential for sediment to be delivered to surface water at the time the project is implemented. However, for a brief period of time during the first storm related runoff event following culvert installation, a minor amount of sediment could be delivered to streams as a result of soil disturbance from the culvert installation. This minor amount of sediment would be delivered to streams at a time when flows are elevated during a time when there is an increased ability of the stream to dilute incoming sediment. Additionally, during high runoff events, sediment levels from all sources are higher including natural background rates. In

the long-term, culvert replacement would reduce the potential for road failure to deliver large quantities of sediment to stream channels.

In addition to culvert replacement, Alternatives C, D, and E also include various amounts of other road reconstruction and maintenance activities (Sayre, 2004). Total road miles of reconstruction and maintenance activities for Alternatives C, D, and E are 3.78, 4.18, and 4.18 miles respectively. Activities including blading of road beds, cleaning of ditches and culvert inlets and outlets, removing sloughed side material, and placing crushed aggregate. These activities would occur during periods of dry weather and would not be expected to result in sediment delivery to streams during implementation. However, similar to potential sediment generated from culvert replacement, these activities could disturb soil and could result in minor quantities of sediment to be delivered to streams during storm related runoff events. The small amount of sediment potentially delivered to streams during high runoff events would be diluted due to increased stream flow associated with these events. At these times sediment levels from all sources would be higher including natural background rates. In the long-term, these road reconstruction and maintenance activities would reduce the potential for road failure to deliver large quantities of sediment to stream channels.

There is a potential for log haul to increase sediment delivery to streams due to road use accelerating the erosion rate of fine sediment from the road surfaces. Total miles of log haul over Forest roads would vary by alternative and would be 7.86 for Alternative C and 8.26 for Alternatives D and E (Sayre, 2004). The total miles on Road #1800 (6.06 miles on paved surface) would be the same for these three alternatives. The distance of haul over aggregate surface roads would be 1.8 miles for Alternative C and 2.2 miles for Alternatives D, and E. In addition to differences in haul distance, the total number of logs, and therefore the total number of trips over the road surface, would vary by alternative. The number of loads would be approximately 373, 733, and 773 for Alternatives C, D, and E respectively. Haul routes for Alternatives D and E would both have an additional 0.40 miles of aggregate road surface compared to Alternative C. The hauling of logs over a paved road surface (Road #1800) would have a low potential to increase sediment to streams. Hauling over aggregate surface roads, however, would have a higher potential to increase sediment delivery to stream particularly if haul occurs during periods of wet weather or if roads are not properly maintained. Log haul for all action alternatives would be restricted to periods of dry weather and all action alternatives include road reconstruction and maintenance activities. There would be the potential for fine sediment from aggregate surface roads generated from log haul to be delivered to stream channels by runoff during periods of wet weather after log haul occurred. Implementation of BMPs including proper road maintenance should result in a low risk of adverse effects from hauling.

Although nutrient concentrations, particularly nitrate, may be elevated in streams for approximately 3 to 5 years from the date of the Clark Fire, proposed management activities under any action alternative would not be expected to elevate nutrient concentrations in streams above levels associated with effects from the Clark Fire.

Alternatives C and D would fall a total of about 70-90 hazard trees and Alternative E would fall about 100-120 trees into Fall Creek. These trees may dislodge minor amounts of sediment when they impact the stream channel of the adjacent stream bank. Also, any of the above mentioned activities associated with the alternatives increase the likelihood of generating sedimentation that could enter the stream channels and effect spring chinook salmon or the aquatic environment. With the implementation of mitigation measure and required BMPs, negligible additional delivery of sediment to stream channels would be anticipated under any of the these alternatives

Cumulative Effects

Cumulative effects of all alternatives include the effects from past, present and future foreseeable actions within the Fall Creek watershed. See Appendix B for a complete list of projects considered to contribute to cumulative effects.

Stream Temperatures

Past timber harvest in the Fall Creek 5th field watershed has reduced stream shade at a watershed scale and is likely a contributing factor to elevated summer stream-water temperatures. Changes in management direction have resulted in a dramatic reduction of harvest within the primary and secondary shade zone of streams in the watershed since 1990 (see Figure 10). Riparian area shading vegetation will recover over time and contribute to cooler stream water temperatures. Within the Clark Fire area, the loss of vegetative shade due to the effects of the fire will contribute to elevated stream temperatures until vegetative shade returns to pre-fire conditions.

The effects of the Clark Fire have reduced the quantity and quality of vegetative shade on Fall Creek and its tributaries in the project area. Since nearly all green trees would be retained under any action alternative and vegetative shade from hardwoods and brush species within the primary shade zone is rapidly recovering, cutting and removal of a small percentage of the dead trees within the primary shade zone of Fall Creek and its tributaries would result in a negligible change in water temperatures. In the long-term under all alternatives, as the dead trees in the effective shade zone of Fall Creek deteriorate, stream shade will be reduced potentially contributing to an increase in water temperature until shading vegetation recovers from the effects of the fire. Planting of conifers within the primary shade zone of streams would contribute to an accelerated rate of vegetative shade recovery.

Alternative A (No Action)

Under this alternative, no additional management actions are proposed and therefore no management related cumulative effects would occur.

Alternative B

The small loss of shade due to falling high hazard rated dead trees could cumulatively add to the effects of shade reducing management activities within the watershed. In the short-term, any loss of shade would be partially offset by recovery of hardwood trees in the primary shade zone and a potential increase in summer stream flow due to reduced evapotranspiration due to effects from the Clark Fire. Since this alternative does not propose tree planting within Riparian Reserves, vegetative shade would recover naturally over an extended time period compared to the other action alternatives.

Alternatives C, D, and E

Under these alternatives, in the short-term, a small reduction in stream shade could occur due to the falling of moderate and high rated hazardous trees in the effective shade zone of Fall Creek. This loss is not expected to be significant and in the short-term would likely be offset by the rapid re-growth of hardwood trees in the primary shade zone of Fall Creek and other perennial streams and to some degree by an increase in summer stream flow due to a decrease in evapotranspiration due to effects from the Clark Fire. In addition, these alternatives propose to plant conifer seedlings in the primary shade zone of Fall Creek accelerating the rate of vegetative shade recovery. Cumulatively, planting the primary and secondary shade zones of perennial streams along with other density management activities in the watershed to accelerate vegetative growth in Riparian Reserves contributes to the overall recovery of stream shading vegetation.

Peak Flows

The ARP methodology was used to assess the cumulative effects of the alternatives on peak flows. The analysis was done at several sizes of drainage areas and for several time periods as displayed in Tables 45, 46, and 47. The analysis included the hydrologic and vegetative conditions of all past, present and future foreseeable management actions within these drainages. Appendix B summarizes the management activities and list of projects considered during the cumulative effects analysis.

Alternative A (No Action)

Under this alternative, no additional management actions are proposed. Therefore, no management-related cumulative effects would occur to peak flows. ARP values would not be affected.

Alternatives B, C, D, and E

The action alternatives would have no cumulative effects on peak flows because the cutting of dead trees would not alter forest canopy closure. Again, ARP values would not be affected. Because Alternatives C, D, and E propose tree planting, this activity would cumulatively contribute to the establishment of hydrologic recovery within the planning area and the watershed and would cumulatively contribute to lowering the risk of increased peak stream flows downstream of the planning area.

Suspended Sediment and Turbidity

The cumulative effects analysis area for sediment and turbidity is the Fall Creek watershed. See Appendix B for a complete list of past, present and future foreseeable projects considered in the cumulative effects analysis. Although debris torrents, large deep-seated mass movement and stream bank erosion have naturally supplied sediment to stream channels in the past, management activities have increased the rate of sediment delivery to stream channels (USDA, 1995). Timber harvest and roads have had the greatest influence on sediment production. Sediment sources associated with roads in the project area include surface erosion from ditches, cutbanks and road surface. Two present actions which are utilizing Road #1800 and #1821 as haul routes include the Borderline Thin and Edge Thin Timber Sales. As discussed in the direct effects section, Road #1800 is a paved surface and Road #1821 is an aggregate surface with the associated potential to produce sediment.

Table 48 presents a relative risk of alternatives in regard to potential increases in sediment. This table is presented only for the purposes of a comparison of alternatives. Activities considered include: acres potentially affected by dead tree cutting and disturbance associated with removal of some of this woody material; miles of road reconstructed and maintained; and, a combined factor that includes the miles of aggregate surface roads used for log haul and the number of loads hauled over this type of road.

Table 48. Relative risk of potential increases in sediment by alternative.

Potential sediment producing activity	Relative risk by Alternative*				
	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
Tree cutting and removal	low	low	low	moderate	moderate
Miles of road reconstructed and maintained	low	low	moderate	moderate	moderate
Miles of aggregate surface roads used for log haul and number of loads	low	low	low	moderate	moderate
Overall ranking	low	low	low	moderate	moderate

*Relative risk rating definition

Tree cutting and removal: Low = 0-200 acres, Moderate = 201+ acres.

Miles of road reconstructed and maintained: Low = 0-2 mile, Moderate = >2 miles.

Miles of aggregate surface roads used for log haul and number of loads: Low = 0-2 mile of aggregate surface haul route road and 0-400 log truck loads, Moderate = >2 mile aggregate surface haul route road and >400 log truck loads.

Alternative A (No Action)

Under this alternative, no additional management actions are proposed and therefore no additional management related cumulative effects would occur. Alternatives A would have a low risk of producing sediments because of no ground disturbance would occur from the cutting of trees and log yarding. Alternatives A would have a low risk of producing sediment because of no road reconstruction and maintenance. Alternatives A does not include the log truck hauling over aggregate surface roads, therefore was assessed a low risk of producing sediment for this factor.

Alternative B

Under this alternative, no dead trees would be removed. Alternatives B would have a low risk of producing sediments because of no ground disturbance would occur from the yarding of trees. A possible exception may be the removal of a few trees from the Fall Creek Road #1800 bridge however this would only be done to protect the bridge from possible damage during high flows. All heavy equipment would remain on the paved road surface and the number and volume of logs hauled would be low (approximately one load). Alternatives B would have a low risk of producing sediment because of the limited road reconstruction and maintenance (0.10 miles) and limited log haul. BMPs would be employed in all cases, therefore cumulatively; management actions from this project, past, present and reasonably foreseeable future projects would have a low probability of contributing significant quantities of sediment or nutrients to streams.

There would be no additional cumulative effects related to sedimentation because of the overall lack of yarding, road maintenance, and log haul in this alternative. The effects of the alternative to salmon and the aquatic environment is expected to be negligible due to the fact that the project area is located in a very small percentage of the overall range of salmon in Fall Creek and the lack of measurable increase in sediment loading

Alternatives C

Alternative C would have a low risk of producing sediments because of the limited acres affected by log removal (146 acres) and the units being on gentle slopes. The 146 acres treated equates to an additional 0.6% of the sub-watershed with the potential for soil disturbance to produce sediments. Alternative C would have a slightly lower number of road miles reconstructed and maintained than Alternatives D and E (3.78 miles) but would still have a moderate risk of producing sediments because it's greater than 2 miles. Alternative C would also construct 300 feet (0.06 mile) of temporary spur road. The road maintenance and temporary spur road totals 3.84 miles and represents 2% of the road system in the sub-watershed with the potential for soil disturbance to produce sediments.

The distance of haul over aggregate surface roads would be 1.8 miles for Alternative C. Although the total miles hauled over aggregate surface roads are similar for Alternatives D, and E (0.4 miles less under Alternative C), a more important factor is the total number of log truck loads hauled. Several timber sales (Borderline Thin and Edge Thin) are either currently hauling through the project area or are

expected to do so in the future (Sayre, 2004). The majority of timber volume would be hauled over Road #1800 (paved surface) minimizing the potential for adverse impacts to water quality from sediment. Alternative C would haul an additional 373 log truck loads on these roads. The 373 log truck load is approximately half the number of the truck loads hauled under Alternatives D and E and was given a low risk rating for producing sediments. BMPs would be employed in all cases and therefore, cumulatively management actions from this project, past, present and reasonably foreseeable future projects would have a low probability of contributing significant quantities of sediment or nutrients to streams.

These proposed activities would have a short term negative effect on sediment delivery rates to streams, which would be offset by immediate short term and long term positive effects due to improved road surface strength and drainage. It is not expected that the effects would be limited in duration and the magnitude of the effect would not be measurable, such that spring chinook salmon or their habitat would not be affected.

Alternatives D and E

Alternatives D include 249 acres of tree cutting and removal. Alternatives E include 328 acres of tree cutting and removal. These acres generally include areas of relatively higher angle slopes and therefore, the alternatives were given a moderate risk rating. The acres treated equates to an additional 1 % of the sub-watershed with the potential for soil disturbance to produce sediments.

Alternative D and E both propose 4.18 miles of road maintenance and reconstruction and 300 feet (0.06 miles) of temporary spur road construction. This road work totals 4.24 miles and represents 3% of the road system in the sub-watershed with the potential for soil disturbance to produce sediments.

The distance of haul over aggregate surface roads would be 2.2 miles for both alternatives and the number of log truck loads is estimated to be about 733 loads for Alternative D and 773 for Alternative E. These alternatives were assigned a moderate risk rating to produce sediments for this factor. As mentioned above, several timber sales are either currently hauling through the project area or are expected to do so in the future. The majority of the timber volume would be hauled over Road #1800 (paved surface) minimizing the potential for adverse impacts to water quality from sediments. BMPs would be employed in all cases and therefore, cumulatively management actions from this project, past, present and reasonably foreseeable future projects would have a low probability of contributing significant quantities of sediment or nutrients to streams.

These proposed activities would have a short term negative effect on sediment delivery rates to streams, which would be offset by immediate short term and long term positive effects due to improved road surface strength and drainage. It is not expected that the effects would be limited in duration and the magnitude of the effect would not be measurable, such that spring chinook salmon or their habitat would not be affected.

Conclusions

All action alternatives including associated mitigation actions and BMPs are consistent with current management direction including Willamette Forest Plan Standards and Guidelines, Aquatic Conservation Strategy (ACS) Objectives (at the watershed analysis area) and the Federal Clean Water Act. Implementation of required BMPs would insure protection of water quality and beneficial uses under all alternatives. Since all action alternatives would cut only dead trees, no effects on peak stream flow would be anticipated for any alternative. In the long-term, those alternatives that include tree planting (Alternatives C, D, and E) would accelerate the vegetative recovery of the area and assist with

moving toward attainment of ACS Objectives at an earlier point in time compared to alternatives that do not include planting (Alternatives A and B). Although the main stem of Fall Creek is currently listed as water quality limited due to elevated summer water temperatures, retention of nearly all green trees and a high proportion of the dead trees within the effective shade zone of Fall Creek would result in a negligible affect in the short-term on stream temperature in Fall Creek. In the long-term, the remaining dead trees in the effective shade zone of Fall Creek will deteriorate and lead to an increased probability of an increase in temperature until shade recovers to near natural levels. Those alternatives that would plant conifers in the primary shade zone of Fall Creek would likely result in accelerating the rate of stream shade recovery leading to cooler water temperatures at an earlier point in time compared to alternatives that do not include planting.

Soils

Potential Soil Erosion and Detrimental Soil Conditions - *Analysis Issue*

Soils within the Fall Creek SIA project area have a low to moderate surface soil erosion potential and a low to moderate potential for land failures (shallow and mass wasting) which could be a source of fine grain sediments to the streams. Roads in the Fall Creek SIA are the primary detrimental soil condition that has occurred from past management activities. Soils of the project area are susceptible to cumulative detrimental soil conditions (soil compaction, soil erosion, severely burned, soil displacement, and road construction), which will affect the long-term potential for soil erosion and soil productivity of the project area.

Existing Conditions

Soils for the Fall Creek SIA project area are primarily on the valley bottom adjacent to Fall Creek and associated smaller portions of side slopes adjacent the valley bottom soils. The soils information comes from the Willamette National Forest Soil Resource Inventory (SRI) prepared by Legard and Meyers, 1973 (updated 1992). Soils were mapped as landtypes and landtype complexes (several landtypes mapped as one mapping unit) which characterize the soils, vegetation, landform (topography), and geology. The basic SRI data provides information to determine effects on the soil and water resources and evaluate the capabilities of soil for various uses. Field reconnaissance and surveys were completed to verify conditions such as existing soil disturbance, observations and surveys of fire effects to the soil, effective ground cover (by field survey), and soil erosion potential.

Detrimental Soil Conditions

Soil compaction

Based on the soil textures being susceptible to compaction and the Fall Creek WA reference that the first logging occurred around 1943, it is suspected that ground based logging methods were utilized in the watershed area and those methods caused soil compaction. The soil compaction portion of detrimental soil conditions should be easily identified within the Lower Fall Watershed area. For the Fall Creek SIA, field investigations have not revealed any evidence of past ground based logging in the valley bottom of Fall Creek.

Severely burned (soil fire intensity)

Severely burned soils (top layer of mineral soils is significantly changed in color, usually to a reddish color) are considered to be a detrimental soil condition. Preliminary field investigations have determined that approximately less than 3% of the Fall Creek SIA soils were severely burned. The severely burned areas are not a contiguous land area. The severely burned areas are generally found where large downed logs or stumps burned. The severely burned areas are mapped as an inclusion within the moderately burned (duff has been completely or partially burned with a darken appearance due to the surface organics being burned and with no apparent reddish color change of the surface soils) soil fire intensity classification. The moderately burned soil fire intensity makes up the primary soil fire intensity for the Fall Creek SIA.

Percent in Roads

The existing transportation system for the area is considered a part of the cumulative detrimental soil condition calculations because they are compacted and displaced. All roads are considered a part of the transportation system for the area. For the Fall Creek SIA, existing roads make up the current detrimental soil condition of approximately 4.9%.

Soil Erosion Potential

Taking a broader look at potential soil erosion condition within the Hehe Creek and Andy Creek 6th field sub-watershed areas have been summarized from Table 7, p. 27 of the Fall Creek WA. Fall Creek SIA soil category (groupings of SRI landtypes and landtype complexes with similar characteristics such as erosion potential) estimates have been added to the following table to show a comparison of the Fall Creek SIA to the surrounding sub-watershed areas:

Table 49. Comparison of Soils (Fall Creek SIA and Hehe Creek and Andy 6th field Sub-Watersheds)

Soil Category	1	2	3	4	5	Total
Surface and sub-surface potential erosion*	M	M-MH	MH-VS	MH-S	L-M	
Fall Creek SIA (ac.)	175	119	21	198	252	765
% Fall Creek SIA	23	16	2	26	33	100
Hehe Ck (ac.)	1,006	805	11,590	4,026	3,190	20,617
% of Sub-watershed	5	4	56	20	15	100
Andy Ck (ac.)	5,577	5,374	3,497	5,295	3,487	23,230
% of Sub-watershed	24	23	15	23	15	100

*Notes: L=low, M=moderate, MH=moderately high, H=high, S=severe, and VS=very severe. (Potential erosion is rated on bare (no effective ground cover) soil conditions).

Approximately 76% of the Hehe Creek sub-watershed and 38% of the Andy Creek sub-watershed area have soils with a surface and sub-surface erosion rating of moderately high to severe and very severe. Soil erosion potential would be a high concern for these sub-watershed areas. For the Fall Creek SIA project area, the surface and subsurface soil erosion is rated approximately 56% low to moderate, 16% moderate to moderately high, and 28% moderately high to severe and very severe. Soil erosion potential is much lower in the Fall Creek SIA valley bottom than the surrounding side slopes of the Hehe Creek and Andy Creek sub-watersheds. Managing the existing organic layer (post-fire needle cast), existing effective ground cover, and the new vegetation is a key to maintaining a low risk of surface soil erosion from the Fall Creek SIA. Since the fire burned over the entire Fall Creek SIA planning area, it has been determined by field survey that there has been less than an inch of post-fire needle cast which has fallen to the ground over nearly 100% of the area. The post-fire needle cast is providing some effective ground cover to minimize soil erosion. Many fallen branches from the dead fire-killed trees (average coverage is 28% of the area) and soil surface rock fragments (average coverage is 18% of the soil surface area) provide a large percentage of the current effective ground cover. Additionally, there is

new ground cover vegetation growing and providing an abundance of effective ground cover (average coverage is 39% of the area) to protect the burned area from erosion.

Steep, bare soil areas exist adjacent to Fall Creek, where the localized steep slopes would be rated as severe soil erosion potential (due to the steep slopes and lack of effective ground cover). The steep, erosive stream banks have been estimated to extend along about 4,731 feet of the total 23,100 feet of stream bank along Fall Creek. Some native vegetation has started to grow on the steep, bare soils but due to the steep slopes there is likely to be more soil ravel and subsequent erosion before native vegetation provides an adequate effective ground cover minimizing the potential for soil erosion and sedimentation to Fall Creek.

Recognizing the Hehe Creek and Andy Creek 6th field sub-watershed soils have decreased soil strength, land failure potential (mass wasting and debris slides) has been identified as a concern for any ground disturbing activities. The Fall Creek WA (WA, Table 3, page 25) presented information on land failures and the future potential for land failures based on the percent slope where roads were previously built. The data shows identified road related land failures were relatively high for the Hehe Creek sub-watershed and there are 25% of all roads on slopes greater than 51 % slope. There were 17 road-related land failures in Andy Creek sub-watershed and only 8% of all roads are on slopes greater than 51 % slope. With the lower strength, clayey soils and documented land failures in these two sub- watersheds, there is a high potential for land failures given any new road construction or re-construction.

In the Fall Creek SIA, 100% of the roads are located on slopes less than 51% and there are no identified land failures. The Fall Creek SIA has a low probability of land failures occurring from road related management activities. Field investigations have not revealed any major sedimentation having resulted from the first winter period. A mild winter with relatively low intensity rainfall and low storm duration, high permeability soils, a high percentage of remaining effective ground cover such as fallen wood, dead tree needle fall, residual surface soil coarse fragments, and the re-growth of ground vegetation have all contributed to minimizing soil erosion from the Fall Creek SIA burned area.

Management Direction

The pertinent soil standard and guidelines focus on maintaining soil productivity, soil stability, cumulative detrimental soil conditions, cumulative watershed effects, and best management protection. For soil productivity, FW-079 states that land management activities shall be planned and conducted to maintain or enhance soil productivity and stability. For cumulative detrimental soil conditions, FW-081 states that the total area of cumulative detrimental soils conditions should not exceed 20% of the total acreage within the activity area. Soil compaction is defined as a detrimental soil condition when there is an increase in soil bulk density of 15% or more and/or by a reduction of macro-pore space of 50% over the undisturbed soils. Soil displacement is a detrimental soil condition and defined as an area 5 feet wide where 50% of the topsoil has been removed. FW-082 states that past, present, and future activities shall be considered when evaluating soil conditions. Roads are considered a part of the activity area management where soil productivity has been reduced or removed due to the amount of soil compaction and lack of the site to produce vegetation (measure of soil productivity). Additionally for cumulative effects, FW-93 states the need to assess cumulative watershed effects of a proposed action; and FW-92 states that water quality would be protected with best management practices (refer to the Hydrology Report in the Analysis File).

Environmental Consequences by Alternatives

Evaluation Criteria:

- Percent of activity area with detrimental soil conditions.
- Tons per project area of potential soil erosion by management activities.

Detrimental Soil Conditions Discussion

The intent of focusing on detrimental soil conditions is that soil quality and water quality are maintained when ecosystems are managed without permanent impairment to land productivity and soil and water quality are maintained or improved. Standards for detrimental soil conditions have been set to meet the direction in the National Forest Management Act of 1976 and other legal mandates. Soil and water quality are maintained when soil compaction, displacement, severe burning, erosion, loss of organic matter, and altered soil moisture regimes are maintained within defined standards. The design of the project should not result in cumulative detrimental soil conditions on more than 20 percent of an activity area (including adjacent roads). For the Fall Creek SIA, the following primary detrimental soil conditions of soil compaction, soil displacement, and severely burned soils were evaluated to include past management and proposed management activities. Definitions of the detrimental soil conditions can be found in the Forest-wide Standards and Guides (WNFP, page IV-60) and the Forest Service Manual, R-6 Supplement No. 2500.98-1, effective 8/24/98. Harvest methods and slash piling and burning, in order of increasing soil detrimental conditions, are loader(12%), helicopter (1%), and grapple piling and burning slash (2% or less). Adjacent roads are considered a part of the activity area when they are adjacent to the management unit. All roads were considered part of the cumulative detrimental soil affects. The detrimental soil conditions for skyline and helicopter are supported in the literature, such as Klock (1975), while the loader yarding and site preparation are both an estimate based on a preliminary logging plan and professional judgment of a logging system specialist, timber sale officer, and soil scientists. Detrimental soil conditions resulting from loader yarding and grapple piling and burning are not well documented in the research literature. Local soil monitoring would provide feedback for future use of both the loader yarding methods and grapple piling and burning.

The following Table 49 displays the percent of detrimental soil conditions found in each of the treatment units (activity area) by alternative for the Fall Creek SIA Fire Recovery Project.

Table 50. – Cumulative Detrimental Soil Conditions by Unit

Units #	Cumulative Detrimental Soil Conditions (% by Unit)				Soil Erosion Potential
	Alt B	Alt C	Alt D	Alt E	
Road Units					
R1	0	12	12	12	M-MH
R2	0	12	12	12	L-M
R3	0	1	1	1	M
R4A	2	1	3	3	M
R4B	2	14	14	14	M
R5	0	14	14	14	L-M
R6	0	1	1	1	L-M
R7	0	-	12	12	L-M
R8A	2	3	3	3	MH-S
R8B	2	15	15	15	MH-S
R9	0	1	1	1	MH-S
R10	0	12	12	12	MH-S

Units #	Cumulative Detrimental Soil Conditions (% by Unit)				Soil Erosion Potential
	Alt B	Alt C	Alt D	Alt E	
R11	0	12	12	12	L-M
Trail Units					
T1	0	-	1	1	L-M
T2	0	1	1	1	L-M
T3	0	14	14	14	L-M
T4	0	-	1	1	MH-S
T5	0	-	1	1	MH-S
Dispersed Rec. Units					
D2	0	0	1	-	L-M
D3	0	0	1	-	L-M
D4	0	0	1	-	L-M
D8	0	0	1	1	L-M
D9	0	0	1	1	L-M
D10	0	0	1	1	L-M
D11	0	0	-	-	L-M
D12	-	0	1	1	L-M
D13	-	-	-	1	L-M
D16	-	0	-	-	L-M
D17	0	0	-	-	MH-S
D21	0	0	12	12	L-M
D22	0	0	1	-	L-M
D23	0	0	1	12	L-M
D26	-	0	-	-	L-M
Fire Salvage Units					
F1	-	-	1	1	L-M
F2		-	12	-	L-M
S1	-	-	1	1	M
S2	-	-	1	1	M-MH
S3	-	1	1	1	M
S4	-	14	14	-	L-M
S5	-	1	1	1	M
S6	-	1	1	1	M
S7	-	-	1	1	M
S8	-	1	1	1	M
S9	-	3	3	3	M
S10	-	14	14	14	L-M
S11	-	1	1	1	L-M
S12	-	1	1	1	MH-S

Note: L=Low, M=Moderate, MH=Moderately High, S=Severe

For a breakdown for roads, harvest systems, and fuel treatments by unit, refer to the Soils Report in the Analysis File.

Exposed Mineral Soil Discussion

Percentage of mineral soil exposed (that lacking effective ground cover due to fire removal or management activities) is an indicator of the potential for soil erosion and the potential reduction in soil productivity. Soil that retains an effective ground cover would have a low probability of eroding and

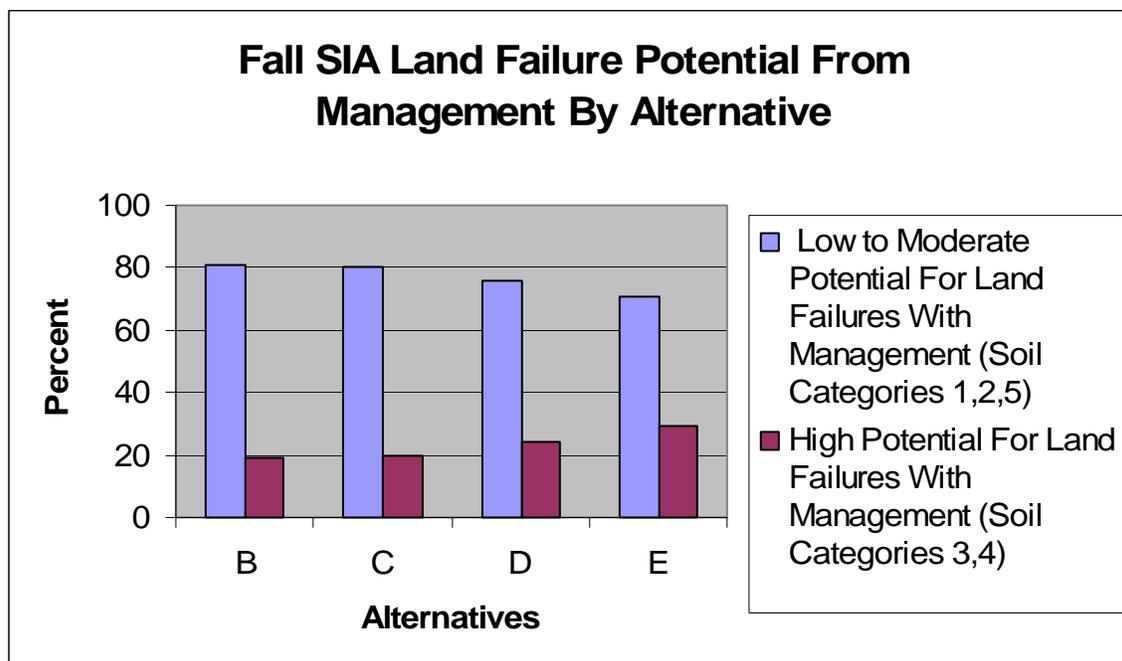
lowering of soil productivity. Field surveys of the current conditions indicate that effective ground cover averages 97.6 % (ranges from 94.6 to 100 percent). The current effective ground cover is made up of new tree needle fall (depth less than 1”), residual soil duff, woody material, surface soil rocks, and the new re-growth of plants (approx. 1 year post-fire).

Maintaining the new soil organic layer and effective ground cover has been emphasized in the proposed alternatives by the use of helicopter and loader log yarding systems. The effective ground cover would not be reduced below 40% of any activity area for all proposed alternatives (FW-084). Additional woody material would be left on-site for all the proposed alternatives (refer to Fire and Fuels and Wildlife Reports in Analysis File). Mitigating measures such as seeding native plants is proposed should there be any bare soil areas created during implementation of the alternatives.

Soil Erosion Discussion

Surface soil erosion was considered an important factor for the Fall Creek SIA project area, due to the proximity to the streams, soils with generally low slopes, soils with a low to moderate soil erosion potential, and a low to moderate potential for land failures (refer to Table 51 for potential land failures by management alternatives). As indicated in the Fall Creek WA (USDA, 1995), road building on slopes >51% had a higher probability of increasing land failures. Proposed alternatives have no more than 300ft. of temporary spur road construction proposed, which would be restored following the timber harvest activities. Helicopter logging is proposed on much of the sloped areas which is considered a low soil disturbance logging system (Klock, 1975). With no permanent road building and the use of helicopter logging on sloped areas, the likelihood of land failures is extremely low to none.

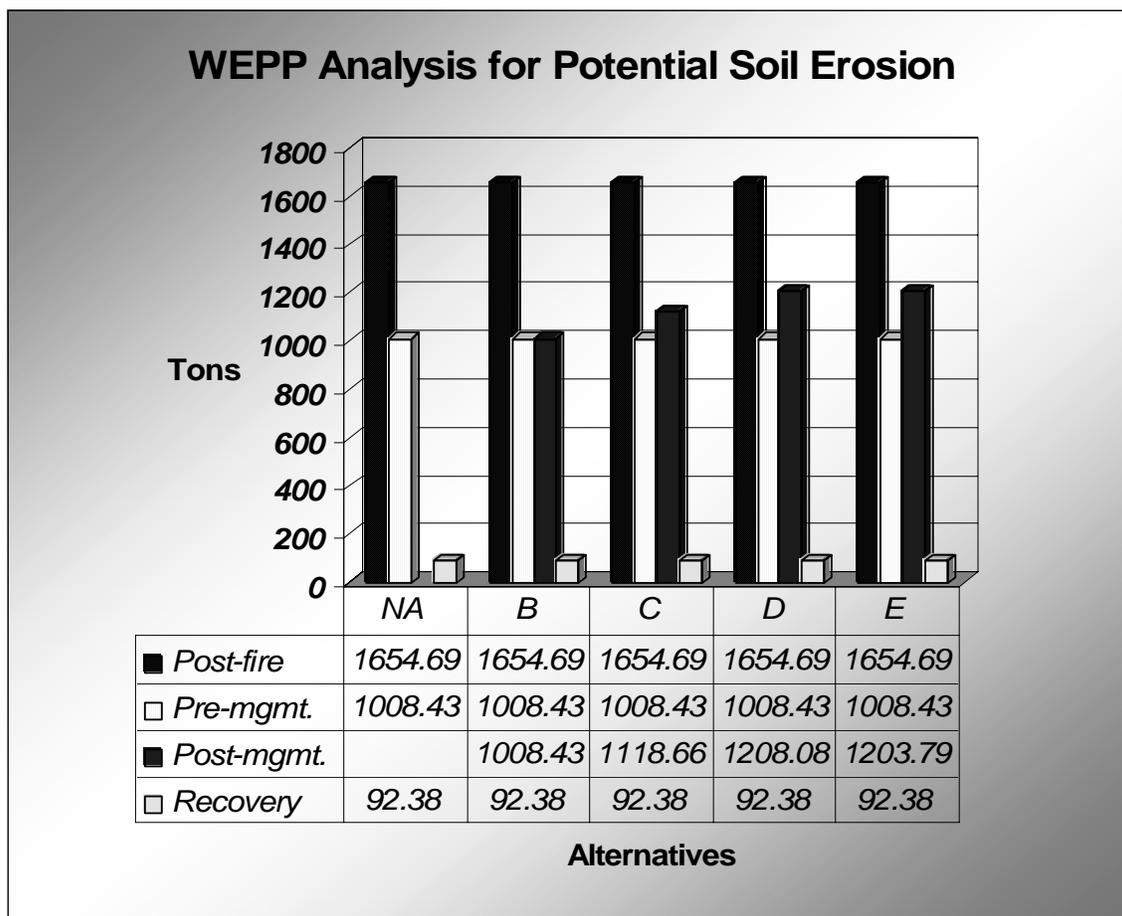
Table 51. Fall SIA Land Failure Potential from Management by Alternative



The computer model “Watershed Erosion Prediction Project” (WEPP)(Elliot, 2000)) was used due to the potential soil erosion more likely being surface soil erosion rather than land failures. The WEPP model uses the characteristics of climate, soil texture, local topography, plant community, and surface residue

cover to estimate soil erosion potential. Also, the WEPP model was designed to predict runoff and sediment yield from prescribed and wild fires, harvested forests, both young and old undisturbed forests, and it recognizes that as vegetation increases there inherently is some site recovery. The erosion values this program generates are intended to be an index of potential erosion rather than actual amounts of erosion that would reach the streams. Many models have shortfalls when applied to large areas and when surface roughness both streams and upland slopes are significantly variable. Most erosion models are best used for predicting erosion rates for short segments of land slopes and when surface roughness is not significantly variable. The soil erosion values presented in Table 52 are **“ONLY INTENDED FOR COMPARISON VALUES AND SHOULD NOT BE CONSIDERED ACTUAL, PREDICTED AMOUNTS”**.

Table 52. WEPP Analysis for Potential Soil Erosion by Alternative



Soil Productivity Discussion

Soil organisms and their interactions profoundly affect forest-site productivity through capture and uptake of nutrients, nitrogen fixation, protection against pathogens, maintenance of soil structure, and buffering against moisture stress. To minimize long-term impacts on beneficial soil organisms, it has been suggested to forest managers that one should: 1) minimize disturbance severity (i.e., intense burns, soil compaction and erosion), 2) emphasize retention of organic matter, and 3) emphasize rapid re-vegetation by indigenous host species and associated beneficial soil organisms (Perry, 1989). Field surveys indicate remnants (< 1” of duff) of the original soil organic matter exist throughout the Fall

Creek SIA project area, indicating that the soil fire intensity was primarily moderate. An intense burn would have deeply burned the soil, changing it to a reddish color and having a greater affect on soil physical, biological, and chemical properties (Boyer, 1980). As soil organic matter, humified material, and decaying wood are centers of microbial activity which can diminish following an intense fire, one can expect some reduction in soil productivity due to the reduced above ground organic component. The degree of soil productivity loss is not readily quantifiable but research results suggest forest managers should take steps to manage the remaining organic layers, the potential for input from the fire killed trees, and re-growth of vegetation to the site. At varying degrees, all the alternatives manage the remaining organic matter and potential input of organic materials to maintain soil productivity. No Action Alternative A would have the greatest potential for long term (indirect) input of organics to maintain site productivity unless the area reburns. Alternative B would primarily fall and leave most of the hazard trees, returning the woody material to the forest floor. Alternative B would provide short term woody material input and provide for the long term woody input as does No Action (Alternative A). The timber harvest alternatives (Alternatives C, D, and E) use primarily helicopter yarding as a mitigation to minimize the disturbance of surface soils and remaining organics, return portions of hazard trees to the forest floor, and maintain the Willamette Forest Plan standards for woody material following timber harvest and fuels treatment. The long-term focus would be to manage the remaining woody materials as a future soil productivity reserve. Mitigation for the protection of the future soil productivity would be to eliminate firewood gathering in the fire area of the Fall Creek recreation corridor following implementation of a selected alternative.

Direct and Indirect Effects

Alternative A - No Action

There would be no new detrimental soil conditions as there is no ground disturbing management activities proposed.

Another direct effect would be the potential for soil erosion which is lower than the immediate post-fire condition due to vegetation re-growth in the first year, and tree needle and branch fall from the standing fire killed trees, and minor amounts of duff remaining after the fire. The WEPP erosion model was used to generate erosion values post-fire and pre-management (current conditions which considers the plant re-growth the first growing season). Alternative A has a post-fire potential soil erosion rate of 1654.69 tons per project area and a changed current potential soil erosion rate of 1008.43 tons per project area due to the plant re-growth during the first growing season. The micro-topography (slope roughness) of the soil surface is a key factor in determining whether the soil would actually reach and enter a stream as sediment. Field surveys have shown that the surface soil micro-topography is very rough, with effective ground cover, and current and anticipated woody material input as the fire killed trees decay and fall to the forest floor would minimize the potential for soil movement. The steeper slopes adjacent to Fall Creek (stream bank length estimated at 4,731 feet of the total 23,100 feet) where the effective ground cover has been burned would remain an area where soil erosion is likely to occur. Some of the soil erosion adjacent to Fall Creek could enter the stream until sufficient protective natural vegetation occupies the steep slopes.

The indirect effects would be the decay of effective ground cover becoming part of the soil profile over time, and the increasing amount of new effective ground cover as the lower ground cover and shrub vegetation increases and fire killed trees decay and fall to the forest floor. Soil productivity would improve and the potential for erosion would decrease with the increased surface roughness from woody material input and as the vegetation moves toward a shrub dominated condition in approximately 4

years. It is estimated that in 4 years following the fire the brushy vegetation would occupy the site and provide sufficient effective ground cover to minimize soil erosion. As determined by the WEPP model, potential soil erosion is anticipated to be reduced from 1008.43 tons per project area (current condition) to 92.38 tons per project area as the brush vegetation layer occupies the site and provides some site recovery. Long term there would be some natural recovery of the steep slopes adjacent Fall Creek but it is likely that some area would remain a source of soil erosion and sediment introduction into Fall Creek.

Alternative B

None of the proposed 25 treatment units would exceed the 20% Regional and Forest standard for detrimental soil conditions. Fuels treatment has been estimated to cause detrimental affects on 0.35 acres in 2 of 25 proposed treatment units. The fuels treatment is estimated as a 2% increase of detrimental soil disturbance in each of the 2 treatment units. For the fuels treatment, detrimental soil conditions would be the high soil fire intensity created under the burning of grapple created slash piles (estimated minimum size of 20'x20') and some minor compaction and displacement affects from the grapple piling equipment.

Another direct effect would be the potential for soil erosion which is lower than post-fire due to the increase in vegetation re-growth in the first year, tree needle and branch fall from the standing fire killed trees, and minor amounts of duff remaining after the fire. Surface soil roughness and soil productivity would likely improve from the immediate input of woody material (felled hazard trees over 15% of the project area) that would be ready for decay and incorporation into the soil and the benefit of increasing soil surface roughness to reduce soil erosion movement. The potential soil erosion is 1008.43 tons per project area (refer to Table 51 for the relative values in comparison to the other management related alternatives). Surface roughness is the key factor in determining whether the soil would actually reach and enter a stream as sediment. Field surveys have shown that the surface soil is very rough with effective ground cover and anticipated additional woody material as the fire killed trees decay and fall to the forest floor. Due to the relatively flat slopes and the roughness of slope from woody material and the irregular nature of the topography, much of the soil modeled as erosion would likely be re-deposited on site rather than enter a stream as sediment. The steeper slopes adjacent to Fall Creek (stream bank length estimated at 4,731 feet of the total 23,100 feet) where the effective ground cover has been burned would remain an area where some soil erosion is likely to occur.

Road maintenance and culvert replacement could cause some soil to be eroded as sediment to the connected stream network.

Alternative B indirect effects would be the same as Alternative A (No Action).

Alternative C

None of the proposed 37 treatment units would exceed the 20% Regional and Forest standard for detrimental soil conditions. The total detrimental soil conditions range from 1% to 15% of the treatment units (activity areas). Treatments in the units include fuels reduction, timber harvest, and temporary road construction. Fuels treatment has been estimated to cause detrimental soil conditions on 0.4 acres in 9 of 37 proposed treatment units. The fuels treatment is estimated to result in a 2% increase of detrimental soil disturbance in each of the 9 treatment units. For the fuels treatment, detrimental soil conditions would be the high soil fire intensity created under the burning of grapple created slash piles (estimated minimum size of 20'x20') and some minor compaction and displacement affects from the grapple piling equipment. The road related detrimental soil conditions would consist of the construction of 300 feet of temporary road to access a helicopter landing. Timber harvest methods would cause detrimental soil conditions on approximately 7.4% of the harvest units.

Another direct effect would be the potential for soil erosion which is greater than both post-fire and current conditions due to the proposed timber harvest treatment on 146 acres. The primary treatments affecting soil erosion would include timber management activities, hazard tree felling, and fuels reduction treatment of woody materials. The WEPP calculated soil erosion rate is 1118.66 tons per project area (refer to Table 51 for the relative values in comparison to the other management related alternatives). Surface roughness is the key factor in determining whether the soil would actually reach and enter a stream as sedimentation. Field surveys have shown that the surface soil micro-topography is very rough with effective ground cover, and current and anticipated woody material as the fire killed trees decay and fall to the forest floor would minimize the potential for soil movement. The steeper slopes adjacent to Fall Creek (stream bank length estimated at 4,731 feet of the total 23,100 feet) where the effective ground cover has been burned would remain an area where soil erosion is likely to occur.

Road maintenance and culvert replacement could cause some soil to be eroded to the connected stream network.

Indirect effects would include the decay of effective ground cover and its incorporation into the soil profile over time. There would be an increasing amount of new effective ground cover as the lower ground cover and shrub vegetation increases, some of the fire killed trees decay and fall to the forest floor, and woody material left following timber harvest decays. Soil productivity would improve and the potential for erosion would decrease with the increased surface roughness from woody material input and as the vegetation moves toward a shrub dominated condition in approximately 4 years. It is estimated that in 4 years following the fire the brushy vegetation would occupy the site and provide sufficient effective ground cover to minimize soil erosion. As determined by the WEPP model, soil erosion is anticipated to recover from 1118.66 tons per project area (current condition) to 92.38 tons per project area as the brush vegetation layer occupies the site and provides some site recovery. Long-term, there would be some natural recovery of the steep slopes adjacent Fall Creek but it is likely that some area would remain a source of soil erosion and sediment source for Fall Creek.

Alternative D

None of the proposed 43 treatment units would exceed the 20% Regional and Forest standard for detrimental soil conditions. The total detrimental soil conditions range from 1% to 14% of the treatment units (activity areas). Treatments in the units include fuels reduction, timber harvest, and temporary road construction. Fuels treatment has been estimated to cause detrimental soil conditions on about 0.87 acres in 9 of 37 proposed treatment units. The fuels treatment is estimated to cause a 2% increase of detrimental soil disturbance in each of the 9 treatment units. For the fuels treatment, detrimental soil conditions would be the high soil fire intensity created under the burning of grapple created slash piles (estimated minimum size of 20'x20') and some minor compaction and displacement affects from the grapple piling equipment. The road related detrimental soil conditions would consist of the construction of 300 feet of temporary road to access a helicopter landing. Timber harvest methods would cause detrimental soil conditions on approximately 7.4% of the harvest units.

Another direct effect would be the potential for soil erosion due to the proposed timber harvest treatment of 249 acres. The primary treatments affecting soil erosion would include timber management activities, hazard tree felling, and fuels reduction treatment of woody materials. The WEPP calculated soil erosion rate is 1,208.08 tons per project area (refer to Table 51 for the relative values in comparison to the other management related alternatives). Surface roughness is the key factor in determining whether the soil would actually reach and enter a stream as sedimentation. The evidence from field surveys, and explanation of effects as stated in Alternative A, B and C apply to this alternative.

Road maintenance and culvert replacement could cause some soil to be eroded to the connected stream network.

Indirect soils effects include the eventual decay of effective ground cover and its incorporation into the soil profile over time. There would be an increasing amount of new effective ground cover as the lower ground cover and shrub vegetation increases, some of the fire killed trees decay and fall to the forest floor, and woody material left following timber harvest decays. Soil productivity would improve and the potential for erosion would decrease with the increased surface roughness from woody material input and as the vegetation moves toward a shrub dominated condition in approximately 4 years. It is estimated that in 4 years following the fire the brushy vegetation would occupy the site and provide sufficient effective ground cover to minimize soil erosion. As determined by the WEPP model, soil erosion is anticipated to be reduced from 1208.08 tons per project area (current condition) to 92.38 tons per project area as the brush vegetation layer occupies the site and provides some site recovery. Long-term, there would be some natural recovery of the steep slopes adjacent Fall Creek but it is likely that some area would remain a source of soil erosion and sediment source for Fall Creek.

Alternative E

None of the proposed 40 treatment units would exceed the 20% Regional and Forest standard for detrimental soil conditions. The total detrimental soil conditions range from 1% to 15% of the treatment units (activity areas). Treatments in the units include fuels reduction, timber harvest, and temporary road construction. Fuels treatment has been estimated to cause detrimental soil conditions on 0.65 acres in 9 of 40 proposed treatment units. The fuels treatment is estimated to cause a 2% increase of detrimental soil disturbance in each of the 9 treatment units. For the fuels treatment, detrimental soil conditions would be the high soil fire intensity created under the burning of grapple created slash piles (estimated minimum size of 20'x20') and some minor compaction and displacement affects from the grapple piling equipment. The road related detrimental soil conditions would consist of the construction of 300 feet of temporary road to access a helicopter landing.

For Alternative E, the primary direct soil effect would be the potential for soil erosion due to the proposed timber harvest treatment on 328 acres. The primary treatments affecting soil erosion would include timber management activities, hazard tree felling, and fuels reduction treatment of woody materials. The WEPP calculated soil erosion rate is 1203.79 tons per project area (refer to Table 51 for the relative values in comparison to the other management related alternatives). Surface roughness is the key factor in determining whether the soil would actually reach and enter a stream as sediment. The evidence from field surveys, and explanation of effects as stated in Alternative A and B apply to this alternative.

Road maintenance and culvert replacement could cause some soil to be eroded to the connected stream network.

Indirect soils effects include the decay of effective ground cover and its incorporation into the soil profile over time. There would be an increasing amount of new effective ground cover as the lower ground cover and shrub vegetation increases, some of the fire killed trees decay and fall to the forest floor, and woody material left following timber harvest decays. Soil productivity would improve and the potential for erosion would decrease with the increased surface roughness from woody material input and as the vegetation moves toward a shrub dominated condition in approximately 4 years. It is estimated that in 4 years following the fire the brushy vegetation would occupy the site and provide sufficient effective ground cover to minimize soil erosion. As determined by the WEPP model, soil erosion is anticipated to be reduced from 1203.79 tons per project area (current condition) to 92.38 tons

per project area as the brush vegetation layer occupies the site and provides some site recovery. Long-term, there would be some natural recovery of the steep slopes adjacent Fall Creek but it is likely that some area would remain a source of soil erosion and sediment source for Fall Creek.

Cumulative Effects

The cumulative effects analysis for detrimental soil conditions was completed at the scale of the project area. The analysis included all past, present, and foreseeable future actions associated with the project area (see Appendix B). The background for the cumulative effects was provided under the discussion of existing conditions. Field investigations have not revealed any evidence of past ground based salvage logging which caused soil compaction in the project area. The post-fire soil surveys have estimated less than 3% of the Fall Creek SIA soils were severely burned. And the existing road system makes up approximately 4.9% of the project area. The high recreation use and associated facilities have likely had adverse impacts on soils and is closely associated with the transportation system. The estimated subtotal of past adverse impact to soils would equal about 7-9 percent of the project area. There are no known foreseeable future actions which would cause soil compaction. The action alternatives include mitigating measures to prevent off-road travel and propose to decommission or close the dispersed recreation sites which would limit adverse impacts to soils.

Alternative A – No Action

Alternative A –No Action would have be no cumulative effects because of the absence of activities which would cause soil compaction. Soil erosion would decrease as the vegetation recovers naturally and the soils surface roughness is increased as the fire killed woody material falls to the forest floor. There would be no anticipated cumulative detrimental soil conditions above the existing conditions describe above (7-9 % of the project area).

Another potential cumulative effect although it is not usually considered a future foreseeable action, is the potential effects of a high intensity wildfire due to the buildup of fuels from the Clark Fire.

For Alternative A, the cumulative effect would be the future fire intensity associated with the large amount of woody material falling to the forest floor and the relationships to cause a higher intensity re-burn. A re-burn could severely burn the soils and significantly reduce effective ground cover as well as reducing the woody material that could be incorporated into the soil.

Alternative B

Alternative B proposes activities which would add another 2% of detrimental soil conditions as a result of the proposed grapple piling fuel treatment on about 19 acres. The cumulative detrimental soil conditions include the existing conditions (7-9 %) and a small amount of grapple piling and burning (0.1) for a total of about 9 % of the project area. The cumulative detrimental soil conditions (including the past conditions) would be less than the Willamette Forest Plan Standards and Guidelines at both project area and activity area (i.e. harvest unit). Potential soil erosion would decrease from 1008.43 tons per project area to 92.38 tons per project area as the vegetation recovers naturally and surface roughness is increased from the woody material of fire killed trees falling to the forest floor.

For Alternative B, the cumulative effect would be similar to Alternative A, where the future fire intensity associated with the large amount of woody material falling to the forest floor. The risk is related to a higher intensity re-burn potential which could severely burn the soils. The severe intensity re-burn would significantly reduce effective ground cover, detrimentally (severe soil fire intensity) damage soils, and further reduce the woody material that could be incorporated into the soil.

Alternative C

Alternative C proposes activities which would add another 12-15 % of detrimental soil conditions as a result of proposed loader yarding on 64 acres and grapple piling fuel treatment on 33 acres. There would be no anticipated cumulative detrimental soil conditions above about 11 % calculated for existing conditions (7-9 %), timber harvest activities (1.5 %), and fuels treatment (0.1%) for the project area. The cumulative detrimental soil conditions would be less than the Willamette Forest Plan Standards and Guidelines at both project area and activity area (i.e. harvest unit). The potential soil erosion would decrease from 1118.66 tons per project area to 92.38 tons per project area as the area recovers.

For Alternative C, the cumulative effect would be a lower future fire intensity associated with the large amount of woody material removed from adjacent roads and dispersed areas in the Fall Creek SIA. Many trees outside the managed areas would fall to the forest floor and would be incorporated into the soil. A re-burn of the untreated areas could severely burn the soil and significantly reduce effective ground cover as well as reducing the woody material that could be incorporated into the soil. Soil erosion would decrease as the vegetation recovers naturally and the soil surface roughness is increased as the fire-killed woody material falls to the forest floor.

Alternative D

Alternative D proposes activities which would add another 12-15 % of detrimental soil conditions as a result of proposed loader yarding on 78 acres and grapple piling fuel treatment on 44 acres. There would be no anticipated cumulative detrimental soil conditions above about 11% calculated for the existing conditions (7-9 %), timber harvest activities (2.1%), and fuels treatment (0.1%) for the planning area. The cumulative detrimental soil conditions would be less than the Willamette Forest Plan Standards and Guidelines at both project area and activity area (i.e. harvest unit). The potential soil erosion would decrease from 1208.08 tons per project area to 92.38 tons per project area as the area recovers. Soil erosion would decrease as the vegetation recovers naturally and the soil surface roughness is increased as the fire-killed woody material falls to the forest floor.

For Alternative D, the cumulative effects would be a lower future fire intensity associated with the large amount of woody material removed from adjacent roads, timber harvest units, and dispersed areas in the Fall Creek SIA. Many trees outside the managed areas would fall to the forest floor and would be incorporated into the soil. A re-burn of the untreated areas could severely burn the soil and significantly reduce effective ground cover as well as reducing the woody material that could be incorporated into the soil.

Alternative E

Alternative E proposes activities which would add another 12-15 % of detrimental soil conditions as a result of proposed loader yarding on 76 acres and grapple piling fuel treatment on 44 acres. There would be no anticipated cumulative detrimental soil conditions above about 11 % calculated for the existing conditions (7-9 %), timber harvest activities (2.1%), and fuels treatment (0.1%). The cumulative detrimental soil conditions would be less than the Willamette Forest Plan Standards and Guidelines at both project area and activity area (i.e. harvest unit). The potential soil erosion would decrease from 1203.08 tons per project area to 92.38 tons per project area as the area recovers. Soil erosion would decrease as the vegetation recovers naturally and the soil surface roughness is increased as the fire-killed woody material falls to the forest floor.

For Alternative E, the cumulative effects would be a lower future fire intensity associated with the large amount of woody material removed from adjacent roads, timber harvest units, and dispersed areas in the

Fall Creek SIA. Many trees outside the managed areas would fall to the forest floor and would be incorporated into the soil. A re-burn of the untreated areas could severely burn the soil and significantly reduce effective ground cover as well as reducing the woody material that could be incorporated into the soil.

Economics

Economics - *Analysis Issue*

Economic efficiency is important in assessing the cost of planning and implementing forest management treatments and the benefits or revenues the project generates. Forest stands which have sustained severe or complete mortality may not currently have value in providing scenic qualities or late-successional habitat. Such stands do have value for wood products. This value will be lost, over time, as the dead timber deteriorates due to insect and fungal activity. This deterioration process is especially rapid in hemlock and hardwood species. Revenue produced from the sale of the timber would provide a return to the government and provide employment and income to local communities. The fire-killed timber would provide a domestic source of forest products and help offset the cost of accomplishing the restoration activities.

Existing Conditions

Volume Deterioration

Merchantable wood in trees killed by fires deteriorates fairly rapidly. The major agents involved in degrading and decaying wood are wood boring insects and wood decay fungi. In addition to degrading wood directly as they tunnel through the wood, woodborers and sometimes bark beetles are also the vector responsible for introducing most decay fungi into dead trees. Sapwood and heartwood decay fungi can be introduced any time when insects are actively penetrating the bark or that windborne fungal spores are deposited on suitable infection areas.

The following list summarizes the deterioration rates for various types of trees under various conditions (Kimmey 1955, Schultz 1994):

- Tree Species – Douglas-fir decays slower than other,
- Tree Sizes – large diameter decays more slowly,
- Percent sapwood – sapwood decays quickly,
- Growth rate – greater rings per inch decays more slowly,
- Climate – cold (<41degrees) slows decay,
- Elevation – High (no range given) has slower decay rates,
- Aspect- north slope timber decays more slowly.

A number of studies have been done on rates of deterioration of fire-killed conifers in the western United States (Kimmey and Furniss 1943, Kimmey 1955, Lowell et al. 1992, Hadfield and Magelssen 2000). Results of these studies differ in detail but all show that the amount of deterioration in fire-killed trees, is quite rapid within the first 5 years. For example Douglas-fir, a tree species that is relatively resistant to degrade and decay, can lose from 4 to 22 percent of the wood volume as dead trees deteriorate in the first year after a fire (Sessions et al. 2003) and 24 to 72 percent deteriorates in the first five years (Table 52). For white fir, a tree species that is prone to rapid degrade and decay, 12 to 25 percent of the wood volume deteriorates in the first year after a fire and 93 to 100 percent deteriorates within the first 5 years. These deterioration rates can be considered worst-case as many of the conditions tied to slower decay are present in this project area. The numbers for each year are percent sound board-foot volume remaining.

Table 53 - Douglas-fir Percent Sound Board Foot Volume

DBH	2004	2005	2006
12	82	35	30
20	85	45	44
30	89	57	56
40	92	66	64
50	93	73	72

Lowell et al (1992) found significant less volume loss in a study of fire-killed timber in Northern California and Southern Oregon coastal forests. They report average volume loss of less than 10% in the second year for all species. Neither study described the time of year their data were taken.

For analysis purposes, the rates given in Table 52 are assumed to be as of the fall of each year, after the hot, dry, summer season. The assumption is that if the timber is logged before the fall of 2005, minor volume loss would be experienced.

Management Direction

Direction for the financial efficiency analysis can be found in the Forest Service Manual 2430-2432 (Amendments 2400-95-1 through 3) and Forest Service Handbook 2409.18, Chapters 10-30 (Amendments 2409.18-95-1 through 6). The financial efficiency analysis provides information relevant to the future financial position of the program if the project is implemented. The analysis basically compares estimated Forest Service direct expenditures with estimated financial revenues. Financial efficiency analysis measures two things – revenue/cost ratio and financial present net value.

A financial efficiency analysis was completed for the project and can be found in the Analysis File. This analysis includes revenues generated from timber sale receipts, and costs of the planning, sale preparation, administration, roads, fuel treatments, reforestation activities, other mitigating measures, and Knutson Vandenberg (KV) funded sale area improvement projects. The analysis did not include an estimate of non-market amenities values due to the unpredictable nature of these values. Non-market values are required “only when excess demand exists for non-market goods (Forest Service Handbook 2409.18 32.24) or the project has detrimental effects on non-market output. For a comprehensive discussion of the social and economic considerations at the forest level, refer to the Willamette Forest Plan FEIS, Chapter III, pages 213-235 and Chapter IV, pages 119-130.

Environmental Consequences by Alternatives

Evaluation Criteria:

1. Timber Volume (MMBF)
2. Present Net Value (PNV)
3. Revenue/Cost Ratio

Direct and Indirect Effects

Table 54. - Financial Efficiency of the Alternatives.

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
	No action				
Timber Volume (MMBF)	0	0	3.0	5.5	5.8
Present Net Value	-\$175,178	-\$323,782	-\$107,124	\$115,720	\$143,240
Revenue/Cost Ratio	0.00	0.00	0.83	1.13	1.16

Cumulative Effects

The cumulative effects of an alternative on the socioeconomic environment are quite difficult to estimate (WNFP FEIS, page IV-127). In terms of cumulative effects, District or Forest timber volumes for sale may have little influence on any one mill, for example an owner can purchase from Bureau of Land Management and private woodlot owners to get additional supply. They can also purchase logs from the Umpqua or Siuslaw National Forests. Or, at the owner's choice, they can increase or reduce the size of the mill operation, sell the operation to another company, or simply close the mill. All of these have occurred in the last decade and few, if any, of the changes to companies or communities can be tied directly to the sale of the Willamette National Forest timber.

No cumulative effects would occur from Alternative A and B because they do not produce any timber volume. Alternatives C, D, and E produce 3.0, 5.5, and 5.8 MMBF, respectively. These timber volumes represent 14%, 25%, and 26 % of the 2005 District's timber probable sale quantity and 6%, 12%, and 12% of the Forest's timber probable sale quantity, respectively. These timber volume produce from these alternative would have no cumulative effects to the economy of Lane, Linn, and Douglas counties.

Un-roaded Areas

Existing Conditions

The Forest Roads Analysis (USDA, 2003) has identified two un-roaded areas greater than 1000 acres in and adjacent to the project area. One un-roaded area is located on the north side of Fall Creek in the Bedrock and Slick Creek drainages. This area was originally designated as Management Area 5A – Special Interest Area and Management Area 10E – Dispersed Recreation Semi-Primitive Non Motorized Use in the Willamette Forest Plan. The Northwest Forest Plan re-designated the area to Late Successional Reserve. The Clark Butte Trail, Clark Creek Nature Trail, Fall Creek National Recreation Trail, Jones Creek Trail, and Slick Creek Developed Recreation Site are located in this area of the project. The Bedrock Campground and Roads #418 and #419 are also adjacent to this area. The second un-roaded area is located approximately 2 miles east of the project area on the south side of Road #1800 in the Puma and Marine Creek drainages and would not be affected by this project.

These areas are less than 5,000 acres in size and are not contiguous with existing wilderness, primitive areas, Administration-endorsed wilderness, or roadless area in other federal ownership.

There are no **inventoried** roadless areas as identified in the Forest Service Roadless Area Conservation FEIS (USDA, 2000) within the project area.

The action alternatives propose no new or temporary roads in Bedrock/Slick Creek un-roaded area. Helicopter yarding is proposed in those alternatives (D and E) that remove dead hazard trees from the area north of Fall Creek. The visual appearance of cut stumps is mitigated by flush cutting stumps and angling away from trails.

Management Direction

There is no formal direction on un-roaded areas other than the informal advice from the Regional office in September 2004. Management direction for inventoried roadless areas (IRA) is provided by Interim Directive No. 1920-2001, December 14, 2001 and the Regional Forester letter (1920) to Forest Supervisors, August 23, 2004 which establish checkpoints and information exchange for forest planning projects in IRAs. The 2001 Roadless Area Conservation Rule (page 3245) describes resource values and characteristic of un-roaded areas and Forest Service Manual 1909.12 Chapter 7.11 provides recommendations on un-roaded area and wilderness designations.

Environmental Consequences by Alternatives

Direct and Indirect Effects

The effects of the alternatives can be summarized by using the roadless values and characteristics from the 2001 Roadless Area Conservation Rule (page 3245).

1. High quality or undisturbed soil water, and air- All of alternatives have been evaluated for their effects on soil, water, and air in different sections of this Chapter 3. All the alternatives meet the intent of the Clean Water Act, Clean Air Act, and the Willamette Forest Plan Standards and Guidelines for soil disturbance.

2. Sources of public drinking water – Fall Creek is **not** a municipal watershed. The Bedrock Campground provides potable water to campers through a 100 feet deep well (transient, non-community water system).
3. Diversity of plants and animal communities - All of the alternative would have no effect on the diversity of plant and animal communities. The proposed activities would cut and leave or cut and remove a small percentage of dead trees which would affect some of the dead structural components (see Issue – Wildlife Habitat - Snag and Down Wood) but would not change these community types. The alternatives proposed no new or temporary roads in the un-roaded area. The area is not unique in terms of it's plant and animal communities.
4. Habitat of threatened, endangered, proposed, candidate, and sensitive species – Alternative were evaluated under Issue – TE&S. Northern spotted owls and spring chinook salmon are the two species which are federally listed and inhabit the area. Alternative A would have “no effect” to species. Proposed activities in Alternatives B, C, D, and E result in an effects determination of “may affect but not likely to adversely affect” the northern spotted owl. The action alternatives would not adversely modify habitat important to spring chinook salmon.
5. Primitive, semi-primitive non-motorized, and semi-primitive motorized classes of dispersed recreation – As mention above, a portions of this un-roaded area was originally designated to Management Area 10E – Semi-primitive, non-motorized dispersed recreation by the Willamette Forest Plan. All the alternatives would meet the standards and guidelines for this Management Area, even though the area is now designated to Late Successional Reserve.
6. Reference landscapes – The Clark Fire - Post-Fire Analysis of the Fall Creek Late Successional Reserve (USDA, 2004c) has determined that no management will occur in 99 percent of the un-roaded area burned by the Clark Fire. The alternatives would affect a range between 0 (Alternative A – No Action) to 0.19 percent (Alternative E) of this area by felling and removal of some of the dead hazard trees.
7. Natural appearing landscapes with high scenic quality – The alternatives affect the natural appearing landscape by the felling and removal of dead hazard trees. Scenic quality and alternative effects are addressed in Chapter 3. The effects of the alternatives are evaluated in detail below.

Alternative A – No Action

The existing conditions include the evidences of fire suppression activities. These activities included the falling of hazard trees to eliminate the danger to firefighter’s safety. Cut stumps and boles of trees are evident along the Fall Creek Trail and around the Bedrock Campground.

Alternative B

This alternative would fall and leave in place the highly rated dead hazards trees along all the trails and around trail bridges and dispersed recreation sites. This would add approximately 40-60 cut stumps and boles of trees to the current conditions and would be visually evident.

Alternative C

This alternative would fall and leave in place the highly rated dead hazards trees only around trail bridges and dispersed recreation sites. This would add approximately 10-30 cut stumps and boles of trees to the current conditions and would be visually evident.

Alternative D

This alternative would relocate the Fall Creek Trail 100-200 feet to the north away from Fall Creek and create a fuel break within 50-100 feet of the trail. Moderate to highly rated dead hazard trees would be felled and removed with a helicopter along the new trail location, around trail bridges and dispersed recreation sites. This would add approximately 80-120 cut stumps and a portion of the boles of trees which are left for coarse woody debris to the current conditions and would be visually evident. The creation of the fuel break would reduce the amount of fine fuel produced by the shrub and understory vegetation along the trail corridor. The brush cutting would be visually evident for 2-3 years. The fuel break would need maintenance every 5-10 years.

Alternative E

This alternative would fall and remove with helicopter moderate to highly rated dead hazard trees with 200 feet of all trails, around trail bridges and dispersed recreation sites. This would add approximately 150-200 cut stumps and boles of trees to the current conditions and would be visually evident.

8. Traditional cultural properties and sacred sites – Cultural resource surveys have been completed for all proposed activities. Sites have been protected, avoided, or mitigated. Alternative D and E propose some removal of dead trees and helicopter yarding is proposed to minimize soil disturbance. There are no known or recognized sacred sites in the area.
9. Other locally identified unique characteristics – The Slick Creek Cave is a unique feature in this area. The area is protected as a Developed Recreation Administrative Site Management Area 12D and is also protected under the National Historic Preservation Act. All alternatives would protect this site.

Based on the preceding evaluation, none of the alternatives would preclude the future consideration of the Bedrock/Slick Creek area as an inventoried roadless area or wilderness.

Air Quality

Existing Condition

Large forest fires in the past have produced high density, large scale smoke events that affect air quality. Vegetation patterns and archaeological evidence suggests Native Americans burned regularly to improve the growth of plants and as a method to hunting. Historical records shows that smoke from these fires, which limited visibility and would today be considered a health risk, were common occurrences throughout the Willamette Valley and Cascade foothills.

Large fires that produce smoke events still occur, but much less frequently. Slash burning and grass field burning are reduced from the higher levels of the 1980s, since regulations to protect air quality were implemented. Smoke from prescribed fires is primarily restricted to days when weather conditions vent smoke away from settled areas. The portion of air pollution attributed to fires has been reduced since the Oregon Smoke Management Plan regulated prescribed fire emissions.

Winter inversions and frequent on-shore storms from the Pacific Ocean characterize the winter weather patterns in the Willamette Valley. Valley inversions often extend as far east as Lowell (about 11 miles southwest of the SIA) and may extend up the Fall Creek valley, but the SIA is generally in a transition zone where inversions break and the low cloud layer lifts more frequently than in the valley. The rainy season prevailing winds are from the southwest, bringing moisture from the ocean. This is the most common time for slash burning on the Willamette National Forest to reduce impact to urban and rural communities.

Airshed

The lower airshed (or surface winds) of the Fall Creek SIA can be described by the Fall Creek Watershed, since air flows up the drainage and is influenced by the topographic features of the watershed. However, the higher airshed is primarily influenced by the prevailing weather patterns at upper elevations and is much less influenced by local terrain features. Weather conditions in this higher elevation airshed determine the level of vertical mixing and therefore smoke dispersion. For example, a stable airmass traps particulate matter closer to the surface and may cause accumulation of particulate matter. Likewise, an unstable airmass supports vertical mixing and smoke disperses readily. An air quality assessment using lichens on the Willamette National Forest showed that “relative to other parts of the region and the nation, air pollution...from sulfur- and nitrogen-containing criteria pollutants is low” (Geiser 2000). The same report indicates that “lead levels were within the background range throughout most of the Willamette NF but were elevated along the Cascade Crest in the Class I Wilderness...[which] can be attributed to regional pollution.”

Management Direction

The Federal Clean Air Act is a legal mandate designed to regulate air quality across the nation and protect public health and welfare from air pollution. The Environmental Protection Agency (EPA) sets the National Ambient Air Quality Standards (NAAQS) which limits the amount of various pollutants acceptable in ambient air. The State of Oregon has developed the Oregon Smoke Management Plan, which is managed by the Oregon Department of Agriculture (ODA). Daily burning authorizations are issued consistent with ODA policy and with evaluation of atmospheric and field conditions.

Using air quality monitoring information, the State classifies communities for attainment or non-attainment of air quality objectives. Non-attainment of air quality for urban areas is determined to occur

when particulate levels exceed the NAAQS standards. The Oakridge/Westfir community, about 15 miles to the south of the project area, is classified as a non-attainment area due to frequent smoke inversions during the winter months. About 15 miles west of the SIA is the urban area of Eugene/Springfield, located at the southern end of the Willamette Valley. Eugene/Springfield is also classified as a non-attainment area.

A component of the Clean Air Act is the Prevention of Significant Deterioration provision or PSD. The premise behind the PSD provision is to prevent effecting areas that currently have very clean air. Three air quality classes were established: Class I, II, and III. Class I areas are subject to the tightest restrictions in terms of allowing additional pollutants into the system. Class I areas on the Forest include the Three Sisters Wilderness and Diamond Peak Wilderness.

Oregon Smoke Management Plan

The Oregon Smoke Management Plan was developed as a voluntary program in 1969 and adopted as a regulatory program by the State Forester and the Environmental Quality Commission (EQC) in 1972. It has gone through several major revisions, the most recent in 1992. Its purpose is to minimize smoke intrusions from forest land prescribed burning into designated areas (urban areas) or other areas sensitive to smoke (wilderness areas). It is a framework through which emission reduction goals are being achieved. The State Forester administers the plan, in cooperation with landowners, land management agencies and air quality agencies. It applies to state, federal, and private forestland in Oregon.

The six principle objectives of the Oregon Smoke Management Plan are to:

1. Protect public health,
2. Minimize smoke intrusions into designated populated areas,
3. Reduce emissions from prescribed burning,
4. Protect visibility in Class 1 wilderness areas during the summer months,
5. Maximize burning opportunities while minimizing emissions, and
6. Coordinate with other state smoke management programs.

No burning will occur unless all of the criteria are met under the daily Oregon Smoke Management instructions. Burns are registered, planned and accomplished only through the Smoke Management program. This is to regulate the amount of harmful particulates suspended in the air by burning treatments.

Oregon Smoke Management also tracks emissions from wildfires that occur around the state.

Smoke Composition

Smoke from wildlife and prescribed fire are similar in composition. The emissions for wildfire are roughly double that of prescribed fire (PNW-GTR-355). These differences in emissions are related to consumption. Consumption varies by fuel moistures at the time of burning. Smoke is composed primarily of carbon dioxide, water vapor, carbon monoxide, particulate matter, hydrocarbons and other organics, nitrogen oxides, and trace minerals. The composition of smoke varies with fuel type: different wood and vegetation are composed of varying amounts of cellulose, lignin, tannins and other polyphenolics, oils, fats, resins, waxes, and starches which produce different compounds when burned.

In general, particulate matter is the major pollutant of health concern from wildfire smoke. Particulate is a general term for a mixture of solid particles and liquid droplets found in the air. Particulates from smoke tends to be very small (less than one micron in diameter) and, as a result, present a greater health concern than coarser particles such as those typically found in road dust. Particulate matter from wood smoke has a size range near the wavelength of visible light (0.4-0.7 microns). This makes the particles excellent at scattering light and therefore excellent at reducing visibility.

Carbon monoxide is a colorless, odorless gas produced as a product of incomplete combustion. It is produced in the largest amounts during the smoldering stages of a fire. Carbon monoxide is potentially one of the most dangerous components of smoke. Fortunately, concentrations drop rapidly as the proximity to the fire decreases and are usually of concern only to firefighters. Hazardous air pollutants such as acrolein, benzene and formaldehyde are present in smoke, but in far less concentrations than particulates and carbon monoxide.

PM_{2.5} and PM₁₀ Emissions

PM_{2.5} and PM₁₀ emissions are particulate matter emissions (2.5 and 10 microns in diameter respectively) that have been identified as harmful to humans. Emissions are commonly estimated for prescribed burning and wildfires and are calculated in tons per acre (TPA) of suspended particles in the air caused by combustion. Particulate matter in tons is hard to visualize, so estimates are best utilized in a comparison analysis. For example, emissions can be compared in relationship to various fuel treatments compared to a wildfire occurrence.

For the project area, emissions are estimated per treatment acre. For example, landing slash piles are composed of material from all acres (i.e., yarded material) but only one acre (i.e., landing site) would be considered a treatment acre. Hand pile burning emissions are simply calculated as the actual acres hand piled.

The calculations shown in Table 55 are from the Oregon Department of Forestry Smoke Management for pile burning in western Cascades fuel types. Average tons per acre (TPA) burned do not include landing piles due to the wide variability in landing pile characteristics.

For all harvested acres the total number of tons to be treated by burning will be calculated and entered into the Oregon Smoke Management database to comply with current criteria for burning and air quality. For fuels treatment in the project area, the resulting emissions from these burning activities would be considered very low.

Table 55. - Average particulate matter (PM) emissions for pile burning in western Cascades fuels

Treatment	PM _{2.5} (lbs/ton)	PM ₁₀ (lbs/ton)	Average TPA (tons/acre) burned	Average TPA emissions
Grapple pile burn	24	29	19.8	PM _{2.5} 0.24 TPA PM ₁₀ 0.29 TPA
Handpile burn	17	23	13.2	PM _{2.5} 0.11 TPA PM ₁₀ 0.15 TPA
Landing pile burn	24	29	variable	PM _{2.5} variable PM ₁₀ variable

Environmental Consequences by Alternatives

Direct and Indirect effects

There is no significant difference in particulate matter emissions between alternatives (see Table 5). Under all action alternatives, piles would be burned in the fall or winter during the rainy season to minimize smoke intrusions. All piles will be burned in compliance with Oregon Smoke Management direction.

The significance of the emission levels changes based on the weather. During periods of atmospheric stability (inversions), particulate matter is not dispersed and debris burning would not occur. However, during atmospheric instability, vertical mixing allows particulate matter to quickly dispersed.

Table 56. - Comparison of particulate matter emissions by alternative in lbs/acre

Alter- native	Grapple Pile Burning			Hand Pile Burning			Strip Cover Burning			Total		
	Acres	Emissions		Acres	Emissions		Acres	Emissions		Acres	Emissions	
		PM _{2.5}	PM ₁₀		PM _{2.5}	PM ₁₀		PM _{2.5}	PM ₁₀		PM _{2.5}	PM ₁₀
A	0	0	0	0	0	0	0	0	0	0	0	0
B	19	4.6	5.5	97	10.7	14.6	0	0	0	116	15.3	20.1
C	33	7.9	9.6	77	8.5	11.6	31	3.4	4.7	141	19.8	25.9
D	59	14.2	17.1	131	14.4	19.7	59	6.5	8.9	249	35.1	45.7
E	44	10.6	12.8	220	24.2	33.0	64	7.0	9.6	328	41.8	55.4

All piles would be burned in accordance with Oregon State Smoke Management instructions. The burning of piles is usually of short duration but in some areas burning may occur over a several day period. Burning would occur in late fall and winter months on days when the most favorable emission dispersion conditions exist. It is not anticipated that pile burning will exceed the National Ambient Air Quality Standards (NAAQS) or the State Implementation Plan (SIP) for air quality.

Cumulative Effects

Numerous activities have the potential to cumulatively impact air quality in the Fall Creek airshed:

- Forest Service slash disposal burning
- Slash burning on adjacent BLM or private lands upwind of the airshed
- Wildfires
- Agricultural burning west or southwest of the project area
- Residential burning in the lower Fall Creek area

Cumulative impacts of burning proposals under any action alternatives and slash burning from other federal or private projects would be limited to levels consistent with the DEQ Air Quality Standards and the Clean Air Act because all daily burning activities are regulated by the Smoke Management Plan.

The proposed action alternatives would not cumulatively impact air quality during the summer and early fall when wildfires and agricultural burning occurs because slash will be burned at a different time of the year (i.e., late fall, winter).

Other Disclosures

Short-term Uses and Long –term Productivity

NEPA requires consideration of the relationship between short-term uses of man’s environment and the maintenance and enhancement of long-term productivity (40 CFR 1502.16). As declared by Congress, this includes using all practicable means and measures to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101).

The Multiple Use – Sustained Yield Act of 1960 requires the Forest Service to manage National Forest System lands for multiple uses (including timber, recreation, fish and wildlife, range, and watershed). All renewable resources are to be managed in such a way that they are available for future generations. The salvage and use of standing timber can be considered a short term use of a renewable resource. As a renewable resource, trees can be re-established and grown again if the productivity of the land is not impaired.

Maintaining the productivity of the land is a complex, long-term objective. All alternatives protect the long-term objective of the project area through the use of specific Forest Plan Standards and Guidelines, mitigation measures, and BMPs. Long-term productivity could change as a result of the various management activities proposed in the alternatives. Management activities could have a direct, indirect, and cumulative effect on the economic, social, and biological environment. Those effects are disclosed in the analyses presented in this Chapter 3.

Soil and water are two key factors in ecosystem productivity, and these resources would be protected in all alternatives to avoid damage that could take many decades to rectify. Sustained yield of timber, wildlife habitat, and other renewable resources all rely on maintaining long-term soil productivity. Quality and quantity of water from the analysis area may fluctuate as a result of short-term uses, but no long-term effects to water resources are expected to occur as a result of timber management activities.

All alternatives would provide the fish and wildlife habitat necessary to contribute to the maintenance of viable, well distributed populations of existing native and non-native vertebrate species. The abundance and diversity of wildlife species depends on the quality, quantity, and distribution of habitat, whether for breeding, feeding, or resting. The alternatives vary in risk presented in both fish and wildlife habitat capability.

None of the alternatives would have an effect on the long-term productivity of timber resources. Although the length of time and success rates vary among various regeneration scenarios, trees would be regenerated to provide post-fire productivity

Unavoidable Adverse Effects

Several expected adverse effects, including some that are minimal and/or short term, were identified during the analysis. Resource protection measures or mitigations were identified and considered for each of these as a means to lessen or eliminate such effects on specific resources. See mitigation measures starting on Chapter 2. Resource areas determined to have potential adverse effects (resulting from any of the alternatives – including No Action and the Action Alternatives) are documented within the appropriate Environmental Consequences sections of each resource in this chapter. See the following sections:

- Recreation: Public Safety
- Fire and Fuels: Fuel Loading
- Fisheries: Spring Chinook Salmon Habitat
- Wildlife Habitat: Snags and CWD Habitat
- Wildlife Habitat: Terrestrial Threatened, Endangered and Sensitive Species, Northern Spotted Owl
- Water: Water Quality
- Soils: Potential Soil Erosion and Detrimental Soil Conditions
- Vegetation: Noxious Weeds

Irreversible and Irretrievable Commitment of Resources

NEPA requires that environmental analysis include identification of “. . . any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.” Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that the use of these resources have on future generations.

Irreversible effects primarily result from use or destruction of a specific resource (e.g., minerals) that cannot be replaced within a reasonable time frame.

Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (e.g., disturbance of wildlife habitat); or is lost as a result of inaction (e.g., failure to monitor and treat forest vegetation to prevent infestation of insects).

The proposed fire salvage project would result in few direct and indirect commitments of resources; these would be related mainly to salvage operations.

The anticipated effects for all action alternatives described in this document are the same as those discussed in the FEIS for the Forest Plan (USDA, 1990b) on page IV-178. Some erosion and soil movement would result from salvage activities. Small amounts of crushed rock from quarries would be committed to construction of temporary spur roads and landings or maintenance of the existing classified road system and would be irretrievable, if used.. Energy used to grow, manage, and harvest trees, and in other management activities is also generally considered irretrievable

The analysis revealed no significant irreversible or irretrievable commitment of resources associated with implementing the alternatives that are not already identified in the Willamette National Forest Plan FEIS

Cultural Resources

The areas proposed for ground-disturbing activities have been surveyed and evaluated for the presence of cultural resources. Several areas containing these resources have been identified. The action alternatives were either designed to avoid or exclude these areas from any management activities, have mitigated the effects by protecting the sites with down logs, and or minimized the site disturbances with yarding log suspension requirements. The action alternatives would have no adverse effects to cultural resource (See Project Review for Heritage Resources form in the Analysis File). If any cultural sites are found during any proposed activity, the activity would be discontinued, and timber sale contract provisions would be invoked until the site is evaluated for significance and appropriate mitigation measures are performed.

Environmental Justice Executive Order 12898

Fall Creek SIA Fire Recovery Project is located near the Cities of Lowell, Oakridge, and Westfir, in Lane County, Oregon. These communities have minority populations of 8%, 7% and less than 1%, respectively. Lane County, in its entirety, has a minority population of 9%, (U.S. Census Bureau, 2000).

For the City of Lowell, approximately 11.5% of the population is at or below poverty level; approximately 14.5% of the population of the City of Oakridge is at or below the poverty level, while 12.2% of the City of Westfir is at or below poverty level, (U. S. Census Bureau, 2000). According to information from the Oregon Economic and Community Development Department (OECDD), Lane County, (excluding areas within the city limits of Eugene, Springfield, Coburg and Dunes City), is rated 1.30, (threshold 1.20), on the distressed area index.(OECDD, 2002). These Cities, as well as much of Lane County, have experienced a significant decline in timber-based jobs over the past decade, contributing to factors used to determine a distressed community.

Implementation of any alternative that provides the opportunity for employment may positively affect low-income families who are either unemployed or underemployed. Implementation of any alternative is not expected to impose a disproportionately high or adverse effect to those populations.

Subsistence and cultural use levels are difficult to quantify and differential patterns of subsistence consumption are unknown at this time. However, the Forest provides access to firewood, Christmas trees, mushrooms and other consumables through a personal-use permit system. Middle Fork Ranger District records indicate the following for 2002: permits were sold for 829 cords of firewood; 2,057 Christmas tree permits were sold; and 490 personal-use mushroom permits were sold.

The proposed treatments have the potential to contribute to the supply of special forest products (SFP) available within the area, such as basic greenery plant species and some mushrooms. Interest in commercial harvest of SFPs is low in this area at this time, and supply far exceeds demand in the Fall Creek watershed. (See “Special Forest Products,” discussed above)

Effects on fisheries are mitigated in all action alternatives to maintain anadromous fish and resident fish populations and habitat.

Road closures may impact subsistence in the immediate project area, but these impacts would be mitigated by the availability of other access routes throughout the area.

The Willamette National Forest has Memorandums of Understanding (MOU) with the Confederated Tribes of the Grand Ronde, the Confederated Tribes of Warm Springs, and the Confederated Tribes of Siletz. These MOUs provide the mechanism for regularly scheduled consultations on proposed activities. Beyond this, the Forest notifies and consults with tribal governments in a manner consistent with the government-to-government relationship on any matters that ripen outside of the meeting schedule. Any potential impacts are discussed and mitigated through these processes.

All alternatives comply with Executive Order 12989 “Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations”.

American Indian Rights

The Confederated Tribes of the Siletz, Grand Ronde, and Warm Spring, Klamath Tribe and Kalapooya Sacred Circle Alliance were notified of the project during the scoping of issues as part of the public participation process. A field trip to the project area was held August 27, 2004 and attended by tribal members of the Grand Ronde Tribe. Presentations were made on the Clark Fire and the Fall Creek SIA

planning efforts and alternatives. No specific comments were received from these tribes as a result of scoping letters and field trip. No specific sacred sites have been identified in the proximity of the proposed units. No impacts, as outlined in the American Indian Religious Freedom Act, are anticipated upon American Indian social, economic or subsistence rights.

All alternatives comply with Consultation and Coordination with Indian Tribal Governments Executive Order 13084 and Indian Sacred Sites Executive Order 13007

Special Forest Products

There is increasing recognition of the economic value of special forest products (SFP) and their potential role in supporting the diversification of forest products dependent communities. The SFP program on the Forest provides a potentially wide range of products.

The Fall Creek SIA treatments areas have a potential to contribute to the supply of special forest products. SFP's available within the proposed harvest areas are limited to some of the basic greenery plants species and some mushrooms. These species include salal, Oregon grape, sword fern, various mosses, and golden chanterelle and morel mushrooms. These SFP's are defined as "non-timber renewable, vegetative natural resources" that can be utilized either for personal or commercial use.

The collections of SFPs are directed by the Forest Plan Amendment No. 23 and the SFP's Management Plan (USDA, 1993b). The latter document suggests that collection of certain SFP's be focused upon areas that are scheduled for harvest, so the proposed actions would provide for a greater amount of potential SFP harvest. This direction ensures resource protection that is consistent with current Forest Plan goals and resource protection and ensures a sustainable long-term supply of desired products. FW-323 to 338 provides direction, such as acceptable harvest levels of various plants/products, acceptable methods of harvest, measures needed to protect other resource values, and where harvesting would be allowed.

At this time, though SFP's provide a potential for economic development, there is a low amount of interest in their collection, and the supply of various renewable forest products existing in the project area and throughout the Fall Creek watershed far exceeds the demand for these products.

KV Funded Projects and Priority

Essential KV

1. Reforestation and the associated activities such as; planting, replanting, exams or stocking surveys, and animal damage control.

Mitigating Measures

2. Road maintenance and culvert replacement,
3. Temporary Spur Road and Landing Decommissioning and Rehabilitation (if not done with timber sale contract),
4. Construction of Johnny Creek fire ecology interpretive kiosk,
5. Re-location of 1.6 miles of Fall Creek National Recreation Trail (Alternative D only)
6. Fuel reduction treatments (i.e., hand piling, grapple piling, strip piling, fuel break)
7. Erosion control seeding and fertilization,
8. Noxious weed prevention with native grass seeding and fertilization,
9. Installation of log and boulder traffic barriers along Road #1800 and various dispersed recreation site parking areas.

Resource Opportunity Projects – Should money be available from timber stumpage payments after implementation of an action alternative or from other sources not connected with the proposed timber sale, the following projects would be implemented, in order of descending priority;

10. Trail signing on Fall Creek National Recreation Trail, Clark Creek Nature Trail, Jones Creek Trail, and Clark Butte Trail,
11. Installation of 2 gates and waterbarring to close Road #1821-190 (1821-207 and 1821-208),
12. Timber Stand Improvement –Precommercial Thinning,
13. Timber Stand Improvement - Pruning.

Monitoring Plan

Based upon the purpose and need for the action, the issues identified during the scoping process and used in the design of the alternatives, the following Forest Plan Standards and Guidelines are recommended to be used as a guide for monitoring key components of the project.

Purpose and Need and Issue: Public Safety

- Did the project meet Forest-wide Standard and Guideline FW-014 on the operation and maintenance of developed sites in meeting public health and safety?
- Did the project meet safety standards provided by the Oregon Occupational and Safety and Health Division for areas adjacent to Forest roads?

Purpose and Need and Issue; Fuel Loading

- Did the project meet Forest-wide Standard and guideline FW-252, or the recommendation for CWD prescription derived from LSRA?

Purpose and Need and Issues: Riparian Habitat and Spring Chinook Salmon

- Did the project implement Fisheries - Biological Assessment's project elements and mitigating measures?
- Did the project meet the Northwest Forest Plan Aquatic Conservation Strategy objectives at the watershed scale?
- Did the project meet the Northwest Forest Plan Standards and Guidelines for Riparian Reserves?

Purpose and Need and Issue: Vegetation Recovery and Scenic Quality

- Did the project meet the Willamette Forest Plan management goals and objectives for Management Area -5A – Special Interest Area and the standards and guidelines associated with MA-5A?
- Did the project meet the Forest-wide Standard and Guideline FW-199 and FW-200 which addresses changed environmental conditions?

Purpose and Need for Economic Recovery

- Was the economic value of the fire-killed timber recovered while meeting multiple-use goals and objectives for wildlife habitat, water quality, soil productivity, fuel management, and recreation safety?

Issues: Water Quality and Soil Erosion

- Did the project implement Best Management Practices?

- Did the project meet Forest-wide Standards and Guidelines FW-081 on detrimental soil conditions, FW-084 on soil erosion?

Other Standard Monitoring

- Monitoring will occur at many points in time during the implementation process of the project such as during timber sale layout and preparation, timber sale contract administration, and service contracts administration.
- The Silviculturist will review marking guides for determining hazard trees with the presale crew prior to marking and monitor quality both during and after the unit is completed marked. The fire area will continue to be assessed and monitored for hazard trees over the next 2-3 years as trees die from the effects of the fire.
- Logging operation will be monitored by the sale administer, soil scientist, and Silviculturist. If standards and guidelines, best management practices, mitigation measures, or the silvicultural prescription are not being met, additional measures will be prescribed to insure compliance. The sale administer will inform the appropriate staff member if logging feasibility issues may make it impossible to meet the desired conditions outlined in the environmental document.
- The District fuels specialist, soil scientist, and Silviculturist will monitor post harvest fuel loading to determine if slash treatment is still warranted. If the unit is plantable and fuel loads are within standards and guidelines, the slash treatments may be waived to promote long term site productivity.
- Harvest units will be examined the 1st, 3rd, and 5th growing seasons after planting or until reforestation is certified complete with a minimum of 125 trees per acres. These exams will determine survival rates, brush competition, species composition, level of natural regeneration, and damage factors. The need for additional follow-up treatments will be based on these exams. These could include replanting, animal damage control, and manual release from brush competition.
- The project will be subject to randomly selected implementation monitoring trips sponsored by either provincial, regional, forest, or district level management teams to determine if the objectives, standard and guidelines, and management practices specified in the Forest Plans are being implemented.
- Additional information about monitoring can be found in the individual resource reports in the project's Analysis File.

CHAPTER 4 – COORDINATION, CONSULTATION AND PUBLIC CONTACTS

This chapter provides a list of the interdisciplinary team who coordinated and designed the project and prepared the environmental assessment document, agencies and tribes consulted, and individuals and organizations that were contacted or commented during the development of the environmental assessment.

Interdisciplinary Team Members:

Gary Marsh	Team Leader / Silviculturist
Mike Gebben	Wildlife Biologist
Al Johnson	Hydrologist
David Murdough	Soil Scientist
Doug Larson	Fish Biologist
Jenny Lippert	Botanist
Tim Bailey	Recreation Planner
Charlie Rasler	Fuels Specialist
Mary Lee Sayre	Road Engineer
Carol Winkler	Archeologist
Julie Cox	Public Affairs
John Orbeton	Fire Planner
Jane Kertis	Ecologist
Chip Weber	District Ranger 10/12/2004
Rick Scott	District Ranger 9/2003 -10/2004
Jim Williams	Recreation and Lands Staff

Federal, State, and Local Agencies:

Army Corps of Engineers Resource staffs and rangers
Oregon Occupational Safety and Health Division (OR-OSHA) inspectors
Oregon Department of Fish and Wildlife
Oregon Department of Environmental Quality
USDI Bureau of Land Management, Dianna Bus, forester
USDI Fish and Wildlife Service
USDC Fisheries Division – National Oceanic and Atmospheric Administration

Tribes:

Klamath Tribe
Confederated Tribes of the Grand Ronde
Confederated Tribes of the Siletz Indians
Confederated Tribes of the Warm Springs

Individuals:

Terri Moffit, Senator Smith's office
Congressman Peter Defazio
David Dreher , Congressman Defazio's office
Jim Geisenger, Associated Oregon Loggers
Ross Mickey, American Forest Resource Council
Tim Ingalsbee, Western Fire Ecology Center, American Lands Alliances
Doug Heiken, Oregon Natural Resource Council
Josh Laughlin, Cascadia Wildlands
James Johnson, Cascadia Wildlands
Roy Keene, consulting forester
Cedric Hayden, adjacent landowner and former State Representative
Ernie Nieme, EcoNorthwest, Middle Fork Watershed Council
Weyerhaeuser Co. Representatives, adjacent land owner
Roseboro Co Representatives, adjacent land owner
Chuck Sheppard, Bedrock Campground concessionaire
Steve, Bud, and Stub Steward, timber industry representatives
Oregon Forest Resource Institute, forest management organization
Obsidians
Native Plant Society
Many Rivers Group of Sierra Club
Joanne Vinton
Susan Applegate
Sally Streeter
Rod Korkoske
Peggy Robinson
James Carpenter
S. Fox
Bob and Ann Vaughn
Judy Wilganowski

As mentioned in Chapter 1 – Scoping and Public Involvement, the scoping record (Scott, 2004b) and an attached cover letter seeking comments and additional information was send out May 12, 2004 to specific individuals, organizations, agencies, and tribes identified as being interested or affected by the proposal. A copy of the specific mailing list can be found in the Public Involvement section of the Analysis File.

The Proposed Action was also published in the Willamette National Forest's Schedule of Proposed Action (SOPA) (Forest Focus) which is mailed out to an extensive Forest mailing list of people interested in the management activities of the Forest. A copy of the mailing list can be found in the Public Involvement section of the Analysis File. The proposal first appeared in the Winter Quarter/February 2003 issue. The SOPA provides one means of keeping the public informed of the progress of individual projects. The SOPA is also made available to the public on the Willamette Forest website.

The interdisciplinary team reviewed all the written comments, electronic mail responses, and notes from fieldtrips and incorporated the concerns into the issues where applicable and appropriate. Information related to these concerns was either addressed in the discussion of the issues and environmental consequences or can be found throughout the different sections of the EA, Analysis File or Decision Notice. For more information on how specific comments were incorporated into the EA or reasons for not considering comments as an issue, see the Public Involvement section in the Analysis File.

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Appendix A

Federal and State Laws, Regulations, and Executive Orders:

The National Environmental Policy Act (NEPA) of 1969, as amended

The purposes of this Act are "To declare a national policy which will encourage productive and enjoyable harmony between man and his environment, to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nations; and to establish a Council on Environmental Quality" (42 U.S.C. Sec. 4321). The law further states "it is the continuing policy of the Federal Government, in cooperation, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of the present and future generations of Americans. This law essentially pertains to public participation, environmental analysis, documentation and appeals.

NEPA establishes the format and content requirements of environmental analysis and documentation such as the Fall Creek SIA Fire Recovery project analysis. The entire process of preparing an environmental assessment was undertaken to comply with NEPA requirements, as codified by 40 CFR 1501 and the Forest Service Handbook 1909.15, Chapter 40.

The National Forest Management Act (NFMA) of 1976

This Act guides development and revision of National Forest Land Management Plans and addresses a range of activities from required reporting that the Secretary must submit annually to Congress to preparation requirements for timber sale contracts. There are several important sections within the act, including Section 1 (purpose and principles), Section 19 (fish and wildlife resources), Section 23 (water and soil resources), and Section 27 (management requirements that relate to perspective project planning).

All alternatives were developed to be in full compliance with NFMA via compliance with the Willamette National Forest Land and Resource Management Plan, as amended. This EA contains references as to how this project complies with Forest Plan and Northwest Forest Plan standards and guidelines. The Silvicultural Prescription in the Analysis File contains a discussion of compliance with NFMA's requirement to identify lands unsuited for management and the requirement to achieve reforestation within five years.

The Endangered Species Act of 1973, as amended

The purposes of this Act are to "provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such endangered species and threatened species, and to take such tests as may be appropriate to achieve the purpose of the treaties and conventions set forth in subsection (a) of this section." The Act also states "It is further declared to be the policy of Congress that all Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of this Act."

Field surveys, Biological Evaluations, and Biological Assessments for all listed endangered, threatened, or sensitive species have been conducted to determine possible effects of any proposed activities in the Fall Creek SIA project area (see the Wildlife and Plant Biological Evaluations, and Fish Biological Assessment in the Analysis File).

The Clean Water Act, as amended in 1977 and 1982

The primary objective of this Act is to restore and maintain the integrity of the Nation's waters. This objective translates into two fundamental national goals: 1. Eliminate the discharge of pollutants into the nation's waters; and 2. Achieve water quality levels that are fishable and swimmable. This Act establishes a non-degradation policy for all federally proposed projects. Under Section 303(d) of the Clean Water Act, the State has identified water quality-limited water bodies in Oregon. Fall Creek is the only water body in the project area that is on the 303(d) list due to elevated temperatures.

All action alternatives including associated mitigation actions and BMPs are consistent with current management direction including Willamette Forest Plan Standards and Guidelines, Aquatic Conservation Strategy (ACS) Objectives (at the watershed analysis area) and the Federal Clean Water Act. Implementation of required BMPs would insure protection of water quality and beneficial uses under all alternatives. Although the main stem of Fall Creek is currently listed as water quality limited due to elevated summer water temperatures, retention of nearly all green trees and a high proportion of the dead trees within the effective shade zone of Fall Creek would result in a negligible affect in the short-term on stream temperature in Fall Creek. In the long-term, the remaining dead trees in the effective shade zone of Fall Creek will deteriorate and lead to an increased probability of an increase in temperature until shade recovers to near natural levels. Those alternatives that would plant conifers in the primary shade zone of Fall Creek would likely result in accelerating the rate of stream shade recovery leading to cooler water temperatures at an earlier point in time compared to alternatives that do not include planting.

The Clean Air Act, as amended in 1990

The purposes of this Act are "to protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population; to initiate and accelerate a national research and development program to achieve the prevention and control of air pollution; to provide technical and financial assistance to state and local governments in connection with the development and execution of their air pollution prevention and control programs; and to encourage and assist the development and operation of regional air pollution prevention and control programs."

The action alternatives are designed to meet the National Ambient Air Quality Standards, as direction by the Oregon Smoke Management Act, through avoidance of practices which degrade air quality below health and visibility standards.

National Historic Preservation Act of 1966, as amended

This Act requires Federal agencies to consult with American Indian Tribes, and various State and local groups before nonrenewable cultural resources, such as archaeological and historic structures, are damaged or destroyed. Section 106 of this Act requires Federal agencies to review the effects project proposals may have on the cultural resources in the Analysis Area.

The areas proposed for ground-disturbing activities have been surveyed and evaluated for the presence of inventoried cultural resources. Several areas containing these resources have been identified. The

alternatives were either designed to avoid or exclude these areas from any management activities, have mitigated the effects by protecting the sites with down logs, and or minimized the site disturbances with yarding log suspension requirements. (See Mitigation Measure section and the Project Review for Heritage Resources form in the Analysis File).

Executive Order 13186 (Migratory Bird)

On January 10, 2001, President Clinton signed an Executive Order (E.O. 13186) titled "Responsibilities of Federal Agencies to Protect Migratory Birds." This E.O. requires the "environmental analysis of Federal actions, required by NEPA or other established environmental review processes, evaluates the effects of actions and agency plans on migratory birds, with emphasis on species of concern."

The primary effect of action alternatives would be to reduce snag habitats. The Primary Cavity Excavator section under Wildlife Habitat summarizes effects to landbirds that use these habitats. These alternatives propose various amounts of treatments within riparian reserves. When taken in the perspective of the watershed the effects would be minor. Planting of conifer tree seedling in Alternatives C, D, and E would accelerate recovery of vegetation; in severely burned areas. Under Alternatives A and B, the elevated fuel loads expected in 10 to 20 years would increase the risk of an intense re-burn. Another stand replacement fire could further delay development of forest vegetation. Alternatives C, D, and E also leave some burn areas untreated, but salvage logging and fuels reductions reduce overall fuel loads and break up the continuity of fuels remaining.

Prime Lands

The Secretary of Agriculture issued memorandum 1827 which is intended to protect prime farm lands and rangelands. The project area does not contain any prime farmlands or rangelands. Prime forestland is not applicable to lands within the National Forest System. National Forest System lands would be managed with consideration of the impacts on adjacent private lands. Prime forestlands on adjacent private lands would benefit indirectly from a decreased risk of impacts from wildfire. There would be no direct, indirect, or cumulative adverse effects to these resources and thus are in compliance with the Farmland Protection Act and Departmental Regulation 9500-3, "Land Use Policy".

Executive Orders 11988 (Floodplain Management) and 11990 (Protection of Wetlands)

Executive Orders 11988 and 11990 direct Federal agencies to avoid, to the extent possible, both short-term and long-term adverse impacts associated with the modifications of floodplains and wetlands. None of the alternatives have specific actions that adversely affect wetlands and floodplains. Proposed activities are compliant with the orders and USDA Departmental Regulation 9500-3. See discussions related to this topic in the hydrology, fisheries and soils resource sections in Chapter 3 for more information.

Executive Order 12962 (Aquatic Systems and Recreational Fisheries)

This 1995 order's purpose is to conserve, restore, and enhance aquatic systems to provide for increased recreational fishing opportunities nationwide. It requires federal agencies to evaluate the effects of federally funded actions on aquatic systems and document those effects relative to the purpose of this order.

There is a potential short term impact of sediments into the streams as a result of the hazard tree removal and the in-stream restoration of Fall Creek. This short term impact would not threaten fish species. The

short term impact are outweighed by the long term benefits to the water quality and fisheries resource. Mitigating measures have been applied in all action alternatives to maintain anadromous fish and resident fish populations and habitat. These mitigating measures include no harvest zones adjacent to streams and other best management practices during harvest activities. Stream rehabilitation projects have been proposed to improve stream temperatures, channel complexity and diversity. The introduction of large wood into the Fall Creek is a key component of spawning and rearing habitat, and currently this structure is in deficit supply in Fall Creek. Road reconstruction and closures have been proposed to reduce the risk of sedimentation to water quality and fisheries resources.

All action alternatives including associated mitigation actions and BMPs are consistent with current management direction including Willamette Forest Plan Standards and Guidelines, Aquatic Conservation Strategy (ACS) Objectives (at the watershed analysis area) and the Federal Clean Water Act. Implementation of required BMPs would insure protection of water quality and beneficial uses under all alternatives.

Executive Order 13112 (Invasive Species)

This 1999 order requires Federal agencies whose actions may affect the status of invasive species to identify those actions and within budgetary limits, "(i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species... (iii) monitor invasive species populations... (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded;... (vi) promote public education on invasive species... and (3) not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species... unless, pursuant to guidelines that it has prescribed, the agency had determined and made public... that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions."

The action alternatives implement the direction from the Willamette Forest Plan and the Integrated Weeds Management EA. The action alternatives include mitigating measure (see Chapter 2 – Mitigation Common to All Alternative – Noxious Weeds) which would limit the spread of noxious weeds. Mitigating measures include the cleaning of off road equipment between infested work sites, pre-treating roads before road maintenance and reconstruction, re-vegetating all disturbed areas with weed-free mulch and native seed, and monitoring weed infestations following treatments..

Energy Requirement and Conservation Potential

There are no unusual energy requirements for implementing any of the alternatives

Alternatives which involve tree removal would create supplies of firewood as a by-product of the timber harvest. This product would contribute to the local supply of energy for home space heating.

Several alternatives propose helicopter yarding of salvaged timber. Helicopter yarding is often considered to have high fuel requirements. Though helicopters may use more fuel per unit of time than other yarding equipment, they are more productive and do not need to be operated for as long as more convention yarding equipment for a given timber volume. Helicopter yarding also avoids the need to consume fuel for road construction. Analysis has shown that the energy used for helicopter use is not unusual not excessive in comparison with other methods of accessing large timber.

Consumer, Civil Rights, Minority Groups and Women

Implementation of any alternative may not by itself have any effect upon consumers, but in combination with other timber harvest projects may have an effect upon the local economy, especially on communities of Lowell, Oakridge, Springfield and Eugene. The Forest Plan FEIS addresses social and economic effects on pages IV 119-128.

Implementation of this project has not been planned to either favor or discriminate against any social or ethnic group. Contracting procedures would ensure that projects made available through this project would be advertised and awarded in a manner that gives proper consideration to minority and women-owned business groups and meet Equal Employment Opportunity requirements. Because of this consideration, there would be no direct, indirect, or cumulative effects to consumers, minority groups with implementation of any of the alternatives

Minorities, Low-income Populations, or Subsistence Users

Environmental Justice Executive Order 12898 (February 11, 1994) requires an analysis of federal actions to determine if there is a “disproportionately high and adverse effect” on minorities (Asian Americans, African Americans, Hispanics), low-income populations, American Indians or subsistence users. The principle behind the concept of environmental justice is that minority and disadvantaged citizens should not experience disproportionate or adverse impact from environmental effects or derive fewer benefits from federal actions relative to the dominant segments of society.

Fall Creek SIA Fire Recovery Project is located near the Cities of Lowell, Oakridge, and Westfir, in Lane County, Oregon. These communities have minority populations of 8%, 7% and less than 1%, respectively. Lane County, in its entirety, has a minority population of 9%, (U.S. Census Bureau, 2000).

For the City of Lowell, approximately 11.5% of the population is at or below poverty level; approximately 14.5% of the population of the City of Oakridge is at or below the poverty level, while 12.2% of the City of Westfir is at or below poverty level, (U. S. Census Bureau, 2000). According to information from the Oregon Economic and Community Development Department (OECDD), Lane County, (excluding areas within the city limits of Eugene, Springfield, Coburg and Dunes City), is rated 1.30, (threshold 1.20), on the distressed area index.(OECDD, 2002). These Cities, as well as much of Lane County, have experienced a significant decline in timber-based jobs over the past decade, contributing to factors used to determine a distressed community.

Implementation of any alternative that provides the opportunity for employment may positively affect low-income families who are either unemployed or underemployed. Implementation of any alternative is not expected to impose a disproportionately high or adverse effect to those populations.

Subsistence and cultural use levels are difficult to quantify and differential patterns of subsistence consumption are unknown at this time. However, the Forest provides access to firewood, Christmas trees, mushrooms and other consumables through a personal-use permit system. Middle Fork Ranger District records indicate the following for 2002: permits were sold for 829 cords of firewood; 2,057 Christmas tree permits were sold; and 490 personal-use mushroom permits were sold.

The proposed treatments have the potential to contribute to the supply of special forest products (SFP) available within the area, such as basic greenery plant species and some mushrooms. Interest in commercial harvest of SFPs is low in this area at this time, and supply far exceeds demand in the Fall Creek watershed. (See “Special Forest Products,” discussed above)

Effects on fisheries are mitigated in all action alternatives to maintain anadromous fish and resident fish populations and habitat.

Road closures may impact subsistence in the immediate project area, but these impacts would be mitigated by the availability of other access routes throughout the area.

The Willamette National Forest has Memorandums of Understanding (MOU) with the Confederated Tribes of the Grand Ronde, the Confederated Tribes of Warm Springs, and the Confederated Tribes of Siletz. These MOUs provide the mechanism for regularly scheduled consultations on proposed activities. Beyond this, the Forest notifies and consults with tribal governments in a manner consistent with the government-to-government relationship on any matters that ripen outside of the meeting schedule. Any potential impacts are discussed and mitigated through these processes.

All alternatives comply with Executive Order 12989 “Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations”.

American Indian Rights

Consultation and Coordination with Indian Tribal Governments Executive Order 13084 and Indian Sacred Sites Executive Order 13007

The Confederated Tribes of the Siletz, Grand Ronde, and Warm Spring, Klamath Tribe and Kalapooya Sacred Circle Alliance were notified of the project during the scoping of issues as part of the public participation process. A field trip to the project area was held August 27, 2004 and attended by tribal members of the Grand Ronde Tribe. Presentations were made on the Clark Fire and the Fall Creek SIA planning efforts and alternatives. No specific comments were received from these tribes as a result of scoping letters and field trip. No specific sacred sites have been identified in the proximity of the proposed units. No impacts, as outlined in the American Indian Religious Freedom Act, are anticipated upon American Indian social, economic or subsistence rights.

State Laws

Oregon State Best Management Practices (BMPs) - State BMPs are employed to maintain water quality and are certified by the Environmental Protection Agency for meeting the Clean Water Act.

The Oregon Smoke Management Plan - The Oregon State Implementation Plan and the Oregon State Smoke Management Plan would be followed to maintain air quality. See Fire and Fuel prescription the Analysis File.

Consultation with the Oregon State Historic Preservation Officer (SHPO) has been completed concerning proposed activities. SHPO has concurred with the finding that there are historic properties but the undertaking would have no effect on them as defined by 36 CFR 800.16(i). The Advisory Council on Historic Preservation (ACHP) has also been consulted about measures to protect significant archeological sites from adverse effects (see the Project Review for Heritage Resources Form in the Analysis File).

Appendix B

Cumulative Effects Analyses

Past, Present, and Foreseeable Future Activities in the Fall Creek Watershed

For the majority of the cumulative effects analyses, the analysis area was defined by the boundary used in the 1995 Fall Creek Watershed Analysis. This analysis area was used in order to remain consistent and comparable with the Watershed Analysis. The boundary is a delineation of topographical and hydrologic boundaries of the watershed drained by Big Fall Creek. The cumulative effects analysis includes the history of harvest and road building which started in the 1940's and 1950's and the effects of timber harvest and road systems on wildlife habitat and the hydrology of the watershed. The analysis includes future harvest projects for which the NEPA process has begun. The table below presents a summary of activities which have occurred in the past, present and foreseeable future within the Fall Creek watershed. The listing includes lands administrated by Bureau of Land Management (BLM) and private lands. Harvest treatments for the private lands were estimated from aerial photography. The various resource analyses may have used a subset of these activities, depending on the size of the appropriate analysis area, for instance, either single or multiple 6th field sub-watersheds.

Tables 1. - Summary by decade of past, present, and future activities in Fall Creek watershed.

Decade	Activity	Acres
Past Activities		
1940's	Regeneration Harvest Treatments	5844
	Fuel Treatments	2960
	Road Construction	See section below
1950's	Regeneration Harvest Treatments	5915
	Fuel Treatments	5630
1960's	Regeneration Harvest Treatments	9203
	Fuel Treatments	8763
	Pre-commercial Thinnings	1760
1970's	Regeneration Harvest Treatments	6152
	Fuel Treatments	5969
	Pre-commercial Thinnings	3298
	Fertilization Treatments	1801
	Commercial Thinnings	26
1980's	Regeneration Harvest Treatments	6979
	Fuel Treatments	6205
	Pre-commercial Thinnings	8626
	Fertilization Treatments	12,338
	Pruning Treatments	20
	Commercial Thinnings	254
1990's	Regeneration Harvest Treatments	1113
	Fuel Treatments	904
	Pre-commercial Thinnings	2815
	Fertilization Treatments	2380
	Pruning Treatments	1065
	Commercial Thinnings	711
2000-2004	Regeneration Harvest Treatments	39
	Fuel Treatments	39
	Pre-commercial Thinnings	1818
	Fertilization Treatments	191
	Pruning Treatments	12

Decade	Activity	Acres
	Commercial Thinnings	962
Present and Future Activities		
2004-2010	Regeneration Harvest Treatments	29
	Fuel Treatments	29
	Pre-commercial Thinnings	1790
	Pruning Treatments	400
	Commercial Thinnings	5,902

Road Systems in the Fall Creek Watershed

The first primitive “truck trail” roads built in the watershed began in early 1900’s for the primary purpose of administrative access for fire protection. In the 1920’s, few roads were constructed. The emphasis was still to develop a road system for effective fire protection. In the late 1940’s demand for timber products increased significantly and lower use project roads, such as roads within a timber sale area, were constructed. In the early 1950’s the road design standards were improved and many of the main access roads were built. The vast majority of the roads in the watershed were constructed from the 1960’s through the 1980’s when the demand for timber and recreation access to public lands dramatically increased. Road construction was minimal in the 1990’s with the decline in timber targets and emphasis shifted toward decommissioning and closure of roads given limited road maintenance budgets.

The Fall Creek watershed has approximately 483 miles of roads. The current road system consist of about 19 miles of paved roads, 364 miles of aggregate surface roads, 52 miles of improved surface or pit run roads, and 48 miles of native surface roads. The Fall Creek ATM Road Management Plan proposes to close or decommission 221 mile of roads this decade.

Listing of specific fire recovery or timber sale activities included in the table above.

Fire Projects

- Puma Hazard Tree Removal Project - 49 ac.
- Clark Fire – Post Fire Analysis –Fall Creek LSR - 0 ac.
- Clark Fire Roadside Salvage – 31 ac.
- Bedrock Campground Restoration Project – 8 ac

Commercial Thinning Project

- Boundary Thin Timber Sale (TS) – 229 ac.
- Borderline Thin TS – 272 ac.
- Edge Thin TS – 352 ac.
- Fringe Thin TS – 326 ac.
- Periphery Thin TS – 537 ac.
- Portland Thin TS – 334 ac.
- Margin Thin TS – 337 ac.
- Fall Thin TS – 230 ac.
- Hehe Thin Project – 4,000 ac.

Regeneration Harvest

- Clark TS – 29 ac.

Other Future Activities

The Fall Creek corridor will continue to have a high level of recreation use in the developed and dispersed sites, trails, and roads which would contribute to cumulative effects on the watershed. Many routine maintenance activities will continued to occur throughout the watershed. They include road maintenance, hazard tree assessment and management, and recreation facility maintenance, and silvicultural maintenance and improvements to the managed plantations.

New delineation of the 5th field Watersheds

In 2004, the 5th field watersheds were re-defined in a Regional effort by the US Forest Service, Soil Conservation Service, US Geological Service, and State of Oregon Water Resources in order to apply a consistent national standard to watersheds. The Fall Creek 5th field watershed boundaries were re-delineated and expanded to include what was defined as the Winberry watershed and the lower portions of the watershed down to the confluence with the Middle Fork of the Willamette River, to meet size requirements. Although the boundaries do not match up exactly, the area defined by the new Fall Creek 5th field watershed is covered by the area analyzed in the Fall Creek Watershed Analysis (USDA,1995) and the Winberry and Lower Fall Creek Watershed Analysis (USDA, USDI, 1996). The new 5th field watershed is approximately 123,538 acres in size and contains six 6th field sub-watersheds. The delineation of 6th field sub-watersheds remain approximately the same, but the names of the sub-watersheds have changed. The table below lists the old names and new names of the sub-watersheds as discussed in the Watershed Analyses.

Watershed Analyses Sub-Watershed Names	New Sub-Watershed Names
Fall Creek WA	
Lower Fall Creek	Fall Creek/Andy Creek
Hehe Creek	Fall Creek/Hehe Creek
Upper Fall Delp Creek	Fall creek/Delp Creek
Portland Creek	Fall Creek/Portland Creek
Winberry and Lower Fall Creek WA	
Winberry Creek	Brush Creek, North Winberry, Lower South Winberry, Upper South Winberry, and portion of South Reservoir
Lower Fall Creek	North Reservoir, and portions of South Reservoir

The cumulative effects analyses for water quality and spring chinook salmon were based on this new delineation of the Fall Creek 5th field watershed. Refer to both the Fall Creek Watershed Analysis (USDA, 1995) and the Winberry and Lower Fall Creek Watershed Analysis (USDA, USDI, 1996) for a description of the important physical and biological components of the existing conditions of this 5th field watershed.