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Myrtle Creek HFRA
Healthy Forests Restoration Act Project
Final Environmental Impact Statement

Bonners Ferry Ranger District
Idaho Panhandle National Forests
Boundary County, Idaho

Myrtle Creek Fire 2003
Kootenai River valley and Bonners Ferry, Idaho

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Idaho Panhandle National Forests
Bonners Ferry Ranger District
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Final
Environmental Impact Statement

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The Myrtle Creek Healthy Forest Restoration Act project proposes fuels reduction and road decommissioning treatments on National Forest System lands in the Myrtle Creek and Snow Creek watersheds of the Bonners Ferry Ranger District. The objectives of the project are to 1) maintain Myrtle Creek watershed as a source of high quality drinking water for the City of Bonners Ferry, Idaho; 2) reduce hazardous fuels in the Myrtle Creek watershed and adjacent forests in Snow Creek watershed; and 3) trend vegetation in Myrtle Creek watershed and adjacent forests in Snow Creek watershed towards conditions that would be less susceptible to catastrophic fire; while maintaining and restoring habitat for fish and wildlife species. Alternative 2, the proposed action and preferred alternative, would improve road conditions on approximately 29 miles of existing roads, decommission approximately one mile of an existing non-drivable road, reconstruct approximately 0.6 mile of temporary road (to be decommissioned following use to meet water quality goals), and use silvicultural treatments on approximately 2080 acres to meet fuels reduction and other resource objectives.

Copies of this EIS are available on compact disc (CD) from the Bonners Ferry Ranger District; and it is posted on the Idaho Panhandle National Forests internet site at www.fs.fed.us/ipnf/eco/manage/nepa/index.html. A limited number of printed copies may also be available.

Document Structure

The Forest Service has prepared this Environmental Impact Statement in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This Environmental Impact Statement discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. Additional documentation, including more detailed analyses of project-area resources, may be found in the project planning record located at the Bonners Ferry Ranger District office. The document is organized into four chapters, various lists, and a few appendices, as follow:

- **Chapter 1. Purpose and Need for Action**: This chapter briefly describes the proposed action, the need for that action, and other purposes to be achieved by the proposal.
- **Chapter 2. Alternatives, including the Proposed Action:** This section details how the Forest Service informed the public of the proposed action and how the public responded. This chapter provides a detailed description of the agency's proposed action as well as alternative actions that were developed in response to comments raised by the public during scoping. The end of the chapter includes a summary table comparing the proposed action and alternatives with respect to their environmental impacts.
- **Chapter 3. Affected Environment:** This chapter describes the current conditions of the project area related to the resources that could potentially be affected by the proposed action.
- **Chapter 4. Environmental Consequences:** This chapter describes the environmental impacts of the proposed action and alternatives.
- **Literature Citations:** Scientific literature and reports, personal communication and other documents which support and aided in the analysis and development of this project are listed by topic (Aquatics, Fish, Soil, Roads, and so on.)
- **List of Preparers:** This section provides a list of individuals and the interdisciplinary team of resource specialists involved with this project.
- **List of Persons, Organizations and Agencies:** This sections lists the agencies who were consulted during the development of the environmental impact statement and the persons, organizations and agencies who received copies of the EIS.
- **Appendices:** The appendices provide more detailed information to support the analyses presented in the environmental impact statement.
  - **Map Appendix:** With exception of a few maps in Chapters 1 and 2, maps are contained in a central appendix. Maps have been added in order to aid reader's understanding, clarify information and in response to comments that some portions of the Draft EIS were confusing or seemed incomplete.
  - **Response to Comments:** Appendix F contains the substantive comments received during the comment period on the Draft EIS and the agency's responses. This appendix is arranged by topic such as Cumulative Effects, Wildlife, Roads.

- **Symbols:** Three symbols are included on selected pages to aid the reader.

A "Note" -- to point out where discussions have been reformatted, such as moving from an appendix to the main body of the EIS; or when items have been added, such as the Map Appendix described above.

A "Key" -- to aid the reader in identifying "Key Issues" (see Chapter 2 for additional information).

A "Check Mark" -- to aid the reader in identifying "Analysis Issues" (see Chapter 2).

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Chapter 1 - Purpose and Need for Action

1.1 - Introduction and Background

In September 2003, a wildfire burned approximately 3,450 acres in the lower portion of the Myrtle Creek drainage, which is the municipal watershed and the primary source of drinking water for the City of Bonners Ferry, Idaho. The fire burned across the intake diversion structure for the City's water system, and caused short-term effects to the water quality. It also heightened the community's awareness of potential risks, if another large fire burned within the watershed.

The Boundary County Idaho Wildland/Urban Interface Fire Mitigation Plan, August 2003, as amended in February 2004, identified the wildland/urban interface as including, "watersheds where citizen groups have organized for joint collection of water for domestic uses." It further stated, "Boundary County is extremely dependent on surface waters for domestic purposes. This dependency includes the residents for the City of Bonners Ferry; protection of water sources and water quality is a high priority." (Boundary County, August 2003)

1.1-A Myrtle Creek HFRA Project Area

The project area encompasses the Myrtle Creek watershed (about 27,000 acres), and the lower section of the Snow Creek drainage (about 3,200 acres), within the Selkirk Mountains of northern Idaho. It includes all or portions of Sections 6-8, 15-23, 26-35, T.62N., R..1W., Sections 1-24, 27-33, T.62N. R.2W., and Sections 2-11, 15-18, T.61N., R.1W., Boise Meridian, Boundary County, Idaho.

1.1-B Community Goals for Myrtle Creek Watershed

Following an initial meeting of the City of Bonners Ferry, Kootenai Tribe of Idaho, Boundary County Commissioners and Forest Service personnel, the Kootenai Valley Resource Initiative[▪] (KVRI) Myrtle Creek Working Group was established (see Chapter 2 for more information concerning the Joint Powers, KVRI and the public collaboration). Under the auspices of the KVRI, the Myrtle Creek Working Group provides a forum to foster discussions between local government agencies, the Kootenai Tribe of Idaho, interested members of the public and Forest Service personnel. The purpose of this KVRI Working Group has been to look at community goals for Myrtle Creek, develop an overarching goal for the watershed, and identify issues. KVRI publishes advance notice of Working Group meetings, which are open to all members of the public, in the local newspaper (*Bonners Ferry Herald*).

The KVRI Working Group discussed needs in the watershed, and asked the Forest Service to evaluate the current and future conditions of the watershed using the following goals:

1) *Maintain a continuous supply of potable water from Myrtle Creek for the City of Bonners Ferry and its customers;*
2) *Reduce the risk of catastrophic fire in the Myrtle Creek watershed, while maintaining and restoring habitat for fish and wildlife species.*

1.2 - The Purpose and Need for the Myrtle HFRA Project

As the primary land management agency within the Myrtle Creek watershed and adjacent areas, the Forest Service was asked to design treatments that will do the following:

- foster long-term reduction of risks from unwanted or undesirable wildfire, and
- reduce or avoid the associated post-fire effects within the municipal watershed.

The goals and objectives for the Myrtle Creek HFRA project (developed through use of the collaboration process described in the Interim Field Guide for community based HFRA projects), are to:

1) *Maintain Myrtle Creek watershed as a source of high quality drinking water for the City of Bonners Ferry;*
2) *Reduce hazardous fuels in the Myrtle Creek watershed and adjacent forests;*
3) *Trend vegetation in Myrtle Creek watershed and adjacent forest towards conditions that would be less susceptible to catastrophic fire, while maintaining and restoring habitat for fish and wildlife species.*

[▪] KVRI was formed in 2001 under a Joint Powers Agreement by the Kootenai Tribe of Idaho, Commissioners of Boundary County, Idaho and the City of Bonners Ferry, Idaho. Sub-committee "working groups" established as needed provide a forum for public collaboration on resource issues important to KVRI and the community. The groups forward recommendations to the 11-member KVRI Board who then take the appropriate action with the affected or interested agencies or members of the public.

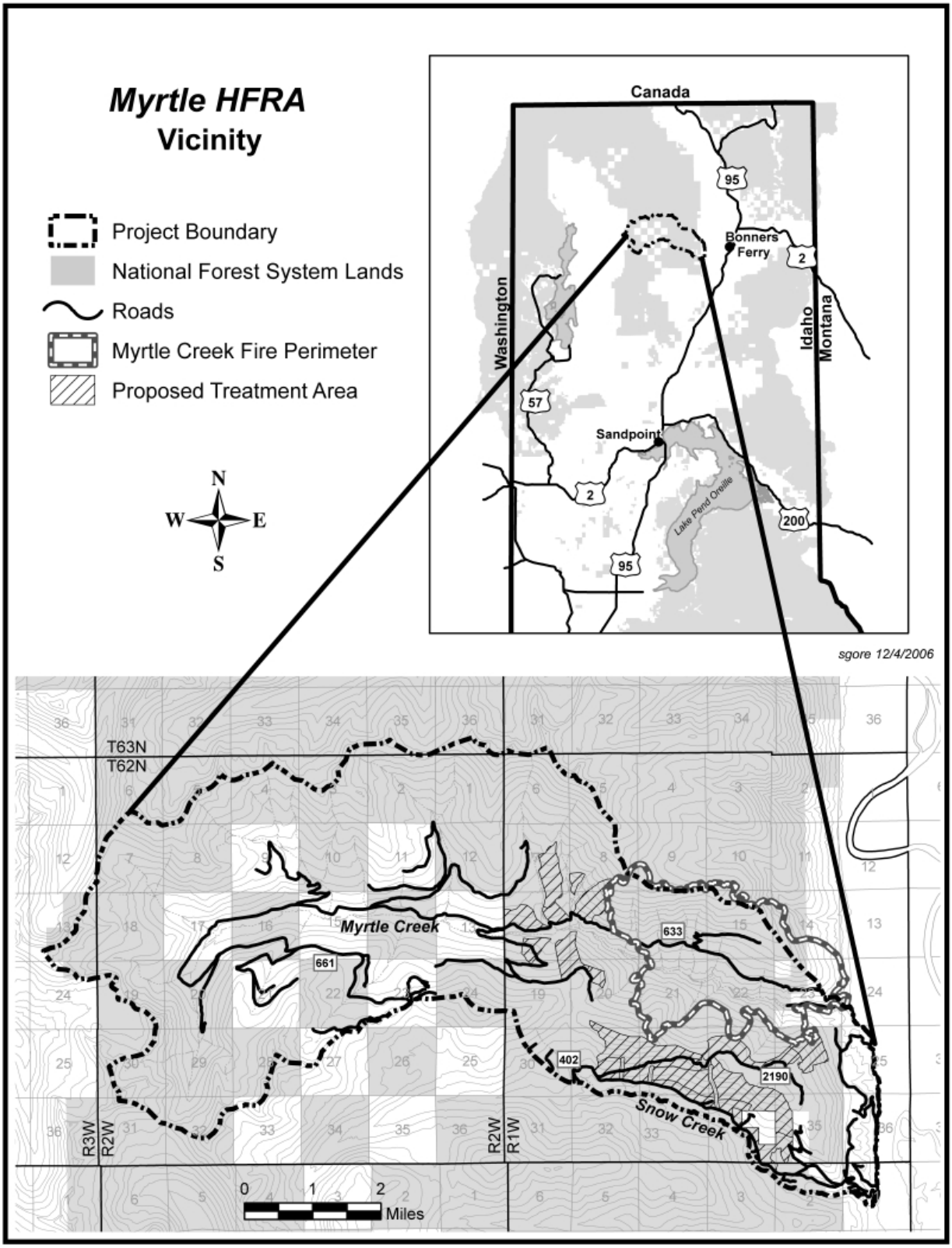

Figure 1.1 Myrtle Creek HFRA Project Vicinity Map

The purpose and need are consistent with the National Fire Plan (National Fire Plan, 2000), the Land and Resource Management Plan for the Idaho Panhandle National Forests (USDA Forest Service, 1987) and also in accordance with the Healthy Forest Restoration Act (HFRA), P.L.108-148 (USDA-FS, USDI-BLM, 2004).

Section 102 (e) (2) of HFRA directs the Forest Service to restore and fully maintain the structure and composition of old growth stands according to the landscape fire adaptation and watershed health, and retaining the large trees contributing to the old growth structure.

To meet the goals and objectives presented to the Forest Service by KVRI, catastrophic fires and their undesirable effects need to be minimized through hazardous fuels reduction treatments.

This photo shows just how close the 2003 wildfire came to the City's municipal water system structures.

Figure 1.2 Myrtle Creek intake structure after the 2003 wildfire.

The proposed fuel reduction treatments, in addition to complying with applicable Federal and state laws, are designed to meet the following goals:

- Reduce forest fuels.
- Reduce the risk and after effects of uncharacteristic and undesirable fires, especially crown fires.
- Restore stand composition and stand resilience to disturbances such as drought, insect and disease, and fire.
- Reduce risk to life, property, natural resources, and wildfire suppression resources.

1.2-A Current vs. Desired Conditions

The need for the proposed action is generated by the differences between the current conditions and the desired conditions of the forest stand structures, forest composition, fuel conditions, and conditions on portions of the road system in the project area. The 2003 Myrtle Creek Fire clearly and undisputedly showed the community that existing conditions can support catastrophic wildfire in the watershed and that such fire has short-term and long-term negative effects on the municipal water supply. These existing conditions include the topography of the Selkirk Mountains and the documented climate in the area – two physical factors which land managers can not influence, but which they must understand when designing fuels reduction projects. The third side of the "fire triangle" – the only one which land managers can influence – is the fuels and vegetation (described below).

1.2-A.1 Current Conditions

a. Fuels and Vegetation

As seen in the "Current Conditions" photo on the next page (Figure 1-3) and additional photos in Chapter 3, the stands of trees are dense and overcrowded from many years of fire suppression. The densely stock stands are declining in health, making them more susceptible to insect and disease outbreaks. In such dense stands, the layered tree canopies have created ladder fuels, predisposing the stands to crown fire behavior. Heavy amounts of dead trees and limbs lying on the ground, as well as standing dead trees, brush and small trees, are also readily available fuels that will burn during a wildfire. Ground fuels, including duff, buried woody material, leaves, needles, and litter, have built up to undesirable levels. In the sub-alpine forests, the stands have limited structural diversity and provide a continuous fuel bed.

In the areas proposed for treatment, the surface fuel conditions are generally categorized as Fuel Model 10. From a fire behavior standpoint, the heavy surface fuels, combined with ladder fuels and dense crowns are contributing to the risk of extreme fire behavior during high fire danger. In the event of a wildfire, flame lengths would be greater than the limit of safe direct attack suppression by hand crews. There would be an increased likelihood of the fire reaching and climbing the ladder fuels into the tree crowns, making ground machinery and aerial resources ineffective for direct attack. (See Chapter 3 Fire and Fuels discussion for more information about fuel models, fire behavior, and suppression capabilities and limitations.)

In the project area as a whole, the percentage of long-lived seral species has decreased significantly (white pine, ponderosa pine, western larch), while the amount of shade-tolerant species has increased significantly (Douglas-fir, Western red cedar, grand fir, hemlock, and subalpine fir). The shade tolerant species that now dominate the landscape tend to be much less resilient to insects, and diseases and less adapted/resilient to fire than the long-lived seral species they have replaced. (See Chapter 3 Vegetation discussion for more information.)

The current condition photo at right, taken in the Snow Creek portion of the project area, shows the current undesirable amount of down fuels and ladder fuels.

Figure 1.3 Current Conditions

b. Fire Regime Condition Class

The role fire would play across a landscape without modern fire suppression (but including the influence of aboriginal burning) is described as the Fire Regime Condition Class (FRCC). It is useful as one indicator for evaluating the health of fire-dependent ecosystems at the landscape level and is a useful tool for designing fuels reduction treatments. (See Chapter 3 Fire and Fuels discussion for more information.)

Fire Regime Condition Class Descriptions

Condition Classes descriptions are based on area's degree of departure from the natural (historical) regime of vegetation characteristics; fuel composition; fire frequency, severity and pattern,and other associated disturbances.

Class 1 – Low degree of departure
Class 2 – Moderate degree of departure
Class 3 – High degree of departure

Over much of the project area, the current stand structures, compositions, and fuel conditions are classified as Condition Class 2 - moderately removed from their historical conditions (http://www.frcc.gov/docs/FrccDefinitionsFinal.pdf) (Project File).

Within the project area, dry forests composed of Ponderosa pine and Douglas-fir are in Condition Classes 2 and 3, and often sustain uncharacteristic and undesirable wildfire behavior, hamper suppression efforts, and as a result, endanger firefighter and public safety.

c. Risk to Municipal Water

Myrtle Creek has been the municipal water supply for the City of Bonners Ferry since 1928. The utility currently serves roughly 3,500 people. The City regularly monitors water quality for inorganic, organic, microbial, and radioactive contaminants, and pesticides and herbicides to assure compliance with State and Federal Water Quality Standards. This monitoring indicates that the beneficial use for municipal water quality is being fully supported (Hydrology Project Files).

Although Myrtle Creek is stable and resilient, the municipal water supply is at an undesirable risk of degraded water quality. The risk in this particular watershed is somewhat elevated by the fact that approximately 13 percent of the area is within the perimeter of the Myrtle Creek Fire of 2003. The watershed's sensitivity from the affects of the fire is one risk factor. Other factors are the current conditions of hazardous fuels and roads, and their potential impacts on sediment production and delivery (in the event of fire – loss of vegetative cover, and effects to soils; from roads – landslide potential and surface erosion risks). See Chapters 3 and 4 Watershed/Hydrology, Fire and Fuels, and Soil Resource discussions for more information.

1.2-B Desired Future Conditions

To meet the overarching community goals for the Myrtle Creek watershed (a continuous supply of drinking water and reduced risk of catastrophic wildfire) certain conditions would be beneficial. These *desired future conditions* describe the ecosystem characteristics that would help reach the objectives of the project.

In summary, the Desired Future Conditions are:

- Decreased intensity and severity of potential wildfire(s).
- Increased potential for successful fire suppression and increased relative safety of suppression crews.
- Decreased risk to the municipal water quality and supply.
- Decreased risk to the water intake facility and infrastructures owned by the City of Bonners Ferry.
- Increase in the vegetation's resilience to fire, insect and disease outbreaks.

An ecosystem with the desired future conditions would have the following characteristics:

- A reduced risk of elevated sediment delivery into the Myrtle Creek aquatic system, or other effects which would degrade the quality or quantity of the municipal water supply. Minimized potential for roads to intercept, concentrate, and route water to streams or unstable slopes. Reduced fire risk helps maintain soil organic layers and functioning riparian zones, which in turn minimizes sediment production and delivery.
- Stand composition and structure are such that the intensity and severity[•1] of a potential wildfire are lessened. This would be accomplished by reducing fuel loading (including ladder fuels) and stand density.
- Potential flame lengths and intensity are decreased. For example, when limited to using hand tools only, fire suppression crews can successfully suppress fires burning with flame lengths less than 4-feet (Andrews 1986).
- Potential for crown fires or higher intensity surface fires is reduced. Stand densities, fuel loadings and ladder fuels are at levels that would minimize the chance of fire behavior moving into the canopy (crown) of the stands or burning with higher intensity in the surface fuels.
- In the event of wildfire, conditions which favor decreased fire behavior levels allow fire suppression crews greater success in decreasing the risk to life, property, and natural resources, as well as increasing the relative safety of our fire suppression crews.
- In dry forests, stand conditions that resemble natural or historic conditions, which in turn, trends the areas toward their historic fire regimes and toward a lower, more desirable and sustainable Fire Regime Condition Class.
- Reduced chance of uncharacteristic and undesired mortality in designated dry forest old growth stands.
- Reduced risk of soil damage or loss of soil productivity.

The picture at right (taken on Dawson Ridge, northeast of Bonners Ferry) depicts desired future condition in a ponderosa pine (dry site) stand. The stand has been thinned and underburned several times in the last 30 years; allowing the remaining overstory trees to grow larger and become more resilient to disturbances such as insect and disease outbreaks and wildfire. Should a fire start in this stand, it is predicted that the fire would remain on the ground and therefore be easier and safer to suppress than a fire burning in the crowns of the trees in an unmanaged stand.

Figure 1.4 Desired Conditions for Dry Site Stands

[•] **Fire intensity** is the rate at which a fire produces heat. **Fire severity** refers to the degree to which a site has been altered by fire.

1.3 - Proposed Action (Alternative 2)

The proposed action (identified as Alternative 2 in the EIS) was developed during more than 12 months of collaboration between the Forest Service, KVRI and other members of the public. The Myrtle Creek ecosystem, its relative health, resilience to disturbance and sustainability were discussed over a period of six public meetings and two field visits/tours to the project area. Water quality, historic fire patterns, stream morphology, soil and landtype stability, land ownership, road systems, roadless areas, sediment delivery and old growth sustainability were some, but not all of the subjects discussed in depth. The proposed treatment units and their probable impacts to the Myrtle Creek ecosystem regarding water quality, soil stability, future fire intensities, sedimentation from old roads, and impacts to wildlife habitat were also discussed during the public KVRI working group meetings.

See Chapter 2 for more discussion of the public collaboration efforts and development of the Proposed Action and alternatives.

In keeping with the Healthy Forests Restoration Act's direction to help reduce hazardous fuel and restore healthy forest and rangeland conditions, Forest Service Fire/Fuels specialists reviewed effects from the 2003 Myrtle Creek Fire and ran computer simulations to project possible future fires from various starting points in the Myrtle and Snow Creek drainages under summer weather conditions. Portions of the Snow Creek drainage are included because of the influence the topography of the Selkirk Mountains has on fire behavior, and known historic fire patterns in which fires spread from Snow Creek into the Myrtle Creek drainage (see Chapter 3 and 4 Fire/Fuels and Vegetation discussions).

The fuels reduction treatments for each location were chosen for their ability to meet the particular needs of the Myrtle Creek watershed as stated in the project's Purpose and Need, and to begin moving the area toward the desired future conditions described earlier. The focus of each treatment is based on the desired conditions of the overall watershed and each treatment area after management, *not* on the quantity or quality of wood products removed.

The proposed action would treat approximately 2,086 acres of National Forest System Lands (involving 23 treatment locations), to achieve the following:

- Reduce the amount of ladder fuels and other types of hazardous fuels in overcrowded stands to help create sustainable stand compositions and structures that are adapted/resilient to fire, using a variety of silvicultural and slash disposal tools. Fuels would be treated by methods that use a mixture of ground-based, skyline and helicopter logging systems, dependant on terrain, access and soil conditions.
- Reduce the risk of fire by treating slash through the use of prescribed burning, or with piling and burning.

The proposed action would also perform the following road work to help achieve water quality and other natural resource objectives:

- Decommission approximately one mile of the UA spur of Road 1309 (Rd 1309-UA). The road is non-drivable due to brush and tree encroachment. The culverts are starting to fail and there is a risk of sediment delivery to Myrtle Creek (see Watershed Report).
- Recondition approximately 29 miles of existing roads. (See Hydrology/Water discussions for more information.)
- Access for fuels reduction treatments would be provided, in part, by reopening about ½ mile of Road 402-C, a spur road in the Snow Creek drainage. The full length of the road to the junction with the main Road 402 (approximately 1 mile) would be decommissioned (full obliteration) after prescribed burning operations are completed. (The work to re-open Road 402-C is described as "reconstruction" in other discussions throughout the FEIS.)

1.4 - Scope of the Analysis

The Myrtle Creek FEIS discloses the environmental effects of the Proposed Action (Alternative 2), Alternative 1 (No Action) and Alternative 5, within the assessment area and the surrounding landscape. It is the site-specific documentation for Forest Plan implementation. The Proposed Action provides the basis of a management strategy and development of alternative strategies for the project area based upon the specific Forest-wide goals, objectives, and standards of the Forest Plan; interdisciplinary team discussions, public involvement, legal framework and agency policies and regulations.

1.4-A Policy Direction and Legal Framework

Shown below is a partial list of federal laws and executive orders pertaining to project-specific planning and environmental analysis on federal lands. Many of them are followed for all land management activities on National Forest System Lands; others are more specific to the Myrtle Creek HFRA project. The following discussion focuses on those that provide the overall framework for this project. Policies, direction and laws that relate to specific resources, such as the Clean Water Act, are discussed in the various resource sections of this document, i.e. Water/Hydrology, and include pertinent disclosures and findings.

1.4-A.1 Federal Laws

- Healthy Forest Restoration Act of 2003
- Roadless Area Conservation Rule (2001)
- National Environmental Policy Act (NEPA) (1970)
- Clean Water Act (1948) and amendments (1972)
- Clean Air Act (1955)
- National Forests Management Act (1976)
- Endangered Species Act (1973), as amended

1.4-A.2 Executive Orders

- Executive Order 11593 (protection and enhancement of the cultural environment)
- Executive Order 12898 (environmental justice)
- Executive Order 12962 (aquatic systems and recreational fisheries)

a. Healthy Forests Restoration Act

The Healthy Forests Restoration Act (HFRA) was passed in December 2003. It provides improved statutory processes for hazardous-fuel reduction project on certain types of at-risk National Forest System lands and also provides other authorities and direction to help reduce hazardous fuel and restore healthy forest and rangeland conditions. The act also provides expedited environmental analysis of HFRA projects and provides administrative review through an Objection process *before* decisions are issued. (USDA 2004)

b. Council on Environmental Quality NEPA Guidance

As part of the Healthy Forests Initiative for Wildfire Prevention and Stronger Communities of 2002, the President directed the Council on Environmental Quality to develop guidance to ensure consistent procedures under NEPA for fuels reduction and fire-adapted ecosystem restoration projects. This EIS follows the CEQ description of core elements of the process and documentation outline. (CEQ memo, 12/9/02)

c. Roadless Area Conservation Rule

At the time the Forest Service was approached by the City of Bonners Ferry and local governments concerning a potential fuels reduction project in the municipal watershed, the National Forests were following direction under what is known as the "2005 Rule" – *State Petitions for Inventoried Roadless Area Management*. However, on September 20, 2006 the U.S. District Court for the Northern District of California issued an ordering setting aside the 2005 Rule and reinstating the 2001 *Roadless Area Conservation Rule*, including the Tongass National Forest Amendment to that Rule. On September 22, 2006 the Chief of the Forest Service issued a letter directing Regional Foresters and others to not approve management activities in inventoried roadless areas that would be prohibited by the 2001 Roadless Rule. This project follows the Chief's interim direction.

This project meets the requirements of the 2001 Roadless Rule. See Chapter 3 and 4 discussions of Roadless Areas for more information concerning compliance with the Roadless Rule and the IPNF Forest Plan.

1.4-A.3 Forest Service Policies and Regulations

a. National Fire Plan

> "Operating principles directed by the Chief of the Forest Service in implementing this include: firefighting readiness, prevention through education, rehabilitation, hazardous fuel reduction, restoration, collaborative stewardship, monitoring, jobs, and applied research and technology" (from Protecting People and Sustaining Resources in Fire-Adapted Ecosystems: A Cohesive Strategy, October 2000 pgs.11-12).

The restoration portion of this strategy states, "Restore healthy, diverse, and resilient ecological systems to minimize uncharacteristically intense fires on a priority watershed basis. Methods will include removal of excessive vegetation and dead fuels through thinning, prescribed fire, and other treatment methods." For this project the treatment methods will be irregular shelterwoods, commercial thinning, and group selections.

The Myrtle HFRA project is consistent with the National Fire Plan direction to manage and reduce overly dense forest vegetation through development of actions which are designed to restore resilient ecosystems and that will sustain the resources through time.

b. Final Rule – Administration of the Forest Development Transportation System

In January 2001, the Forest Service Manual that governs regulations concerning the management, use, and maintenance of the National Forest Transportation (Road) System, (Chapter 7700) was revised with a "Final Rule." The Final Rule de-emphasized the development of forest road systems and added a requirement for science-based roads analysis. The intent of the revision is "to help ensure that additions to the National Forest network of roads are those deemed essential for resource management and use; that, construction, reconstruction, and maintenance of roads minimize adverse environmental impacts; and finally, that unneeded roads are decommissioned and restoration of ecological processes are initiated," (36 CFR Part 212).

An interim directive issued in December 2001 established that all road management decisions signed after January 12, 2002 must be informed with a "roads analysis" (Interim Directive 7710-2001-3, project file). The Final Rule set forth that if a Forest level roads analysis has not been completed, the Responsible Official determines whether a roads analysis is needed at the project scale, and if so, what level of analysis is necessary to support a project-level decision.

The Roads Analysis conducted for the project area is included in the project file (project file document).

c. Forest Plan Direction

The IPNF Land and Resource Management Plan (Forest Plan) provides direction for all resource management programs and resource activities on the IPNF. The Forest Plan consists of Forest-wide goals and standards as well as Management Area specific standards and guidelines that provide for land uses and resource outputs. The Forest Plan embodies the provisions of the National Forest Management Act (NFMA) of 1976 and its implementation regulations, as well as those of other guiding documents (see "Legal Framework" section).

Specific Forest Plan goals (USDA 1987, p. II-1 & II-2) that guided the development of the Purpose and Need are:

- Provide for a diversity of plant and animal communities.
- Maintain high quality water to protect fisheries habitat, water based recreation, public water supplies, and be within state water quality standards.
- Manage resource development to protect the integrity of the stream channel system.
- Provide efficient fire protection and fire use to help accomplish land management objectives.
- Manage the forest resources to protect against insect and disease damage.

Many Forest Plan Standards are applicable to the general design of the proposed action. Specific Forest Plan Standards (USDA 1987, pp. II-32-34, II-38-39) that guided the development of the Purpose and Need are:

- Reforestation will normally feature seral tree species, with a mixture of species usually present.
- Silvicultural practices will promote stand structure and species mix that reduce susceptibility to insect and disease damage.
- Project design will provide for site preparation and slash hazard reduction practices that meet reforestation needs of the area.
- Maintain concentrations of total sediment or chemical constituents within state standards.
- Encourage utilization of forest products to reduce biomass, which must be disposed of otherwise.
- Suppress fires that threaten designated old growth stands.
- Activity fuels will be treated to reduce their potential rate of spread and fire intensity so the planned initial attack organization can meet initial attack objectives.
- Vegetation management [through fire] will favor the use of fire, hand treatment, natural control, or mechanical methods whenever feasible and cost effective. Direct control methods, such as chemical or mechanical, may be used when other methods are inadequate to achieve control.

Management Areas, and Riparian Habitat Conservation Areas

The Forest Plan designated Management Areas (MAs) to guide the management of National Forest System lands within the IPNF. They are described in detail in the Forest Plan on pages III-1 through III-87. Each MA provides a combination of activities, practices, and uses appropriate to the management goals and objectives of that specific management area. The Myrtle HFRA project area is comprised of lands in Management Areas and Riparian Habitat Conservation Areas.

Riparian Habitat Conservation Areas (RHCAs) were developed for the Inland Native Fish Strategy, which amended the Forest Plan in 1995. These RHCAs are defined as, "portions of watersheds where riparian-dependent resources receive primary emphasis, and management activities are subject to specific standards and guidelines. ... [they] include traditional riparian

corridors, wetlands, intermittent streams, and other areas that help maintain the integrity of aquatic ecosystems," (INFS, 1995; page A-4).

Management Area goals specific to the project area can be summarized as shown in the following table:

Table 1.1 Management Areas, Distribution in the Project Area, Summarized Forest Plan Goals

Management Area	Percent of Project Area	Management Area Goals (IPNF Forest Plan)
MA 1	6 %	Timber production
MA 2	30 %	Timber production and grizzly bear recovery
MA 3	2 %	Timber production, grizzly bear recovery, and big game winter range
MA 4	2 %	Timber production and big game winter range – permanent forage areas for big game populations
MA 7	30 %	Designated caribou habitat, timber management activities should enhance caribou habitat
MA 9	15 %	Generally, areas not capable of producing forest products, should be managed primarily for Visual Quality objectives
MA 10	5 %	Areas managed primarily for semi-primitive recreation experiences and to meet visual quality objectives
MA 11	10 %	Designated lands in the Selkirk Crest managed primarily for primitive recreation experiences and to meet visual quality objectives

See the Forest Plan for more information about Management Areas and their associated goals. A map of Management Areas is included in the Map Appendix to this EIS (Management Area Map 1).

d. Forest Service Handbook Objectives and Direction

Forest Service Handbook (FSH) 2409.17 Interim Directive No.1 states, "Harvest cutting is done to carry out the intent of the Forest Plan. The objective of harvest cutting is two fold:

- Develop and maintain desired forest conditions over time, and
- Utilize the timber resource."

These Handbook objectives are not mutually exclusive. Both must be considered when applying a harvest cutting method. Specific silvicultural operations can be used to create the desired stand structures and manipulate biomass accumulations within each stand. These operations include:

- Control of tree density and species composition;
- Salvage of dead and dying trees to reduce the amount of carbon on the site - and reduce the potential for unplanned fires and reburn of areas in subsequent years;
- Site preparation to reduce undesired fuel, soil, or vegetation conditions; and competition control to encourage targeted species and avoid excesses or non-targeted species
- Productivity enhancement through fertilization, which may also increase tree resistance to insects and diseases;
- Genetic management for trees, shrubs, and herbs to develop races which are resistant to introduced pests (Oliver et al. 1994).

1.5 - Decision to be Made

This environmental analysis is not a decision document. The EIS discloses the environmental consequences of proceeding with the proposed action or any of the alternatives. The Responsible Official (Forest Supervisor) will select an alternative based on the information in this document, on public comments, on financial considerations, and on how well the preferred alternative meets the purpose and need of the project and complies with applicable state and federal laws, agency policy and Forest Plan direction.

The decision to be made involves the selection of an alternative. When an action alternative is chosen, the decision will include:

- When proposed activities could begin and whether there are any timing restrictions.
- What type of fuels treatment would occur and where.
- Which elements of the Transportation Plan, including road improvements, would be implemented, and any timing requirements.

- Associated activities that would take place, such as monitoring and mitigation measures.
- Priorities for other opportunities that have been identified, including watershed restoration activities such as road decommissioning.

1.6 - Healthy Forest Restoration Act Pre-Decisional Objection Process

This project is an authorized fuel reduction project as defined by the Healthy Forest Restoration Act of 2003, section 102(a). As such it is subject to the Predecisional Administrative Review Process (referred to as the 'objection process') pursuant to 36 CFR 218, subpart A. Thus, this project is not subject to notice, comment, and appeal provisions under 36 CFR 215 (see 36 CFR 218.3).

Objections will be accepted only from those individuals and organizations who previously submitted substantive written comments specific to the proposed project during the 45-day public comment period on the Draft Environmental Impact Statement (Section 105 (a)(3) and 36 CFR 218.6).

A legal notice published in the Coeur d'Alene Press, our designated newspaper of record, announcing availability of the FEIS also describes the objection process. The publication of the legal notice is the *exclusive* means for calculating the time to file an objection (36 CFR 218l9(a)). Those wishing to object should not rely upon dates or timeframes provided by any other source. At a minimum, an objection must include the following items (36 CFR 218.7(d)):

- The objector's name and address, with a telephone number if available;
- A signature or other verification of authorship upon request (a scanned signature for Email may be filed with the objection);
- When multiple names are listed on the objection, identifications of the lead objector (verification of the identity of the lead objector will be provided upon request);
- The name of the proposed authorized hazardous fuel reduction project, the name and title of the Responsible Official, and the name(s) of the National Forest(s) and/or Ranger District(s) on which the proposed authorized hazardous fuel reduction project will be implemented; and
- Provide sufficient narrative description of those aspects of the project that are objected to, to identify specific issues related to the proposed project and to suggest remedies that resolve the objection (36 CFR 218l7(b)).

Pursuant to 36 CFR 218.7(c), incorporation of documents by reference will not be allowed in an objection.

An objection, including any attachments, must be filed in writing (regular mail, fax, Email, hand-delivery, express delivery, or messenger service) with the Reviewing Officer within 30 days of the date of the legal notice (35 CFR 218.9(a)). The Reviewing Officer for this project is the Northern Regional Forester. Objections may be submitted by mail at: USDA Forest Service, Northern Region, P.O. Box 7669, Missoula, MT 59807; by fax to (406) 329-3411; or by Email to appeals-northern-regional-office@fs.fed.us. Acceptable formats for submitting an electronic objection are MS Word, Word Perfect or RTF. Please include the name of the project in the Email subject line. Hand-delivered objections will be accepted at the Northern Region office at 200 E. Broadway, Missoula, Montana between the hours of 8:00 a.m. and 4:30 p.m. Monday through Friday, exclusive of Federal holidays. All objections will be open to public inspection during the objection process (36 CFR 218.7(a)).

The Deciding Official for this proposal is Idaho Panhandle Forest Supervisor Ranotta K. McNair at 3815 Schreiber Way, Coeur d'Alene, Idaho 83815; telephone (208) 765-7223. She will make a decision on the project following the objection period. A copy of the decision (Myrtle Creek HFRA Record of Decision) will be mailed to those who request a copy or have otherwise expressed an interest in the project.

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Chapter 2 - Proposed Action and Alternatives

This chapter outlines public involvement and collaboration involved in identifying issues and developing this proposal and includes detailed description of the proposed action and other alternatives. Design criteria and monitoring features are explained. It concludes with a summary comparing the probable environmental impacts of the proposed action and alternatives.

2.1 - Public Involvement

In March 2004, the City of Bonners Ferry, Boundary County Commissioners, and Kootenai Tribe of Idaho approached the Bonners Ferry Ranger District about the possibility of a Healthy Forest Restoration Act (HFRA) project in the Myrtle Creek watershed. Their concern about the future of the watershed was generated by the 2003 Myrtle Creek Fire and these local entities wanted to see pro-active land management in the area to reduce the risks and potential effects of future wildfires. The first public meeting to discuss such a project, sponsored by the Kootenai Valley Resource Initiative, was held in July, 2004. KVRI provided a forum for the Myrtle Creek Working Group sub-committee which met three additional times in 2004 (August, September and November). After these meetings and discussions of the community goals for the watershed, the Forest Service developed an initial proposal for management activities and presented it to the Working Group in January 2005. One more public meeting of the Myrtle Creek Working Group, and two trips to the project area, were held during 2005. (project file records). Following release of the Draft EIS, another meeting was held to let the public and members of the Myrtle Creek Working Group know what types of comments had been received on the Draft EIS.

Newspaper articles about the proposed project included those published in the local Bonners Ferry Herald on 8/5/04, 8/12/04, 12/2/04; Kootenai Valley Press on 9/1/04; and Spokesman-Review on 8/24/04. The project file also contains documents related to the 2003 Myrtle Creek Fire and its affects on the community as well as on natural resources of the areas. The documents include news clippings of articles published in the Spokesman-Review, Idaho Statesman, Forest Conservation Portal, "Wildfire" by the Wild Rockies organization, news releases from the Office of Idaho Governor Dirk Kempthorne; minutes of a meeting of the Idaho Water Resource Board, the "Morning Report" from the National Park Service, and the Northern Rockies Interagency Information Center's Congressional Staff Update.

a. Scoping

Notice of the proposal was published in the IPNFs' Quarterly Schedule of Proposed Actions (SOPA) in February 2005, and in each subsequent SOPA. The SOPA was sent to the Forest-wide SOPA mailing list. A letter with additional information concerning the project was sent to 54 contacts on the Bonners Ferry Ranger District mailing list including adjacent landowners, individuals, organizations, and government entities also on the district's contact lists. The public was asked to provide comments during this initial scoping period. Letters were received from local interested members of the public, state agencies, and regional environmental organizations. See the project file for complete documentation.

Concerns and questions included the following specific subjects:

- potential effects on steep slopes,
- soil stability,
- thermal cover for deer and elk winter range,
- potential increase in sediment delivery and its effect on public drinking water,
- considerations used in the selection of harvest methods in the fuel treatment areas (helicopter, skyline or tractor systems),
- risk of future wildfires,
- potential impacts to water quality (including chemical influences),
- effects on old growth,
- effects on fisheries,
- road densities,
- consistency with the Boundary County Idaho Wildland/Urban Interface Fire Mitigation Plan.

More broad-based comments included items such as the following:

- range of alternatives,
- purpose and need of the project,
- inclusion of the adjacent Snow Creek area,
- cumulative effects analysis
- wildlife, including Management Indicator Species and Threatened, Endangered or Sensitive Species
- Threatened, Endangered and Sensitive plants,
- watershed and hydrology,
- soil and soil productivity,
- conditions of forest vegetation and potential risks, including insects and diseases
- roads and their effects,
- snags,
- motorized access potential effects on wildlife,
- overall support for the project.

b. Notice of Intent

Based on scoping and discussions with the Working Group, the Forest Service believes an EIS is the appropriate level of documentation for Myrtle Creek. The Notice of Intent to prepare an Environmental Impact Statement was published in the Federal Register on May 31, 2005 (see project file). The Environmental Protection Agency and an interested citizen on the East Coast responded.

The citizen's concerns were as follows:

- the purpose and need for the project, stating, "this is a national area – not a local area. The national interest is involved here,"
- opposing commercial thinning and use of helicopters,
- opposed to prescribed burning,
- opposed to use of heavy equipment, and
- stating that water quality would be far higher if the forest was left alone.

c. Release of the Draft EIS

The Myrtle Creek Draft EIS (DEIS) was released in May, 2006; copies were sent to 30 parties on the project mailing list and 28 letters were sent to notify others of its availability, it was also sent to the required internal offices and external government agencies (project file). Legal notice of the DEIS release was published in the Spokesman-Review. The Notice of Availability (NOA) appeared in the Federal Register on May 19, 2006, starting the comment period for the DEIS.

Comments were received from the following agencies, organizations and individuals (see the project file for detailed information).

The Environmental Protection Agency review of the DEIS, as stated in their letter, was specific to their responsibilities under the National Environmental Policy Act (NEPA) and Section 309 of the Clear Air Act. The EPA provided a list of Best Management Practices (BMPs) to assist in the protection of drinking water sources. The BMPS related to the following aspects of this project:

- Inland Native Fisheries Strategies (INFS),
- Watershed Management Planning,
- Timber Management,
- Fire Management,
- road maintenance and construction.

Table 2.1 Comments Received on the Draft EIS

(This table is continued on the next page.)

Comments Provided by:	Topics covered in Comments:
Idaho Department of Parks & Recreation	– Current groomed snowmobile routes and recommendations for timing of operations that could affect this recreation use. – Concurrence with proposal to sign roads alerting drivers (snowmobilers) of potential vehicle traffic during operations.
US Dept of Interior – Office of Environmental Policy and Compliance	– No comments on the DEIS
US Environmental Protection Agency	– Assigned a rating of "Lack of Objections" indicating that the "review has not identified any potential environmental impacts requiring substantive changes to the proposal."
Local interested members of the public	– Appreciation and support for the project. – Not enough acres are being treated.
The Kootenai Valley Resource Initiative Board Members	– Support for the Proposed Action

Table 2.1 Continued Comments Received on the Draft EIS

Regional Environmental Organizations	– Membership in KVRI and the Myrtle Creek Working Group subcommittee, and other public collaboration group efforts. – Activities in Inventoried Roadless Areas. – Activities in old growth areas. – Roads analysis, density, and management. – Concern that the project would lead to detrimental impacts to water and soil quality; threatened, endangered and sensitive species and management indicator species. – Concern that the project will not successfully reduce threats to the wildland urban interface resources and the drinking water supply for the City of Bonners Ferry. – Request for additional information / clarification in portions of the DEIS – Existing fuels and fire regime conditions. – Water quality, including TMDLs. – Fisheries. – Soils and soil productivity. – Cumulative effects, including past activities and management. – Use of BMPs and other mitigation measures. – Wildlife – Snags – Potential effects from forest insects and diseases. – Fuels treatment operations (use of helicopters) and silvicultural treatments.. – Compliance with Forest Plan Management Area direction. – Concerns with the computer models used in the analysis – in particular for the Water Quality/Hydrology portion.

d. Changes from the Draft EIS to the Final EIS

After further field reviews, IDT meetings and comments from the public, some of the fuels reduction treatment areas (or units) have changed in size, silvicultural prescription or logging system to better meet the purpose and need of the project.

For example:

- Alternative 5 was added and considered in detail in response to feedback on the Draft EIS.
- Unit B3 will be underburned.
- Unit D4 has been dropped for hydrologic reasons.
- Unit F1 has moved slightly to the north to better treat the fuels above the water intake.
- Unit D1 has been changed from a seed tree to an irregular shelterwood silvicultural prescription.
- Units G6 and G7 have more fuels reduced in the ephemeral draws, include more helicopter yarding and less skyline and tractor yarding.
- Road #2405 has been added to the haul route for the Proposed Action (Alternative 2).

Other changes that have been made in response to public comments are:

- Moving the Soil discussion from the Appendix to Chapters, 2, 3 and 4; including additional related maps in the Map Appendix.
- Moving the Roadless Area discussion from the Appendix to Chapters, 2, 3 and 4; including additional related maps in the Map Appendix.
- Adding a Map Appendix with additional maps to aid in understanding discussions and provide more information.

2.2 - Kootenai Valley Resource Initiative and Myrtle Creek Working Group

As explained in Chapter 1, under the auspices of the Kootenai Valley Resource Initiative[•] (KVRI), the Myrtle Creek Working Group provided a forum to foster discussions between local government agencies, including the Kootenai Tribe of Idaho, interested members of the public, and Forest Service personnel. The purpose of the KVRI group has been to look at

[•] KVRI was formed in 2001 under a Joint Powers Agreement by the Kootenai Tribe of Idaho, Commissioners of Boundary County, Idaho and the City of Bonners Ferry, Idaho. Sub-committee "Working Groups" established as needed provide a forum for public collaboration on resource issues important to KVRI and the community. The groups forward recommendations to the 11-member KVRI Board who then take the appropriate action with the affected or interested agencies or members of the public.

community goals for Myrtle Creek, develop an overarching goal for the watershed, and help to identify issues. The KVRI group publishes advance notice of Working Group meetings, open to all members of the public, in the local newspaper (Bonners Ferry Herald).

As mentioned earlier, the **first meeting** of the Working Group was held July 29, 2004. **Nine additional meetings, including two field trips t**o the project area were held over the next two years. Meetings were well attended (see meeting notes and attendance lists in the project file).

The Myrtle Creek project file also contains notes taken during the collaborative meetings held by the Myrtle Creek Working Group, public letters, records of phone calls and visits to the area, mailing lists, news articles, Schedule of Proposed Actions, and other documentation of the outreach and discussions held with members of the public.

2.3 - KVRI Goals for Myrtle Creek Watershed

The KVRI collaborative Working Group discussed needs in the watershed, and asked the Forest Service to evaluate the current and future conditions of the watershed using the following goals:

- Maintain a continuous supply of potable water from Myrtle Creek for the City of Bonners Ferry and its customers;
- Reduce the risk of catastrophic fire in the Myrtle Creek watershed, while maintaining and restoring habitat for fish and wildlife species.

2.3-A Collaborative Development of the Proposed Action

The KVRI goals, along with additional discussions with the Working Group, aided the Forest Service interdisciplinary team in developing the Proposed Action and alternatives described and analyzed in this EIS. As described in Chapter 1, the Working Group spent many hours discussing the goals of the project, potential management actions, and their predicted effects on the natural resources in the area. Meeting notes are included in the project file. This discussion will describe the major consensus items that were reached during development of the Proposed Action. Please keep in mind that the role of KVRI and the Myrtle Creek Working Group was to outline the goals for the watershed, and it was the task of the Forest Service Interdisciplinary Team to analyze the project and determine the management activities that would achieve those goals.

Old Growth

Moist Forest Old Growth – Early in the Working Group's discussions and debates, the City of Bonners Ferry requested that the upper portion of the Myrtle Creek watershed be included in the project in order to further reduce risks to the municipal watershed. The vegetation and fire regime in the upper watershed is different than in the lower watershed. Moist forest old growth stands, such as those in upper Myrtle Creek watershed, burn infrequently and typically have abundant moisture to sustain stand characteristics. Thus these stands have a lower priority for treatment than stands in the lower watershed. Following further discussion, the City supported focusing on the higher priority stands with this project at this time, and asked that treatment of the upper portion of the watershed (including moist forest old growth) remain open for consideration during any future proposals. The Working Group recommended that over 6000 acres of moist site allocated old growth in the upper Myrtle Creek watershed be dropped from further consideration for fuels treatment in this project.

Dry Forest Old Growth – In contrast, dry forest old growth stands (such as those in the lower Myrtle Creek watershed) have different fire regimes than the moist forest and have more frequent fire return intervals. (The Chapter 3 Fuels discussion contains additional information about the Fire Regime Condition Class in the project area.) As determined by Pfister and others, "Overstocked stands with sapling/pole understories are at a high risk to stand-replacing fire, and may not have the capacity to regenerate themselves following such fires. The appropriate treatment is to significantly reduce the density of understory and overstory trees established since Euro-American settlement, and remove them from the site. Following cutting, restoration of fire, through prescribed burning, is necessary if such stands are to perpetuate themselves in place, consistent with historic disturbance processes, intervals, and intensities." (Pfister, et. al. 2000, page 15, Harvesting to Perpetuate Old Growth).

Road Construction in Inventoried Roadless Areas

This discussion included the pros and cons of constructing new roads, weighed against the need to treat fuels in these areas, and the policy and legal framework guiding activities in roadless areas. It was agreed that construction of roads in either the Kootenai Peak or Selkirk Roadless Area would not be given further consideration for this project.

Wildlife

The proposed silvicultural and fuel reduction treatments could have both positive and negative effects on wildlife habitat, including potential effects on grizzly bear core habitat. The Interdisciplinary Team addressed grizzly bear core habitat,

along with the concerns about old growth and road construction in roadless areas, in the design of Alternative 5 and in the analysis of Alternatives 1 and 2.

2.4 - Community Wildfire Protection Plan

The Boundary County Community Wildfire Protection Plan identified Myrtle Creek as part of the at-risk community infrastructure for Bonners Ferry, Idaho. Thus, this project meets the criteria for *Authorized Hazardous Fuels Reduction Projects* under Section 102 of the *Healthy Forests Restoration Act.* (See Chapter 1- Regulatory Framework.)

2.5 - Key Issues, Analysis Issues, and Indicators

A list of preliminary issues was developed by the interdisciplinary team using their knowledge of the area's conditions and concerns, and based on the Working Group discussions and other public comments. After review, these issues were sorted into Key Issues, Analysis Issues, and Other Resource Concerns. The issues and issue indicators (used to measure predicted changes) are described in the following sections.

Key issues are those within the scope of the project and of sufficient concern to drive the development of the Proposed Action and its alternatives. These issues are used to develop the focus of and specific activities of the alternatives, sharply define effects of the proposed action and help define the scope of the analyses and documentation. These issues are specific to this geographic area and proposal. Throughout the document, key issues are easily recognized by the "key" symbol next to the discussions.

Analysis issues are not key to developing alternatives, but are important for their value in designing specific protective measures, and to measure the effects of each alternative on different forest resources. Analysis issues are easily recognized by the "check mark" symbol that appears next to the discussions.

The following information is provided for both Key Issues and Analysis Issues:

- A brief description of the issue
- The issue indicators that are used to determine differences between alternatives and effectiveness of the alternatives in addressing the issue
- The measurements used for the individual indicators

Other resource concerns (see Appendix A) did not warrant the development of a separate alternative. Predicted negative impacts of the action alternatives would be reduced or avoided by changing the design, or location, or timing of the fuel treatment activities, or a combination of these options.

The following Key Issues and Indicators were used to track the issues through the discussions of the existing conditions in Chapter 3 and the effects analysis in Chapter 4, as well as in comparing the Proposed Action (Alternative 2) and alternatives at the end of this chapter.

2.5-A Aquatics

Watershed Condition, Water Yield, Sediment Yield, Channel Morphology, and Water Quality

As explained in Chapter 1 and earlier in this chapter, the existing conditions in the project area include potential risks to the municipal water supply for the City of Bonners Ferry and these conditions are a major concern. Proposed management activities can also affect the hydrology and water quality in the area. The fuels reduction and silvicultural treatments, road decommissioning, and temporary re-opening of a 0.6 mile segment of Road 402-C were designed to address this issue. Please refer to the alternative descriptions in this chapter for additional details.

This issue was broken down into five primary indicators – watershed conditions, water yield, sediment yield, channel morphology, and water quality. The following table describes the indicators and the measurements used for the analysis and documentation of effects.

See the table of Aquatics issues and issue indicators on the next page.

Various computer models were used to estimate effects and to compare the relative differences between alternatives. The analysis methods and the models are discussed in Chapter 3 and more detailed information is included in Appendix D.

Table 2.2 Aquatics Issues and Issue Indicators

Issue	Indicators	Measurements
Watershed Condition (Sensitivity)	Indicators for direct and indirect effects are a series of metrics that can be used to index the level of disturbance in a watershed. They are usually expressed as densities or discrete amounts of various disturbances within a watershed. For example, road density expressed in miles of road per square mile (mi/mi^2) of watershed area is a common watershed condition indicator. Road density is used as a indicator because it not only serves as a gauge of watershed sensitivity, it can also be a sign of the degree of past management within a watershed. Extensions of road density include the density within riparian habitat conservation areas (RHCAs) or landslide prone terrain (LSP). Other indicators include various forms of timber harvest density, such as percent of the watershed harvested, percent of RHCAs harvested and percent of LSP terrain harvested (expressed as ECA – Equivalent Clearcut Area). Changes in watershed condition are compared to the existing watershed conditions discussed in the affected environment section.	Road density measured as road mi/watershed mi^2 . Timber harvest density measured as percent ECA
Water Yield	Indicators for direct and indirect effects are measured in peak flows or water yield. It is usually expressed as the percent change from the estimated "natural" peak month discharge. - Models were used for this analysis to estimate the effects of the proposed fuels reduction treatments, reconstruction and decommissioning of temporary and classified roads, and site preparation treatments. Changes in peak flows are compared to the existing peak flows.	Peak Flows, expressed as % change. Water yield, expressed as % change.
Sediment Yield	Indicators for direct and indirect effects are expressed in terms of tons of sediment. Models were used for this analysis to estimate the effects of the proposed fuels reduction treatments, reconstruction and decommissioning of temporary and classified roads, and site preparation treatments. Changes in sediment production are compared to the existing sediment production.	Sediment measured in tons, expressed as % change.
Channel Morphology	Indicators for direct and indirect effects are expressed in terms of stream classification parameter changes that lead to morphological changes. Water yield and sediment yield can interact to change channel morphology conditions through erosion of stream channels or deposition of sediment. Channel morphology can also be affected directly through activities such as road encroachment, stream crossings, and in-channel improvements. Changes in channel morphology are compared to the existing channel morphology parameters, and comparable reference reaches.	Changes in Channel Morphology, expressed as probability of a change in channel reach parameters.
Water Quality	Indicators for direct and indirect effects are expressed in terms of physical and chemical characteristics of water. Parameters commonly measured include pH, alkalinity, hardness, specific conductance, nutrients, metals, sediment and water temperature. Many of these parameters are affected only to a slight degree, or not at all, by forest practices. Changes in water quality are compared to the existing water quality parameters.	Conducted by the City of Bonners Ferry.

2.5-B Fuels

Condition Class, Crown Fire Hazard, Fuel Model, Risk to Life and Resources

As explained in Chapter 1 the existing conditions and desired future conditions of the fuels indicate there are needs for fuels reduction in order to reduce risks to the water and other natural resources. The fuels reduction and silvicultural treatments were designed to address this issue; however some people felt that the proposed action does not treat enough acres (referring to Alternative 3 with 2800 acres of treatments). Please refer to the alternative descriptions in this chapter for additional details.

This issue was broken into four primary indicators – Improvement in Condition Class (acres moved towards natural range of conditions), Crown Fire Hazard, Fuel Model, and Risk to Life and Resources (Suppression Capabilities). The following table lists the indicators and the measurements used for the analysis and documentation of effects.

Table 2.3 Fuels Issues and Indicators

Issues and Indicators	Measurements
Improvement in Condition Class•	Acres
Crown Fire Hazard	
- Potential Flame Length	Feet
- Canopy Base Height	Approximate Feet
- Canopy Bulk Density	Approximate kg/cubic meter
- Predicted Fire Type	Crown Fire / Surface Fire
- Potential Rate of Spread	Chains/hour (1 chain = 66 feet)
Fuels	
- Fuel Model	Acres of Fuel Model 10 and 8
Risk to Life and Resources - Suppression Capabilities	
- Direct Attack by Hand Crews	Yes / No
- Production Rates	High / Low
- Fire Severity	High - Low / Moderate

2.5-C Old Growth Stands

As described earlier in this chapter, the dry forest old growth in the project area is in need of fuels reduction treatment, and is currently at risk of stand-replacing fires. With the current fuel loadings, a fire would most likely result in a loss of the old growth component in areas affected by the fire. The fuel reduction and silvicultural treatments to be used in these areas were designed to address this issue. Please refer to the alternative descriptions in this chapter for additional details.

This issue was broken into two primary indicators – trend toward restoration, and risk of stand-replacing fire. The following table lists the indicators and the measurements used for the analysis and documentation of effects.

Table 2.4 Old Growth Issues and Indicators

Issue and Indicators (Dry Forest Old Growth)	Measurements
- Trend toward restoration of long-lived seral species such as ponderosa pine and western larch. Restoration and maintenance of these dry forest types is a primary concern for their short- and long-term resilience to drought, insects and disease.	Acres
- Risk of stand replacement fire in old growth stands.	Risk of stand-replacing fire. (measured as percent)

• Fuels: Improvement in Condition Class – Acres moved toward natural range of conditions.

2.5-D Roadless Areas

The project area contains portions of the Kootenai Peak and Selkirk Inventoried Roadless Areas (see maps in the Map Appendix). As explained earlier in this chapter, management in either of these roadless areas was recognized as an internal and external issue and was used in developing the proposed action and alternatives. Would activities affect the roadless area characteristics? The management in these areas was designed to address this issue. Please refer to the alternative descriptions in this chapter for additional details.

This issue was divided into primary indicators – Road Construction, Natural Integrity, Natural Appearance, Opportunities for Recreation and Solitude, Affected Areas, and Manageability of Boundaries. The following table lists the indicators and the measurements used for the analysis and documentation of effects. Forest Service Handbook 1909.12 includes the following wilderness attributes which would correspond to the inventoried roadless area indicators: Natural, Undeveloped, Outstanding Opportunities for Solitude or Primitive and Unconfined Recreation, Special Features and Values, and Manageability. See Chapters 3 and 4 discussion of Inventoried Roadless Areas.

Table 2.5 Roadless Area Issues and Indicators

Issue and Indicators	Measurements
Road Construction	Miles
Natural Integrity	Amount of Change from Existing Condition
Natural Appearance	Amount of Change from Existing Condition
Opportunity for Recreation or Solitude	Amount of Change from Existing Condition
Acres Affected	Number of Acres and Location
Manageability of Boundaries	Amount of Change from Existing Condition

2.5-E Soil

The National Forest Management Act (NFMA) directs the Forest Service to maintain the soil resource and soil productivity. Soil was also recognized as an external issue and aided in the development of the proposed action and alternatives. Because it did not result in the development of an alternative to specifically address this issue, it is considered an Analysis Issue, and can be tracked throughout the document.

Management activities could affect the soil and in turn affect soil productivity, hydrology, water quality, and other ecosystem components in the area. The design criteria and features discussed later in this chapter were designed to address this issue. Please refer to the alternative descriptions in this chapter for additional details.

This issue was broken into three primary indicators –soil disturbance, soil productivity, and potential effects from wildfire. The following table lists the indicators and the measurements used for the analysis and documentation of effects.

Table 2.6 Soil Issues and Indicators

Issue and Indicators	Measurements
Soil Disturbance (four features)	
Meeting Regional Soil Quality Standards	Number of treatment Units
Exceeding or At Soil Quality Standards	Number of treatment Units
Amount of Predicted Detrimental Disturbance	Acres affected
Nutrients	Potential effects & mitigation
Soil Productivity (four features)	
Coarse Woody Debris	Retained at appropriate levels
Localized areas of soil sterilization, reduced water infiltration, and lost ground cover below burn piles.	Duration of effects
Short-term reduction in ground cover (due to prescribed burns, skid trails, skyline corridors)	Duration of effects
Potential increase in risk of mass failure due to removal of live trees, especially near roads.	Change in risk

Table 2.6 (continued) Soil Issues and Indicators

Risk from Wildfire and Degree of Fire Severity	
Degree of fire severity	Change in potential severity
Soil Erosion and Mass Movement Potential	Degree of change and level of effects
Soil Health and Productivity	Degree of change and level of effects
Chances for High Severity Fire Effects	Change compared to No Action (Alt 1)

2.6 - Issues Not Discussed in Detail

Collectively, the ID team and the District Ranger concluded that some issues (such as air quality and heritage resources) are already addressed through alternative design, while others are outside the scope of this project. These issues are not addressed in detail in the main body of the FEIS; they can be found in Appendix A or B. It was determined through assessment of potential effects, and agency and public comments that several issues could be addressed through criteria common to all action alternatives, site-specific implementation measures, silvicultural treatments, timing of the proposed action, or opportunities for associated projects (such as those funded under Knutson-Vandenberg [•] (KV)). None of the KV projects or other opportunities are required for project implementation; however, they would enhance the biodiversity in the project area.

Below is a list of resource issues (analyzed to varying degrees) with a reference to their location in Appendix A or B.

Biological Factors – Appendix A

Rare Plants	Minerals
Noxious Weeds	Range

Biological Factors – Appendix B

Wildlife	Fisheries

Social/Economic Factors – Appendix A

Cultural Resources	Effects on Minority Populations and Low-income Populations
Recreation	Economics - Community Stability
Visual Quality	Public Health and Safety – also see Design Features discussed later in this chapter.

2.7 - Proposed Action and Alternatives

Section 104 of the Healthy Forests Restoration Act (HFRA) establishes special procedures when agencies prepare an Environmental Assessment (EA) or an Environmental Impact Statement (EIS) for an authorized hazardous fuel reduction project. In general, except for projects proposed in the wildland-urban interface (as defined in Section 104), the requirements state the agency shall study, develop, and describe (a) the proposed agency action, (b) the alternative of no action, and (c) under certain situations, an additional action alternative.

2.7-A Alternatives Considered but Eliminated from Further Study

The following alternatives were considered, but eliminated from further study.

2.7-A.1 Alternative 3

Alternative 3 would treat approximately 2800 acres, reducing fuels on about 600 additional acres in the Myrtle Creek drainage when compared to Alternative 2, (the proposed action). The collaboration group recommended that the Forest Service drop this option on March 30, 2005.

[•] Knutson-Vandenberg – The Knutson-Vandenberg Act (K-V) of June 9, 1930 (16 U.S.C. 576-576b; 46 Stat. 527), as amended by the National Forest Management Act of October 22, 1976 (16 U.S.C. 1600 et seq.) (FSM 1011), is the authority for requiring purchasers of National Forest timber to make deposits to finance sale area improvement activities needed to protect and improve the future productivity of the renewable resources of forest lands on timber sale areas. Activities include sale area improvement operations, maintenance and construction for reforestation, timber stand improvement, range, wildlife and fish habitat, soil and watershed, and recreation. (FSH 2409.19-01 – Authority). Proposed projects that are unlikely to be funded with K-V funds, should be evaluated for programming with appropriated funds (FSH 2409.19-03 Policy).

This alternative included the following features and concerns:

- About two miles of temporary roads would have to be built to access these 600 additional acres.
  - Cost of the construction and future maintenance during their lifespan. (The temporary roads would cross multiple ephemeral draws with steep side slopes and would need numerous drainage structures to address concerns that sediment could enter tributaries to Myrtle Creek.)
  - Landtypes with potential for mass failures would require consideration during layout and construction.
  - Potential effects to sediment yield and delivery.
  - Risks from temporary roads compared to risk of wildfire and need for fire suppression access
  - Current and future levels of road density in the project area
  - Longer-term benefits of this proposal weighed against the risk from the road construction

- Portions of temporary roads would be in inventoried roadless areas and grizzly bear core habitat which have stringent management standards, as follow:
  - Timing of the project and potential for delays by pursuing road construction in inventoried roadless areas.
  - The temporary roads can remain in the grizzly bear core habitat for no more than three years*. This would be a very narrow timeline from an operations perspective for conducting the silvicultural / fuel reduction treatments and associated follow-up activities.

    * Under the Terms and Conditions of the 2004 Biological Opinion for grizzly bears, the roads would be required to be decommissioned / obliterated at the end of three years.

For these reasons, as recommended by the Working Group, this alternative was eliminated from further consideration and study. (Alternative 3 was originally described as Proposal #2 during Working Group meetings.)

2.7-A.2 Alternative 4

Old Growth Collaboration – As described earlier in the discussion of collaboration for the Proposed Action, old growth issues were discussed during several Working Group meetings, and a field trip was taken on May 23, 2005 to walk through and talk in greater detail about these particular stands in Snow Creek (83 acres and 159 acres). During a subsequent collaboration meeting, members of the Selkirk Conservation Alliance and The Lands Council opposed commercial logging as tool of choice in these stands and suggested using fire alone to restore the old growth stand composition and structure. The Selkirk Conservation Alliance submitted examples from Sequoia National Park in California to the Forest Service.

A recommendation was made by the collaboration group (KVRI Working Group) to evaluate the potential fuels reduction methods, other than using timber harvest equipment, that could meet the old growth stand attributes described in the Chapter 3 discussion of the desired future conditions, and the hazardous fuel reduction objectives for this project. This evaluation is described below as Alternative 4.

Alternative 4 differs from Alternative 2 in the method of fuels reductions to be used in the old growth stands. On the hot, dry southern aspect of the Snow Creek drainage, both alternatives would treat the same 83 acres of allocated dry forest old growth and 159 acres of potential dry forest old growth (about three percent of the total old growth in the project area). Instead of removing the ladder fuels in the old growth by using equipment and following up with an underburn, Alternative 4 included the use of "fire only" to reduce the fuels in the old growth stands. Proposed fuel reduction using silvicultural prescriptions (group selection) in these stands would feature the maintenance of large (greater than 21" DBH) old growth (ponderosa pine, larch, and Douglas-fir), culture intermediate size trees, (especially ponderosa pine and larch) and create small openings of two to three acres to promote regeneration of these species, which will not regenerate in shaded conditions (smaller openings). Although it is obviously critical to retain the larger old trees, it is equally as critical in the long-term maintenance of dry forest old growth, to develop replacement cohorts within these stands.

Alternative 4 includes two methods the collaboration group considered to accomplish these objectives; both of which would reintroduce fire back into these fire dependent stands:

- The first method would involve prescribed burning the stands without any site preparation at temperatures hot enough to kill the majority of the seedling and sapling sized trees (ladder fuels) and about one-fourth of the pole and medium sized trees. For a burn like this to be effective, the weather and fuel conditions would have to be very dry. Consequently, the risk of an escaped fire would be high.

- The second method would include some felling of the unwanted trees, followed up with prescribed burning. This could be done under more moist conditions than the first method; however, with the acres involved and the proximity to private lands, this would still be very risky.

Both of these methods, regardless of success rates would have the following risks and consequences:

- The volume of smoke and particulates that would violate air quality standards. The prescribed fire would burn greater amounts of biomass, and burn at temperatures hot enough to kill most of the ladder fuels. There would be a risk of losing the entire organic (duff) layer and stored nutrients, which would be a violation of Region 1 soil quality guidelines.
- Through heat girdling, this would risk killing the very same old trees that we are trying to save.
- Waste wood fiber that could be utilized as commercial products and to generate funds for watershed improvement projects.
- Post-treatment – Alternative 4 might not meet old growth status after the fuels reduction treatments.

At the conclusion of the June 30, 2005 collaboration meeting, all but two members of the Myrtle Creek Working Group agreed by consensus to go ahead with the Proposed Action (Alternative 2) that uses commercial logging followed with underburning to reduce fuels in the two old growth stands described above (June 30, 2005 meeting notes in the project file). Alternative 2 was subsequently adopted by consensus by the KVRI Board.

For the reasons explained above, Alternative 4 was dropped from further consideration and study.

2.7-B Alternatives Considered in Detail

This section describes Alternative 1 (No Action), Alternative 2 (the Proposed Action), and Alternative 5, which was analyzed in response to public feedback following release of the Draft EIS.

The proposal also includes design criteria or features developed by the resource specialists to address the issues that did not warrant analysis of separate alternatives. A listing of the Features and Design Criteria for the Action Alternatives, is included in Section 2.9 to allow for easy reference to one section of the document.

Three alternatives were considered. The following section includes a description of each alternative, which is then followed by maps and detailed features tables for the action alternatives (Alternatives 2 and 5).

- Alternative 1 – No Action
- Alternative 2 – Proposed Action
- Alternative 5

2.7-B.1 Alternative 1 - No Action

The No Action alternative provides resource specialists a means to evaluate the current ecosystem conditions as a baseline. It can also be used to compare the projected effects of each management alternative. The decision-maker and members of the public can use No Action to look at the differences that would take place under other alternatives, as well as the consequences of not conducting treatments at this time if this alternative is selected. Selection of this alternative would defer all proposed treatment activities.

It is important to keep in mind that "No Action" does not mean there would be no further management within the project area. The current level of management would continue. Activities such as fire suppression, projects analyzed in earlier environmental analysis and decisions, and routine road and trail maintenance would continue. The reasonably foreseeable activities, which would not be affected by this EIS and subsequent Record of Decision, are included, as appropriate, in the resource discussions (such as Hydrology, Fire/Fuels, Old Growth) in Chapter 4.

Under the No Action alternative, none of the proposed silvicultural and hazardous fuel treatments, prescribed burning, road improvement or watershed improvement activities would be implemented with this project. Stand health would decline as the competition for water and soil nutrients continues, and fuels would continue to build up with continued fire suppression, leading to increased risk of undesirable stand-replacing fires and their associated negative effects over time.

The 2003 Myrtle Creek Fire burned approximately 13 percent of the watershed. Thus, there is greater concern over the potential effects of more unwanted wildfire in the drainage, given the potential additive impacts a subsequent fire would have.

2.7-B.2 Alternative 2 - Proposed Action - Summary

The Proposed Action was developed through consideration of public comments and collaboration with and feedback from the KVRI Myrtle Creek Working Group following numerous specialist presentations and group discussions concerning probable treatment effects to various resources in the project area. Comments from members of the public and other agencies are discussed earlier in this chapter.

The Proposed Action is designed to meet the purpose and need statements in Chapter 1.

The main topics that were discussed in detail during the KVRI Myrtle Creek Working Group collaboration meetings and integrated into the proposed action are as follows:

- Watershed health - effects of roads, sedimentation, turbidity, risk of culvert failures and 100-year storms.
- The role of fire, historical events and the resulting effects to resources in the project area.
- Fuels management options and fire suppression tactics.
- Vegetation management – Forest types in the watershed, specifically dry forest old growth stands and their dependence on understory fires every 10 to 20 years.
- Landforms, hydrophobic soils, nutrient cycling, soil compaction.
- Wildlife species such as grizzly bear, flammulated owl, their respective habitat requirements, and any mitigation requirements.
- Inventoried Roadless Area requirements.

2.7-B.3 Alternative 5 - Summary

This alternative was developed through consideration of public comments received on the Draft EIS and during discussions with the collaboration group. (Comments from other agencies are discussed earlier in this chapter.)

The design for this alternative does <u>not</u> treat the following areas that raised concerns with regional environmental groups.

- Inventoried Roadless Areas
- Dry forest old growth stands
- Grizzly bear core habitat

2.7-B.4 Alternatives 2 and 5 – Road Management Features

Road management features are similar for both action alternatives, so they are summarized together (differences are noted).

- Improvements and maintenance of the transportation system (roadside and surface maintenance, etc.) would be made on roads that would be used as haul routes. A map of the haul routes is included in the Map Appendix.
    - Under Alternative 2 this would include approximately 29 miles of haul route roads.
    - Under Alternative 5 this would include approximately 22 miles of haul route roads.
- Under both alternatives, about 0.6 mile of Road 402 C (spur road) would be reopened for access to conduct fuels reduction treatments in Units G2, G3 and G4. This spur road (total length of approximately one mile) would be decommissioned (by full obliteration) after treatments and follow-up activities are complete. (This activity is described as reconstruction and decommission in various tables and sections of this FEIS.)
- Under both alternatives, approximately one mile of Road 1309 UA (spur road) would be decommissioned. The road is non-drivable due to brush and tree encroachment. The culverts are starting to fail and there is a risk of sediment delivery to Myrtle Creek (see map of priorities for road decommissioning in the Map Appendix; and Watershed Report, in the project files).

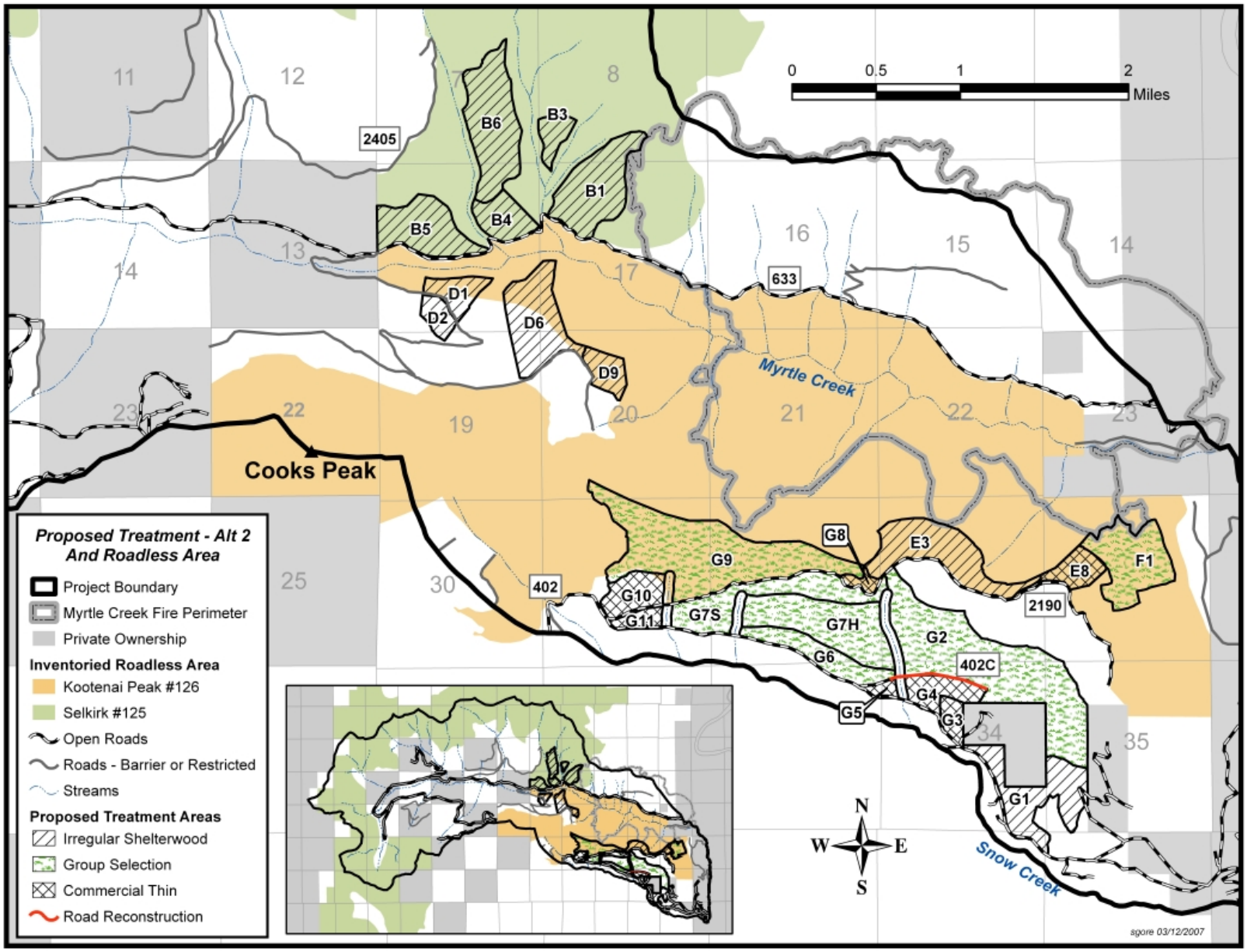

Figure 2.1 Alternative 2 - Proposed Action

2.7-B.5 Alternative 2 - Proposed Action - Features

The proposal includes silviculture and fuels reduction treatments in 24 units, totaling approximately 2086 acres.

Table 2.7 Alternative 2 – Proposed Action Silviculture and Fuels Reduction Treatments

Treatment Unit	Silvicultural RX	Acres	Harvest System	Fuels RX	PCC_BEFORE (estimated)	PCC_RESIDUAL (estimated)
B1	ISW	118	H	GP	65	35 - 45
B3	ISW	25	H	YT	70	35 - 45
B4	ISW	47	T	GP	70	35 - 45
B5	ISW	97	T	GP	65	35 - 45
B6	ISW	137	H	GP	70	35 - 45
D1	ISW	36	S	GP	70	35 - 45
D2	ISW	25	T	GP	70	25 - 35
D6	ISW	114	S	GP	70	35 - 45
D9	ISW	32	T	GP	70	35 - 45
E3	ISW	124	S/T	GP	65	35 - 45
E8	CT	35	S	GP	70	45 - 55
F1	GS	112	H	UB	65	35 - 50
G1	ISW	113	T	GP	65	35 - 45
G2	GS	309	H	UB	65	35 - 50
G3	CT	20	T	UB	70	45 - 55
G4	CT	45	S	UB	70	45 - 55
G5	CT	10	T	GP	70	45 - 55
G6	GS	68	T	UB	70	45 - 55
G7H	GS	144	H	UB	70	35 – 50
G7S	GS	113	S	UB	70	35 - 50
G8	CT	11	T	UB	70	45 - 55
G9	GS	283	H	UB	65	35- 50
G10	CT	49	T	GP	65	45 - 55
G11	CT	19	T	GP	65	45 - 55
Total Acres Treated		**2086**				

Table Legend:

Silvicultural Rx = Silvicultural prescription:
- **CT** = Commercial thin
- **ISW** = Irregular Shelterwood
- **GS** = Group selection

PCC = Percent canopy closure (Before or Residual)

Fuels Rx = Fuels Treatment:
- **UB** = Underburn
- **GP** = Grapple pile
- **YT** = Yard Tops

Harvest System:
- **S** = Skyline (Cable)
- **T** = Tractor
- **H** = Helicopter

2.8 - Silvicultural Treatments

2.8-A Alternatives 2 and 5 - Treatment Methods

Several fuels reduction methods, by means of selected silvicultural prescriptions, would be used to meet the Purpose and Need for this project. In general, each silvicultural prescription would remove trees that are typically about 10 inches DBH or smaller (project file tree data and summaries). The following descriptions apply to Alternatives 2 and 5; these descriptions are not repeated again in the Alternative 5 discussion.

Commercial thinning would improve the health and vigor of the residual stands by favoring the development of the biggest and best quality trees. Ponderosa pine, western larch and white pine would be the favored species. Generally, the larger-diameter trees with full live crowns would be retained. Poor quality smaller trees (mostly suppressed trees with very little live crown) would be targeted for removal.

Group selection prescriptions (uneven-aged management) would create a mosaic of forested openings and thinned areas. The openings would treat the areas in the stand with the highest risk of insect, disease and ladder fuels. Ponderosa pine and larch would regenerate in these openings; the thinned areas would favor the retention of the largest existing ponderosa pine, Douglas-fir, and larch. This prescription would also be used to increase the overall quality and integrity of the dry forest old growth stands by giving the larger trees access to more nutrients and water to meet their large metabolic needs and fuel their defense mechanisms against insect and disease attacks. Removing ladder fuels from below and around the large old relic trees would lower the risk of stand-replacing crown fires in the future. Periodic treatments such as thinning and underburning would be used every 15 to 20 years to develop and maintain historical values relating to stand composition, structure, fuel loadings and wildlife snags.

Regeneration harvesting would use the **irregular shelterwood** with reserve tree method in stands that are currently overcrowded and the overstories are dominated by lodgepole, larch and Douglas-fir, and the understories are nearly impenetrable thickets of grand fir, cedar, and hemlock. The objective of both methods is to improve health and vigor and favor development of larch and white pine. Generally, the larger-diameter trees with full live crowns would be retained for seed, shelter and future snags for the regenerated stand. To help meet fuel reduction objectives, dead and dying trees not needed to meet snag management requirements would be removed, and logging slash and undesirable understory trees would be burned using grapple piling and underburning where appropriate. Units would be reforested with ponderosa pine, larch and white pine where appropriate.

Underburning would have multiple roles in the restoration of historic attributes in the treatment units. Fire would be used as tool to burn slash, recycle nutrients, resprout decadent shrubs (browse for wildlife), reduce heavy duff layers around relic trees, harden the bases of ponderosa pine (creating long-standing, rot-resistant snags for wildlife), and prepare the units for natural or artificial regeneration (planting) into seral species.

2.8-B Alternative 2 - Openings Exceeding 40 Acres

As required by the Forest Service Manual (FSM 2471.1), openings created through the use of regeneration harvest that are greater than 40 acres in size need approval from the Regional Forester.

The proposed openings that would exceed 40 acres (Units B1, B4, B5, B6, D6, E3, and G1) have been incorporated into the watershed, wildlife, fire, vegetation, visual and other analyses. These openings are strategically placed fuel breaks that are an integral part of the fuels reduction strategy in the project area. The district received approval from the Regional Forester to exceed the 40-acre limit (see project file).

Table 2.8 Alternative 2 – Silvicultural and Fuels Treatment Summary

Unit	Acres	General Stand Conditions	Description of Treatment
Treatment -- Commercial Thin (CT)			
E8 **G10** **G11** **G3** **G4** **G5** **G8** **Total**	35 49 19 20 45 10 11 **189**	Generally, these are 70-90 year old mixed conifer stands. The primary overstory species are Douglas-fir, with lesser amounts of lodgepole pine and larch. Grand fir, cedar, and hemlock dominate the understory. These stands are overstocked, and growth is declining.	A combination of commercial thinning and sanitation-salvage would be prescribed to remove most of the ladder fuels in these units and maintain the health and vigor of these stands. Generally, the larger-diameter trees with full live crowns would be retained. Poor quality smaller trees would be targeted for removal. These would mostly be suppressed trees with very little live crown. Smaller diameter dead and dying trees not needed to meet snag management requirements would also be removed. Those areas where ladder fuels are removed would change from a Fuel Model # 10 to a Fuel Model # 8, which is less apt to maintain a crown fire. (See the Fire/Fuels section for additional information.)

Treatment -- Group Selection Cut (GS)			
F1 **G2** **G6** **G7H** **G7S** **G9** **Total**	112 309 68 144 113 284 **1030**	Overstory species such as ponderosa pine, Douglas-fir and larch are common. Understory trees are composed of thickets of Douglas-fir which have formed ladder fuels.	In order to protect the stands from crown fire and restore the historical stand structure, group selection cuts from three to five acres in size would be used to regenerate the areas of the stand that are departed from historical stand composition and structure values and will often encompass overstocked areas and root disease centers in areas of susceptible Douglas-fir, allowing the area to be reforested with relatively root disease resistant seral species such as ponderosa pine, larch or white pine. Large diameter ponderosa pine, larch, and Douglas-fir relic trees and snags will be left in the group selection openings for future stand structure, snags and genetic seed banks. Commercial thinning and sanitation-salvage harvesting would be carried out between the group selection openings to maintain the health and vigor of these trees. Generally, the larger-diameter trees with full live crowns would be retained. Trees that are of poor form or suppressed would be targeted for removal. Smaller dead and dying trees not needed to meet snag management requirements would also be removed. Ladder fuels would be reduced; in these areas, Fuel Models would change from #10 to #8, which is less apt to maintain a crown fire. (See the Fire/Fuels section for more information.)

Fuel Model descriptions are in the Chapters 3 and 4 Fire and Fuels discussion. In general, Fuel Model 8 is typically a timber overstory with light timber litter on the ground; fires are slow-burning surface fires with low flame lengths. Fuel Model 10 is typically a timber overstory with heavy amounts of timber litter. Surface fires burn with more intensity and flame lengths up to four feet can be expected. Direct attack is more difficult and there is greater potential for crown fires. In the project area, most of the timber stands with no record of past management (not including the area of the 2003 fire) can be classified as FM 10.

Table 2.8 Alternative 2 – Silvicultural and Fuels Treatment Summary - continued

Treatment – Irregular Shelterwood Cut (ISW)			
Irregular Shelterwood		These stands have thick overcrowded overstories, dominated by lodgepole, larch, and Douglas-fir. The larch, lodgepole, and white pine component of the stands are declining in health and are being replaced by cedar, grand fir and hemlock. In the case of white pine, blister rust has nearly eliminated this species. The understories in these units are nearly impenetrable thickets composed of grand fir, cedar, and hemlock.	The objective of this prescription would be to favor the development of larch and white pine. Generally, the larger-diameter trees with full live crowns would be retained for seed, shelter and future snags for the new stand. Dead and dying trees not needed to meet snag management requirements would be removed. The logging slash and undesirable understory trees would be burned using grapple piling and underburning where appropriate. Units would be reforested with ponderosa pine, larch and white pine. By reducing the ladder fuels, Fuel Models would change from #10 to #8, which is less apt to maintain a crown fire. (See the Fire/Fuels section for more information.)
B1	118		
B3	25		
B4	47		
B5	97		
B6	137		
D6	114		
D1	36		
D2	23		
D9	32		
E3	124		
G1	113		
Total	**867**		

2.8-B.1 Alternative 5 - Features

This alternative includes silviculture and fuels reduction treatments in 13 units, totaling approximately 865 acres.

Table 2.9 Alternative 5

Treatment Unit	Silvicultural RX	Acres	Harvest System	Fuels RX	PCC_BEFORE (estimated)	PCC_RESIDUAL (estimataed)
D1	ISW	12	S	GP	70	25 - 35
D2	ISW	23	T	GP	70	25 - 35
D6	ISW	62	S	GP	70	35 - 45
G1	ISW	107	T	GP	65	35 - 45
G2	GS	228	H	UB	65	35- 45
G3	CT	20	T	UB	70	45 - 55
G4	CT	45	S	UB	70	45 - 55
G5	CT	10	T	GP	70	45 - 55
G6	GS	68	T	UB	70	35 - 50
G7H	GS	178	H	UB	70	35 - 50
G7S	GS	48	S	UB	70	35 - 50
G10	CT	45	T	GP	65	45 - 55
G11	CT	19	T	GP	65	45 - 55
Total Acres Treated		**865**				

Table Legend:

Silvicultural Rx = Silvicultural prescription:
- **CT** = Commercial thin
- **ISW** = Irregular Shelterwood
- **GS** = Group selection

PCC = Percent canopy closure (Before or Residual)

Fuels Rx = Fuels Treatment:
- **UB** = Underburn
- **GP =** Grapple pile

Harvest System:
- **S =** Skyline (Cable)
- **T =** Tractor
- **H =** Helicopter

2.8-C Alternative 5 - Treatment Methods

Several silvicultural treatment methods would be used to meet the Purpose and Need for this project. The treatment methods are described in detail in the previous description of Alternative 2 and are not repeated again in the Alternative 5 discussion.

2.8-D Alternative 5 - Openings Exceeding 40 Acres

The proposed openings that would exceed 40 acres (Units D6, and G1) have been incorporated into the watershed, wildlife, fire, vegetation, visual and other analyses. These openings are strategically placed fuel breaks that are an integral part of the fuels reduction strategy in the project area. The district received approval from the Regional Forester to exceed the 40-acre limit, as stated in the Forest Service Manual (see project file).

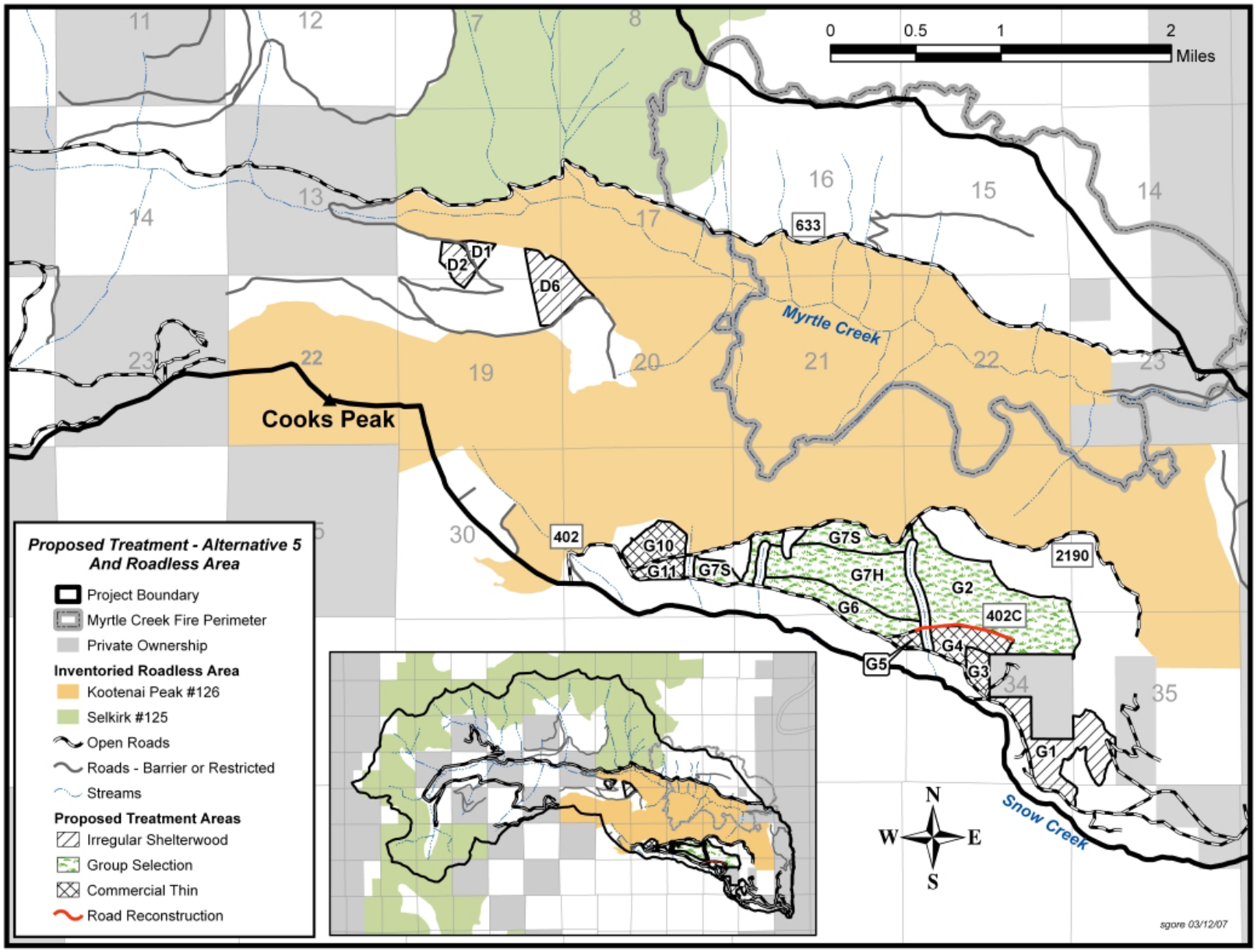

Figure 2.2 Map of Alternative 5

2.8-E Alternative 5 – Silvicultural Treatment Summary

Unit	Acres	General Stand Conditions	Description of Treatment
Treatment -- Commercial Thin (CT)			
G3 **G4** **G5** **G10** **G11** **Total**	20 45 45 10 19 **139**	Generally, these are 70-90 year old mixed conifer stands. The primary overstory species are Douglas-fir, with lesser amounts of lodgepole pine and larch. Grand fir, cedar, and hemlock dominate the understory. These stands are overstocked, and growth is declining.	A combination of commercial thinning and sanitation-salvage to remove most of the ladder fuels in these units and maintain the health and vigor of these stands. Generally, larger-diameter trees with full live crowns would be retained. Poor quality smaller trees would be targeted for removal. These would mostly be suppressed trees with very little live crown. Smaller diameter dead and dying trees not needed to meet snag management requirements would also be removed. In areas where the ladder fuels are removed, Fuel Models would change from #10 to #8, which is less apt to maintain a crown fire. (See the Fire/Fuels section for more information.)
Treatment -- Group Selection Cut (GS)			
G2 **G6** **G7H** **G7S** **Total**	228 68 178 48 **522**	Overstory species such as ponderosa pine, Douglas-fir and larch are common. Understory trees are composed of thickets of Douglas-fir which have formed ladder fuels.	To protect stands from crown fire and restore historical stand structure, group selection cuts from one to five acres in size would be used to regenerate the areas of the stand that are departed from historical stand composition and structure values, and will often encompass root disease centers in areas of susceptible Douglas-fir, allowing the area to be reforested with relatively root disease resistant seral species such as ponderosa pine, larch or white pine. Large diameter ponderosa pine, larch, and Douglas-fir relic trees and snags will be left in the group selection openings for future stand structure, snags and genetic seed banks. Commercial thinning and sanitation-salvage harvesting would be carried out between the group selection openings to maintain the health and vigor of these trees. Generally, the larger-diameter trees with full live crowns would be retained. Trees that are of poor form or suppressed would be targeted for removal. Smaller dead and dying trees not needed to meet snag management requirements would also be removed. By reducing the ladder fuels, Fuel Models would change from #10 to #8, which is less apt to maintain a crown fire. (See the Fire/Fuels section for more information.)

Treatment – Irregular Shelterwood Cut (ISW)			
Irregular Shelterwood **D6** **G1** **D1** **D2** **Total**	 62 107 12 23 **204**	These stands have thick overcrowded overstories, dominated by lodgepole, larch, and Douglas-fir. The larch, lodgepole, and white pine component of the stands are declining in health and are being replaced by cedar, grand fir and hemlock. In the case of white pine, blister rust has nearly eliminated this species. The understories in these units are nearly impenetrable thickets composed of grand fir, cedar, and hemlock.	The objective of this prescription would be to favor the development of larch and white pine. Generally, the larger-diameter trees with full live crowns would be retained for seed, shelter and future snags for the new stand. Dead and dying trees not needed to meet snag management requirements would be removed. The logging slash and undesirable understory trees would be burned using grapple piling and underburning where appropriate. Units would be reforested with ponderosa pine, larch and white pine. By reducing the ladder fuels, Fuel Models would change from #10 to #8, which is less apt to maintain a crown fire. (See the Fire/Fuels section for more information.)

Fuel Model descriptions are in the Chapters 3 and 4 Fire and Fuels discussion. In general, Fuel Model 8 is typically a timber overstory with light timber litter on the ground; fires are slow-burning surface fires with low flame lengths. Fuel Model 10 is typically a timber overstory with heavy amounts of timber litter. Surface fires burn with more intensity and flame lengths up to four feet can be expected. Direct attack is more difficult and there is greater potential for crown fires. In the project area, most of the timber stands with no record of past management (not including the area of the 2003 fire) can be classified as FM 10.

2.9 - Required Design Features, Mitigation Measures and Estimated Effectiveness

The following criteria would be applied during implementation of any action alternative associated with this project. The purpose of these measures is to avoid, or minimize the potential for adverse effects to the resources discussed below. The effects analyses have incorporated these measures. Where protective (mitigation) measures are listed, the effectiveness of the measure is included.

Many of these criteria are addressed through language in the timber sale contracts and the Sale Administrator monitors those criteria for compliance.

Additional information on these criteria is included in the project file and is available by request.

2.9-A General Design Features

a. Cultural Resources

Cultural resources (including any newly encountered historic or pre-historic cultural sites) including buildings, objects, and properties would be protected by avoiding or buffering the sites. This includes caves, sinkholes, vertical shafts, and related features protected by the Federal Cave Resources Act of 1988.

Estimated Effectiveness – High. Contract provisions for protection of cultural resources are utilized in all contracts and have been effective in protecting cultural resources. (2000 Forest Plan Monitoring Report, Summary of Findings, page 2)

b. Improvements and Survey Monuments

Survey monuments, landlines, and all other improvements would be protected by buffering, appropriate clauses in the timber sale contract, or both.

Estimated Effectiveness – High. Contract provisions for protection of improvements are utilized in all contracts and have been effective in protecting these features.

c. Habitat of Threatened, Endangered, or Sensitive Species

Location of areas needing special measures for protection of plants or animals listed as TES are shown on the Timber Sale Map(s) included in the timber sale contract package and buffers are designated on the ground. Measures to protect such areas are included in the contract as applicable, this can include restrictions on timing of activities to minimize or avoid impacts to some species.

Estimated Effectiveness – High. Contract provisions for protection of TES habitats and locations are utilized in all contracts and have been effective in protecting these resources (See Forest Plan Monitoring and Evaluation reports).

See Botany, Wildlife and Fisheries sections for additional requirements for TES.

d. Hazardous Materials

Oil and oil product storage totaling more than 1,320 gallons or a single container with capacity greater than 660 gallons must be stored in a manner consistent with regulations in 40 CFR 112 and INFS requirements. Storage sites must be designated prior to operations and will meet specifications to minimize potential for hazardous spills and infiltration into soils or delivery to streams, if a spill does occur. Proper notification must occur if any leak or spill enters live water. A petroleum and chemical products spill protection plan would be required and shall meet applicable EPA requirements.

Estimated Effectiveness – High. Contract provisions for storage and use of hazardous materials are utilized in contracts and have been effective in protecting natural resources.

e. Sanitation and Servicing

The timber sale purchaser shall take all reasonable precautions to prevent pollution of air and water by purchaser's operations.

Any changing of hoses, parts, or refueling would be conducted 300 feet away from streams and tributaries. A pre-operational inspection would be conducted by the Forest Service contract inspector for signs of leakage on machines that would be used to reconstruct stream crossings. The inspector and operator would inspect hoses daily for signs of wear. In the event any leakage or spillage enters any stream or open water, the operator would immediately notify the Contracting Officer Representative (COR) or the timber sale administrator who would be required to follow the actions to be taken in case of hazardous spill, as outlined in the spill protection plan. A possible effect would be the damage to water quality should a leak of petroleum products or hydraulic fluid occurs. As long as these requirements are followed, impacts to downstream water quality, fish habitat and aquatic organisms, or any of these individual resources, from contaminants are not likely.

Estimated Effectiveness – High. Contract provisions for sanitation and servicing are utilized in contracts and have been effective in protecting air and water resources.

f. Public Health and Safety Features:

1) <u>Dust Abatement</u> -- Dust Abatement used on Forest Service roads consists of road surface preparation and application of water or other materials. . Use of materials other than water will require approval of the Forest Service, shall meet specifications provided in the timber sale contract, and follow manufacturers recommendations for application.

Magnesium chloride or calcium chloride would only be applied under the following conditions to prevent delivery to stream channels:

- Only the road prism would be treated, not the ditch line.
- These products would not be applied during rainstorms or when storms are forecast within 24 hours.

Estimated Effectiveness – High. Contract provisions for dust abatement applications are utilized in contracts and have been effective in protecting natural resources.

2) <u>Traffic Signing</u> -- During logging activities signs would be posted to inform the public of log truck traffic.

Estimated Effectiveness – High. Contract provisions for traffic signing are utilized in contracts and have been effective in protecting public safety.

3) <u>Air Quality</u> -- For local air quality reasons; restrictions on prescribed burning may be implemented by the Bonners Ferry Ranger District, in addition to those imposed by the North Idaho and Montana Airshed Groups.

Estimated Effectiveness: High. The Idaho Division of Environmental Quality recognizes the North Idaho Smoke Management Memorandum of Agreement (1990) as the best available control technology for prescribed burning. This mitigation has a high degree of effectiveness to keep air pollution from smoke at acceptable levels and ensure that air quality standards would be met.

g. Noxious Weed Measures

1) Any priority weed species (as defined by the IPNF) identified during road maintenance would be reported to the District Weed Specialist. A list of priority weed species is included in the project file.

2) Treatment would be conducted according to the Bonners Ferry Noxious Weed Management Projects FEIS and Record of Decision (USDA 1995).

3) Washing Equipment -- In order to prevent the spread of noxious weeds into the Sale Area, the purchaser shall clean all off-road logging and construction equipment prior to entry onto the Sale Area to ensure that off-road equipment is free of noxious weeds. In addition, after operating in areas of known weed infestations, any off-road equipment to be transported to those portions of the project area considered to be relatively weed free must be cleaned before entry into those areas. A map of weed-infested and relatively weed-free areas would be included in the timber sale contract package.

4) Construction Sites -- Gravel or borrow pits to be used during road maintenance would be inspected by the District Noxious Weed Coordinator for infestations of new weed invader species. As appropriate, the purchaser would treat any new weed invader species and clean equipment as necessary. A list of weed species defined by the IPNF Weed Specialist as potential new invaders is included in the project file.

5) Haul Routes -- Prior to ground-disturbing activities, where feasible the purchaser of any timber sale contract shall treat with herbicides all travel ways, shoulders and turnouts of Forest Service roads being used for hauling. If the timing of ground disturbing activities would not allow weed treatment to occur when it would be most effective, it would occur in the following treatment season.

6) Sites of New Construction – Newly constructed skid trails, landings or other areas of disturbance (including ground-disturbing maintenance on existing roads) would be seeded with a weed-free seed mix of native and desired non-native species and fertilized as necessary.

7) Use of Certified Weed-Free Materials – Straw or hay used for mulching or watershed restoration activities will be certified "Weed Free."

8) Decommission or Stored Roads -- Road segments proposed for decommissioning or storage that have also been identified as needing treatment for weeds will be treated prior to those activities.

Estimated Effectiveness - The above mitigation measures are accepted weed prevention practices developed by public land management agencies and University Cooperative Extension offices and promoted by weed management organizations across the nation (e.g. Sheley et al. 2002, Drlik et al. 1998, USDA 2001). The above measures include those required in Forest Service Manual (FSM) 2080 for activities related to timber harvest and roads. They are described in FSM 2981.2- 1a and FSM 2081.2 - 6a, respectively (see project file). Also included are weed prevention practices that are recommended but not required (see project file).

For new weed invaders, the estimated effectiveness of the above measures is high; the measures are expected to be very effective at preventing establishment of new invaders. According to current research (Hobbs and Humphries 1995), early detection and treatment of infestations before explosive spread occurs can significantly reduce the social cost of weed invasions.

For existing infestations that occur along road rights-of-way, estimated effectiveness is moderate; the measures are expected to be somewhat effective at reducing the spread of these in the project area. For existing infestations that have spread off the road, estimated effectiveness is low. Effectiveness of treatments on National Forest System lands could be reduced if adjacent landowners do not treat their weed infestations. Existing weeds and new invaders are also spread by wildlife, winds, water and hikers – the mitigation measures would have no effect on these sources of weed spread

h. Road Reconstruction and Maintenance

A contract package for road improvement, reconstruction, or maintenance would include the site-specific BMP criteria to be applied during project implementation.

All slash would be removed from road ditch lines according to contract specifications.

Estimated Effectiveness – High to Moderate. See the discussion on Best Management Practices for more information.

2.9-B Features Designed to Protect Water, Soils, and Aquatic Habitat

2.9-B.1 Features Designed to Protect Water

a. Road Work to Improve Watersheds

To help reduce potential and existing sediment risks to the watershed, road maintenance activities would be conducted to improve existing road drainage structures and surfaces on approximately 29 miles of road (haul routes) under Alternative 2 or

22 miles of road (haul routes) under Alternative 5. Existing roads would be improved to meet standards suitable for use by large trucks and equipment. Drainage structures in roads that pose sediment risks would be repaired, replaced, removed, or redesigned.

In the Snow Creek watershed, approximately one mile of Road 402-C is proposed for decommissioning (please keep in mind that 0.6 mile of this road would be reopened and is shown as reconstruction in the activities tables). However, when post-sale activities are complete, a total of approximately 1.0 miles would be decommissioned (by full obliteration). Road 402-C would be part of the transportation system (haul routes) used to accomplish treatments and the decommissioning would be part of the timber sale package or would be funded from revenues generated by the timber sale.

In the Myrtle Creek watershed, about one mile of Road 1309-UA is proposed for decommissioning. Because this road is not part of the transportation system that would be used to accomplish treatments, funding for the decommissioning work would have to come from appropriated funds or other funding sources.

b. Road Design

To avoid potential resource damage from temporary roads that may remain on the landscape until post-sale activities are completed, temporary roads greater than 300 feet in length would be designed by a Forest Service Engineer and would be incorporated into a road package tied to the timber sale. An engineering representative would monitor temporary road construction to ensure design specifications were met. At the end of all project activities, all temporary roads would be decommissioned and consideration of the level of decommissioning will include consultation with the hydrologist. There will be restrictions for temporary road locations. No roads will be constructed near stream channels, nor be on landslide prone slopes. Storm protection of temporary roads would be required. See "Features Designed to Reduce Sediment" and "Features Designed to Protect Water and Fish Habitat" for specific mitigation measures. (The only proposed temporary road is the re-opening of approximately 0.6 miles of Road 402-C as discussed elsewhere in this Chapter.)

Estimated Effectiveness -- High; extensive research has demonstrated that improved design, building, and maintenance of roads can reduce road-related surface erosion at the scale of individual road segments. Key factors are road location, particularly layout relative to stream systems (USDA 1999b), road drainage (Haupt 1959, Copstead 1998), surfacing (Burroughs and King 1989, Kochenderfer and Helvey 1987, Swift 1984), and cut slope and fill slope treatments (Burroughs and King 1989, Cook and King 1983, Hungerford 1984). Many studies show that surfacing materials and vegetation measures can be used to reduce the yield of fine sediment from road surfaces (Beschta 1978, Burroughs et al 1983, Kochenderfer and Helvey 1987, Swift 1984, Foltz and Truebe 1995).

Appropriate Best Management Practices (BMPs) would be in place to prevent or reduce the amount of pollution generated from nonpoint sources. BMPs would also ensure propoer drainage and seeding of the landings. Weed treatment of service landings would take place prior to logging activities. All other weed mitigation measures and prevention practices would occur in accordance with the requirements of the Bonners Ferry Noxious Weed EIS (1995).

Estimated Effectiveness – High – locating landings on existing classified National Forest system roads that are considered designated lands eliminates additional impacts to activity units. BMPs are very effective in reducing nonpoint source pollution from silvicultural activities (Lynch and Corbett 1998 and 1999). Effectiveness of weed mitigation practices are described in "Noxious Weeds" earlier in this section.

c. Features Designed to Reduce Sediment

i. Temporary and Classified Road Decommissioning to Improve Aquatic Habitat

Identified roads would be decommissioned or stored, which would be conducted at the appropriate level and would include consultation with the hydrologist. Decommissioning levels may include full or partial recontouring; removing all culverts; or stabilizing fill slopes and restoring stream channel crossings back to natural grade. Seeding, fertilizing, and placement of woody debris would follow to establish desired vegetation and prevent noxious weed spread.

Roads 402-C and 1309-UA would be decommissioned under Alternatives 2 and 5.

Estimated Effectiveness – High**;** road-decommissioning activities provide long-term improvements in reducing erosion and sediment delivery to stream channels. Removing culverts would prevent them from plugging and prevent the associated fill from failing and delivering large quantities of sediment (USDA 1999 and 2000).

ii. Timing of Road Decommissioning

Unless circumstances change during implementation that would extend the duration of time a road is needed, roads would be decommissioned within the following timeframes:

- Temporary or existing road segments proposed for decommissioning that are needed for post-harvest activities, such as prescribed burning or planting, would be decommissioned after completion of post-harvest activities (within two to three years of harvest activities). This timing would apply to Road 402-C.
- Any road segments identified for decommissioning opportunities that are not being used for harvest activities would be decommissioned as soon as funds become available. This timing would apply to Road 1309-UA.

iii. Sediment Reduction

Spot gravelling with approximately six inches of gravel would be required at all stream crossings, rolling dips, and in any perennial wet areas.

Effectiveness Rating --High; One study showed it 92% effective in reducing the amount of sediment delivered to streams (Foltz & Truebe 1995).

iv. Hydro Mulching

All road construction would require hydro-mulching on soil disturbance sites within critical areas such as wet areas or stream crossings, and large cut and fill slopes. Mulching would occur immediately after road construction is completed.

Effectiveness Rating – Moderate to High; this measure is 40 to 80% effective in reducing sediment (Burroughs and King 1989).

d. Best Management Practices

All activities would be designed to protect water quality and fisheries habitat. Best Management Practices (BMPs) are the primary mechanism to enable the achievement of water quality standards for non-point source sediments. Forest Service Handbook 2509.22 (Soil and Water Conservation Handbook) outlines BMPs that meet the intent of the water quality protection elements of the Idaho Forest Practices Act. Site-specific best management practices have been specifically designed for the proposed management action, and are part of the required design criteria. They are described more fully in Appendix C-BMPs.

Estimated Effectiveness – Moderate to high; depending on the practice. A description of each practice and an estimate of its effectiveness are located in Appendix C, BMPs. Research has evaluated the effectiveness of BMPs (Seyedbagheri 1996, USDA Forest Service Monitoring Reports 1995 - 2000). These practices will be implemented since they are requirements tied to the timber sale contract. The Forest Service Timber Sale Administrator will frequently review the project for compliance with these and other timber sale requirements. The North Zone Aquatics personnel would also do periodic monitoring to assess the effectiveness of these practices.

e. Protection Of Wetlands, Seeps, Bogs, Wallows and Springs

All known or discovered wetlands, seeps, bogs, elk wallows and springs less than one acre in size will be protected with a "no activity" buffer approximately 100 feet in diameter.

Estimated Effectiveness – High; this practice will be implemented. It is incorporated into project design and unit layout, and implemented by the sale administrator.

f. Road Surface and Drainage Crossing Maintenance to Improve Aquatic Habitat

The main source of erosion and sediment delivery from roads is usually from the road surface. Road maintenance activities that focus on reducing sediment delivery are, as follows: blading along the road prism; spot surfacing at stream crossings; installing relief culverts where the distance between locations of ditch relief is not adequate based on the gradient of the road and topography of the landscape; cleaning and improving ditches; cleaning the inlet and outlets of culverts; and installing rolling dips and outlet ditches. These activities will help improve road surface drainage and decrease sediment delivery to stream channels.

Road drainage crossings that pose a hazard and risk to aquatic species and their habitat from sediment delivery have been evaluated throughout the project area. (See Chapters 3 and 4 for more information.)

Recommendations for each crossing may include replacing, redesigning or upgrading crossings as needed. Some specific culvert improvements to reduce sediment risks include increasing the culvert's flow capacity and constructing a rolling dip to prevent the road from capturing stream flow if the culvert fails or its capacity is exceeded.

Estimated Effectiveness – High; proposed road surfacing and drainage crossing upgrades will occur because they will be included in the road package as part of the Timber Sale Contract or will be accomplished by the Forest Service using appropriated or other funding.

2.9-B.2 Features Designed to Protect Soil and Site Productivity

The following practices are designed to minimize the detrimental impacts of soil compaction, displacement, severe burning, and nutrient and organic matter depletion on long-term soil productivity. The use of these practices would insure that the soil quality standards listed in the Forest Plan and Regional Soil Quality Standards would be met. Best Management Practices (BMPs) related to soil and sediment processes also apply and are outlined in "Features Designed to Protect Water and Aquatic Habitat" and Appendix C-BMPs.

a. Protection of soils within specific stands identified for ground-based yarding

Existing skid trails within units D2, G1, G3, G6, G8, G10, and G11 and slash mats would be used whenever available to reduce additional impacts from harvest and site preparation activities. All new skid trails would be designated and laid out to take advantage of the topography and minimize disruption of natural drainage patterns. Where terrain is conducive, trails would be spaced at maximum distance. Excavated skid trails would be fully re-contoured after logging is completed. Skid trails would be seeded with the appropriate seed mix.

Estimated Effectiveness – High - past Forest Plan monitoring reports and literature (USDA FS 1998, 1999a, 2000 and 2001a) indicate little to no detrimental soil compaction and displacement with these requirements. These guidelines exceed the requirement of the Idaho Forest Practices Act and meet the Forest and Regional Soil Quality Standard by limiting disturbance to less than 15% of the activity area (Niehoff 2002; Adams 1997).

b. Protection During Logging Activities

In ground-based treatment units, soil protection would be provided by using one or more of the following requirements depending on the current site conditions:

- Operate on a 24-inch snow layer or 18 inches of settled snow.
- Operate when the ground is frozen to a depth of 4 inches.
- Restrict equipment operation to skid trails or where adequate slash matting exists.

Estimated Effectiveness – High - past Forest Plan monitoring reports and literature (USDA FS 2001a, 2002, and 2003; Flatten 2003; Philipek 1985) indicate little to no detrimental soil compaction and displacement with these requirements.

Units that would be treated with ground-based systems are: B4, B5, D2, D9, part of E3, G1, G3, G5, G6, G8, G10, and G11 in Alternative 2; D2, G1, G3, G5, G6, G10 and G11 in Alternative 5.

c. Skyline Yarding

The leading end of logs would be suspended during yarding. Yarding across any designated RHCA requires full suspension.

Estimated Effectiveness – High - the intent is to reduce the potential detrimental soil impacts of displacement and compaction. Past Forest Plan monitoring (Niehoff 2002; USDA FS 2004) indicates low amounts of soil compaction and displacement with skyline yarding systems.

d. Net-improvement of Soils

Units G3 and G10 currently exceed or are at soil quality standards due to past impacts. Once proposed harvest and site preparation activities are completed, the skid trails/rutting and an old road bed would be rehabilitated, thereby moving towards a net improvement in soil quality. This would be accomplished through decompaction, addition and incorporation of organic matter, seeding, and weed control.

Estimated Effectiveness – Low to moderate - Decompaction would provide for improvements in hydrologic function and would initiate a recovery process that otherwise may be prolonged as soil compaction from past and proposed harvest activity persist (Froehlich 1984; Froehlich and Miles 1984; Heninger et. al 2002; Luce 1997; project file document SOIL-34).

e. Temporary Roads

Reconstruction proposed to temporarily re-open 0.6 mile of Road 402-C in Snow Creek would utilize the existing roadbed. The full length of Road 402-C (approximately 1 mile) would be obliterated to the junction with Road 402 after post-harvest activities are concluded.

An engineer or hydrologist would review locations of all roads longer than 300 feet prior to construction. (However, as stated above, this project does not include construction of any new temporary roads in any new locations.)

Estimated Effectiveness – High - road location, particularly relative to streams, is a key factor in reducing road-related surface erosion at the scale of individual road segments (Lynch and Corbett, 1990; USDA FS 1999b). This feature would be implemented through contract provisions, administration of the contract provisions, use of Best Management Practices, and compliance monitoring by the sale administrator or engineering representative (Lynch and Corbett 1990; USDA FS 1999b).

f. Nutrient Protection on Machine- or Hand-piled Areas

The latest soil nutrient management recommendations from the Intermountain Forest and Tree Nutrient Cooperative (IFTNC) and Rocky Mountain Research Station would be applied to each activity area.

- Conventional removal (lop and scatter of tree branches) would be used, rather than whole-tree removal, on all units as appropriate.
- In general, activity fuel (slash) would remain on site over-winter so mobile nutrients such as potassium can leach from fine materials back into the soil.
- Perimeter piling and whole tree yarding would be used adjacent to fire control lines or roads where fire control problems are anticipated. Perimeter width would be approximately 150 feet, or two tree lengths, and is often less depending on fuel loading or slope restrictions.
- Broadcast burn or underburns would be "light" in nature. (See information on the next page in sub-section j. Protection During Prescribed Burning Activities.)
- Tree species suitable to the site would be planted.

Estimated Effectiveness – High to moderate - these practices are based on research and Intermountain Forest Tree Nutrition Cooperative recommendations (Baker 1989; Barber and Van Lear 1984; Edmonds 1987; Garrison and Moore 1998; Laskowski et al. 1995; Moore et al. 2004; Palviainen et al. 2004).

g. Retention of Coarse Woody Debris

Management of coarse woody debris and organic matter in all units would follow the USFS Region 1 guidelines described in the following table. In units where presently existing coarse material is not sufficient (Unit G3), project activities would provide enough dispersed dead and downed coarse material to meet the guidelines in Graham et al. (1994).

Estimated Effectiveness – High - based on research (Graham et al. 1994, Brown et al. 2003) and Forest Plan Monitoring Reports (USDA FS 1998, 1999a and 2000), effectiveness is high when guidelines are used; implementation has been moderately successful.

Table 2.10 Coarse woody debris guidelines

Stands	Habitat Type	Coarse Woody Debris[1]
Douglas-fir/ninebark	PSME/PHMA	7-13 tons/acre
Grand fir/bear grass	ABGR/XETE	7-14 tons/acre
Western hemlock/queencup beadlily	TSHE/CLUN	17-33 tons/acre

([1]Graham et al. 1994)

h. Protection During Grapple Piling, Excavator Piling, or Mechanical Harvest Activities

Grapple piling, excavator piling and ground-based yarding or harvester equipment would operate on a slash mat and existing skid trails on slopes under 35% when possible.

Estimated Effectiveness – High - Forest Plan monitoring and research (Han 2006; Niehoff 2002; USDA FS 2001a, 2002 and 2003) indicates little to no soil disturbance if equipment is operated on a slash mat.

i. Service Landings

All landings and helicopter pads would be located on system roads. Appropriate BMPs would be in place to prevent or reduce the amount of pollution generated from nonpoint sources. BMPs would also ensure proper drainage and seeding of the landings. Weed treatment of service landings would take place prior to logging activities. All other weed mitigation measures and prevention practices would occur in accordance with the requirements of the Bonners Ferry Noxious Weed EIS (1995).

Estimated Effectiveness – High – locating landings on existing classified National Forest system roads that are considered designated lands eliminates additional impacts to activity units. BMPs are very effective in reducing nonpoint source pollution from silvicultural activities (Lynch and Corbett 1998 and 1999). Effectiveness of weed mitigation practices are described in "Noxious Weeds" earlier in this section.

j. Protection During Prescribed Burning Activities

Prescribed underburning and pile burning would take place only when the upper surface inch of mineral soil has a soil moisture content at or above 25 percent. On the south facing dry site units (G2, G3, G4, G5, G6, G7S, G7H, and G8 under Alternative2; G2, G3, G4, G5, G6, G7S, and G7H under Alternative5), the prescribed burns would only be done in the spring when fuel and soil moisture would not result in a severe burn that could produce hydrophobic soils or eliminate the soil duff layer.

Estimated Effectiveness – High - this practice is effective in retaining decomposing forest floor litter and organic matter to retain nutrients and soil productivity potential (Niehoff 1985; Niehoff 2002; USDA FS 2001a, 2002 and 2003).

k. Protection of Landslide Prone Unconsolidated Soils

The soils above the retention walls along Road 633 are unstable and would be protected using the following recommendations in addition to Best Management Practices:

- Retain live trees and root structure on the slope approximately 300 to 400 feet above the road prism up to the first main bench.
- Removal and fuels reduction of trees should be limited to those already dead or dying.
- Trees should be hand-felled towards the road; no ground-based equipment up to the first main bench.
- Where the ladder fuels next to the road are of concern, consider lopping/limbing the bottom branches of live trees to reduce potential progression of roadside fire, yet retain trees for slope stability.
- Maintain access trails from main Road 633 so that ditches can drain freely and are not obstructed by sediment or slash.
- Construct appropriate waterbars and slash protection for soils to keep additional sediment entry onto main road prism to a minimum.

Estimated Effectiveness – High - this practice would retain an appropriate amount of canopy cover and live roots to continue soil water uptake and stabilize soils (Gray and Megahan 1981; Megahan et al. 1978).

l. Protection of Soils from Weed Infestation

Weed mitigation measures and prevention practices would occur in accordance with the requirements of the Bonners Ferry Noxious Weed Management EIS (USDA FS 1995) for all landings, helicopter pads, and road disturbances.

Estimated Effectiveness – Moderate to High – Mitigation measures are accepted weed prevention practices developed by public land management agencies and university cooperative extension offices and promoted by weed management organizations across the nation (Drlik et al. 1998; Sheley et al. 2002; USDA FS 2001c). Effectiveness of weed mitigation practices are described in more detail in the earlier weed section.

2.9-B.3 Features Designed to Protect Fish and Fish Habitat

This section describes specific features which were selected for this project. A description of additional Inland Native Fish Strategy (INFS) standards and guidelines which are applicable, and their estimated effectiveness, are included in Appendix B.

a. Inland Native Fish Strategy

Standards and guidelines established by the Inland Native Fish Strategy (INFS) would be used to protect water quality and fish habitat, including the designation of Riparian Habitat Conservation Areas (RHCAs). These zones include 300-foot (slope distance) protection zones for fish-bearing streams, 150-foot (slope distance) protection zones for permanently flowing (perennial) non-fish bearing streams, ponds, lakes, reservoirs and wetlands greater than one acre and a 50-foot (slope distance) protection zone for intermittent streams and sensitive landtypes. With the exception of the ephemeral draws (discussed in section b. Ephemeral Draws below), commercial timber harvesting would be prohibited in these RHCAs.

Ephemeral draws would have a 50-foot (slope distance) protection zone if they are either directly tied to an intermittent channel or lack large woody debris and vegetation that prevent scouring or head cutting. Limited timber harvesting would be conducted to reduce fuels in designated draws (Units G2, G6, G7H, G7S and G9) under the limitations described in the "Ephemeral Draws" design feature described below.

Estimated Effectiveness: Generally high; a description of each applicable INFS standard and guideline and its estimated effectiveness may be found in Appendix B. These requirements would be implemented since they are incorporated into the project design. Research studies and monitoring results conducted on the Idaho Panhandle National Forests verify that when RHCAs or adequate buffer strips are incorporated into timber sales, sediment delivery to stream channels is "not measurable" or "is negligible" (USDA 2003, 2002, 2001, 2000, 1999, Belt et al 1992, Reid and Hilton 1998).

b. Ephemeral Draws

To reduce levels of hazardous fuels, limited activities would be allowed to occur within the 50-foot RHCA of the specified ephemeral draws in Units G2, G6, G7H, G7S and G9 under the restrictions listed below. There would be no activities within ephemeral draws in any other units.

- No ground based equipment within the RHCAs to prevent ground disturbance. If crossing one of these draws is necessary in order to reduce the need for multiple approaches of the road cut-slope to provide access for tractor

skidding in Unit G6, the hydrologist would be consulted to determine the best location of the crossing, taking into account BMPs, topography, methods (e.g. snow road, log cribs) is appropriate.

- Hand felling and whole tree yarding would be allowed in the draws where a feller buncher cannot reach in order to reduce fuels within the draw.
- Only lodgepole pine and Douglas-fir less than 12 inches dbh would be removed.
- All ponderosa pine and western larch would be designated as leave trees because they are more fire resistant and western larch would continue to add needles annually to the RHCA organic profile.
- Underburning would be allowed only in the spring to allow for a moist soil mantle and to avoid the consumption of large woody material during the fire.

Estimated Effectiveness: High; Leave trees within the draws would be designated by size and species during project layout. Fuel reduction activities under these requirements would be expected to maintain and not retard the attainment of appropriately functioning riparian management objectives for the draws (e.g. large woody debris, organic profile). Site-specific burn plans, which have been shown to be successful (USDA 1996), would be prepared for each unit that contains draws to be treated.

c. Protection of RHCAs During Prescribed Burning

There would be no fireline construction within any RHCAs; nor would prescribed fires be ignited within any RHCAs. However, during spring prescribed burning in Units G2, G4, G5, G6, G7H, G7S and G9, a backing fire would be allowed to creep into the outer edges of the designated 150-foot RHCAs as a low intensity underburn. There would be no activities within the RHCAs of any other units.

Estimated Effectiveness: High; these requirements would be implemented since they would be incorporated into the project design. Site-specific burn plans would be prepared for each area to be burned. Burning would occur when weather, fuel conditions and available resources are at the levels specified in the prescribed burn plan. The ability to allow only low intensity underburning within the outer edges of the listed RHCAs would be incorporated into the burn plan. Burns conducted in compliance with an approved prescribed burn plan have a very high success rate (USDA 1996).

d. Protection of Fish When Using Streams for Prescribed Burning Control

To avoid adverse effects to fish and redds while using natural water sources, water removal may not exceed 90 gallons per minute and pumping sites would be located away from spawning gravels. The intake hose would be screened to prevent accidental intake of small fish. An emergency spill clean up kit would be on site in the unlikely event of a fuel spill outside the containment system. This is consistent with INFS direction (USDA 1995; Appendix B, RA-5).

Estimated Effectiveness: High; a description of each applicable INFS standard and guideline and its estimated effectiveness may be found in Appendix B. These requirements would be implemented since they are incorporated into project design.

e. Protection of Aquatic Habitat During In Stream Work

Activities that would take place within perennial streams (e.g. culvert removal/replacement) would take place after July 15 and prior to September 15 to minimize erosion and sedimentation from these ground-disturbing activities, thereby reducing the risk of effects from sediment during spring runoff and to avoid effects to westslope cutthroat trout redds and staging or spawning bull trout downstream.

Estimated Effectiveness: High; this practice would be implemented because it would be part of the project design and it would be administered by the Timber Sale Administrator.

2.9-C Threatened, Endangered, and Sensitive Plants, and Forest Species of Concern (Rare Plants)

No rare plants were found in or near any areas proposed for treatment. Any changes to the selected alternative that may occur during layout would be reviewed, and rare plant surveys would be conducted as necessary prior to project implementation. Newly documented occurrences would be evaluated, with specific protection measures implemented to protect population viability. Such measures could include the following:

- Dropping units from harvest activity
- Modifying unit boundaries to provide a minimum 100-foot slope distance around documented occurrences
- Modifying harvest methods, fuels treatment or logging systems to protect TES plants and their habitat
- Implementing, if necessary, Timber Sale Contract provisions for Protection of Endangered Species, and Settlement for Environmental Cancellation.

Estimated Effectiveness: High. (No rare plants were found in or near any areas proposed for treatment.) The provisions would ensure that rare plant population viability would be protected in the event of changes to the selected alternative.

2.9-D Harvesting Systems

A variety of ground-based, cable, and aerial yarding systems are used. The selection of a certain system was based on a variety of factors including, but not limited to, resource protection, economics, and current and future access needs. If necessary, any on-site changes in logging systems would be made to protect resources.

As determined through monitoring, mechanical fellers would only be allowed off skid trails if they travel on snow, frozen ground, or a slash mat (to avoid levels of detrimental impacts that would exceed Region 1 Soil Quality Standards).

A Forest Service representative on logging operations would conduct a pre-work conference. Special conditions of the contract would be reviewed in advance (Garten 1991). The purpose of this measure is to make sure that resource protection objectives are clearly communicated and understood by all parties responsible for project implementation. When logging operations are active, they will be monitored, at least once a week, by the Forest Service Sale Administrator. Other resource specialists also monitor sale activities as described in the Watershed and Fisheries, Noxious Weed, and TES Plants design criteria.

Estimated Effectiveness: High. Timber Sale Contract provisions have been effective in protecting these natural resources.

Weed and release, underburning, or slashing treatments would be used in specific units (see descriptions of Alternatives 2 and 5) to reduce stocking levels of existing regeneration. Regeneration units would be planted with seral species that are adapted to local site conditions. All regeneration units would be successfully regenerated within five years.

2.9-E Features Designed to Protect Wildlife Habitat

a. Wildlife Tree Retention

Design features for the project were developed to ensure the retention and selection of snags at a level and distribution that have been shown to support viable populations of species that use them.

Snags and live tree replacements would be retained where opportunities exist in treatment units at levels recommended by scientific literature based on recent studies (Bull et al. 1997). Retention objectives are consistent with recent published data that suggests that populations of cavity nesters were viable in stands of ponderosa pine and mixed conifer forests that contained about four snags per acre (Bull et al. 1997). The following minimum amounts of snags and live tree replacements are to be retained within applicable cutting areas:

- Dry forest habitats: 4 snags and 8 live tree replacements/acre from the largest trees.
- Moist forest habitats: 6 snags and 12 live tree replacements/acre from the largest trees.

While retention objectives are accounted for on a treatment level scale, some snags would be represented on every 10 acres of treatment, in clusters or clumps where feasible, to promote good distribution of snags. Large diameter snags (greater than 15 inches diameter) that are felled for safety reasons would remain on site to provide for large woody debris recruitment and long-term site productivity.

Selection of snags and live tree replacements would emphasize practices that assure the highest probability for long-term retention (Bull, et al. 1997). The high hazard snags and snags in the advanced stages of decay would not be used to meet retention objectives (Intermountain Forest and Industry Association et al. 1995). Retention practices would focus on ponderosa pine, western larch, Douglas-fir and western red cedar trees, especially veteran or relic ponderosa pine and western larch trees. Trees killed by root disease should be avoided, where possible, to meet retention objectives because of their rapid deteriorate/fall-down rate.

Slash would be pulled back from veteran or relic ponderosa pine and western larch live trees and snags to protect them from the adverse effects of prescribed burning. Grapple piling would be considered to treat fuels on moderate slopes where residual snags would be at risk from broadcast burning.

Estimated Effectiveness – Moderate; this measure would be implemented using project layout, contract provisions, compliance monitoring and fuels treatment, and would have a moderate chance of avoiding and/or reducing adverse effects on snag dependent wildlife. It would not be the intent of this project to willfully remove the high hazard snags, and snags in the advanced stages of decay ("soft" snags). Some of these "soft" snags would survive and remain standing during the life of the project.

Past monitoring has demonstrated that tree harvesting and subsequent burning removes a large portion of existing snags, especially the "soft snags." However, through the strategic placement of leave patches or clumps, snags within these areas should be relatively protected. In addition, prescribed underburning will recruit "new" snags by fire-killing residual green trees. There would be no problem meeting and exceeding live tree replacement criteria in that vegetative prescriptions are designed

to leave ample green trees scattered in patches and individually (regeneration cutting), and uniformly (selective cutting) across treatment areas. Consequently, this measure should provide more than the minimum number of snags and live tree replacements.

b. Retention of Hardwood Trees

To maintain forest species diversity and wildlife habitat, aspen and birch trees would not be harvested for pulp. If for safety reasons these species need to be cut, they would remain on site for coarse, woody debris and long-term site productivity. Selected merchantable conifers in and around aspen patches would be removed to reduce competition for water, nutrients and sunlight.

Estimated Effectiveness – High; this measure has a high potential for being implemented. These measures would be implemented through contract provisions (see Section 2.6 subpart A for discussion of timber sale provisions), and compliance monitoring. Effectiveness is high because regardless of whether hardwood trees remain standing or felled for safety reasons, they remain on site and provide benefits to various wildlife species. Hardwoods, such as aspen and birch, will re-sprout if felled or killed by burning.

c. Dry Forest Ecosystems

Because there are fewer ponderosa pine trees in the northern Rocky Mountains than historically (Interior Columbia Basin Ecosystem Management Plan), it is necessary to retain large Douglas-fir trees in addition to the large ponderosa pine trees to achieve suitable habitat conditions for species associated with the drier habitats (e.g. flammulated owls, white-breasted nuthatch, Cassin's finch). For stands associated with the dry forest ecosystem, design harvest prescriptions to maintain the persistence of a mature ponderosa pine/Douglas-fir community by:

- Retaining an overstory canopy closure of 35-65 percent.
- Achieving a relatively open landscape of ponderosa pine/Douglas-fir that is structurally complex as opposed to a landscape that is structurally simple. Design for non-uniform spacing of trees (moderate within stand variability) with patchy microhabitats of understory trees.
- Retain patches (approximately 1/10th acre in size) of densely vegetated understory across all mature dry-site harvest units. Where possible, these patches should be in the vicinity of large residual snags or snag recruits.

Estimated Effectiveness – High; using silvicultural prescriptions, marking guides, contract inspections and appropriate fuel treatment methods, this feature would have a high likelihood of avoiding or reducing adverse effects on flammulated owl habitat. This feature is intended for selective cutting treatments that are designed to advance current stands toward larger, more open forest structure.

Estimated effectiveness is rated high because selective harvesting is a relatively light treatment, leaving a number of management options for the future.

d. Fuels Treatment

Where grapple piling is prescribed for fuel reduction, leave slash piles unburned to provide habitat for small forest animals (e.g. snowshoe hares), where consistent with fuels reduction objectives.

Estimated Effectiveness – High

e. Goshawk Nest Site Protection

Nest searches would be conducted during project layout and implementation. Operations and related activities would be suspended within approximately ½ mile of known or discovered nests between March 15 and August 15 to reduce risk of failure. Timing restrictions for activities can be removed after June 30 if nest site is determined to be inactive or unsuccessful. Existing and newly discovered nest sites would be protected by a 40-acre, no activity buffer during any contractual operations.

Estimated Effectiveness – Moderate to High; District marking and layout crews have been reliable in reporting new territories and alternate nests of existing territories in the vicinity of activity areas in past sales. The 40-acre no-activity area should provide an adequate post-harvest nest stand for goshawks as long as known nest trees are located near the center of the buffer. Seasonal restrictions are likely to minimize disturbance to active nests, particularly if ground-based systems are being used outside the one-half mile buffer.

f. Threatened, Endangered, and Sensitive Wildlife Species Management

If any threatened, endangered, or sensitive species were located during project layout or implementation, management activities would be altered, if necessary, so that proper protection measures are taken. Timber sale contract clause B(T)6.25, Protection Of Threatened, Endangered And Sensitive Species, would be included in any timber sale contract.

Estimated Effectiveness – High; using contract provisions, this feature would have a high likelihood of achieving desired objectives.

g. Grizzly Bear Restrictions

Logging of helicopter units that impact grizzly core (Units B1, B3, B6 & G9) would be restricted during the grizzly "spring" season (April 1 - June 14). Similarly, no helicopter yarding will be allowed during spring in helicopter Unit G7H, and in helicopter Unit G2 in the Pack River Occupancy Area. Harvesting and slashing of submerchantable timber in Unit G9 would be completed in two operating seasons, and harvest of Units B1, B3 and B6 would also be completed in two operating seasons. Timber harvest, grapple piling and slashing in Units B1, B3, B6 and G9 must be completed in four consecutive calendar years. Helicopter yarding of Units B1, B3, and B6 would not be allowed during the same bear year as helicopter yarding of Unit G9.

Timber hauling will not be permitted on FR 2405 and FR 1309 during the same Bear Year (April 1 – Nov 15) in order to remain compliant with Forest Plan security standard. The portion of Road 402-C reopened for project implementation will be returned to an undriveable condition following post-sale fuels treatments. All harvest units utilizing tractor yarding will be logged during the grizzly bear denning period (November 16 – March 31).

Estimated Effectiveness – High, these measures would minimize disturbance to grizzly bears, particularly during the sensitive spring season.

2.10 - Monitoring

2.10-A Introduction

The IPNF has developed a monitoring and evaluation plan that fulfills several needs. Monitoring is designed to gather the information and data necessary for evaluation. The collected information and data are then evaluated and interpreted to determine effectiveness of the project. The monitoring and evaluation plan looks at the following items:

- The degree to which the objectives, standards, and guidelines of the Forest Plan are being implemented.
- The effectiveness of management practices used in site-specific projects.
- Verification of the assumptions and models used in planning.

Forest Plan monitoring can include the following items: timber management, wildlife, watershed and fisheries, threatened and endangered plants, soil productivity, and visual quality objectives. Forest Plan Chapter IV section 7 includes the goals, elements, standards and practices to be used in monitoring and evaluation (Forest Plan, IV-7 through IV-13). Because of the nature of some of the monitoring items and the diversity of forest management projects, all of these items are rarely monitored on any one project.

Funding for the monitoring plan may vary; this may lead to assessing priorities as needed to assure the integrity of Forest Plan monitoring and evaluation direction. The IPNF prepares an annual Monitoring and Evaluation Report to document the results of monitoring conducted across the entire IPNF. Reports are available for public review on the IPNF website.

For activities related to this project, all alternatives would comply with specific monitoring requirements identified by the IPNF Forest Plan. The length of time needed for monitoring is determined by the results and evaluation of the activity or effect that is being monitored. When it is certain that regulations and standards are being met, monitoring of a particular element would cease. If monitoring evaluations show that regulations or standards are not being achieved at the desired level, management intervention would occur and monitoring would continue.

Not all monitoring is considered mandatory, and its implementation is not a consideration in the determination of environmental effects. Site-specific monitoring of project activities is designed to verify that the projects are effective in meeting project and Forest Plan objectives. Monitoring projects are designed to be accomplished during project activities, but are dependent upon the availability of funds and other resources.

Predicting the effects from our land management activities also depends on research information. Research findings used for this project can be found in the List of References.

2.10-B Project Monitoring (Implementation and Effectiveness)

Project implementation generally involves the efforts of a variety of individuals with both specialized and general skills and training. Employees are accustomed to working together to achieve the desired project objectives. For example, it is common for a sale preparation forester or sale administrator to discuss specific ground or project conditions with the wildlife biologist or hydrologist to apply the best practices on the ground. Joint field reviews are taken as needed. These steady informal

communications allow for incremental project adjustment throughout implementation to achieve the desired results. In addition to these less formal monitoring procedures, the following monitoring would be conducted:

2.10-B.1 Watershed Hydrology and Fisheries:

Best Management Practices: Best Management Practices (BMPs) are incorporated into many different phases of the project. The hydrologist would review the planned design of all temporary roads and all road maintenance to assure compliance with BMPs. The engineering representative and hydrologist would monitor all temporary and reconditioned roads to ensure that they were built or restored to specifications. The completed reports would be given to the IPNF Aquatics Program Leader, who forwards them to the State Bureau of Water Quality on an annual basis.

A sale administrator would visit each active cutting unit at a frequency necessary to assure compliance with the BMPs and the timber sale contract. Minor contract changes or contract modifications would be agreed upon and enacted, when necessary, to meet objectives and standards on the ground.

BMP effectiveness would be monitored following at least one runoff season after BMP implementation. Watershed rehabilitation projects typically are monitored annually or biannually for effectiveness and maintenance needs. Monitoring would be correlated with watershed exams on the sale area through the 5th year after project implementation based on available funding.

Decommissioned Roads: Decommissioned roads would be checked periodically during the first year (and periodically thereafter if no problems are noted) to monitor effectiveness of erosion control and noxious weed control.

Water Quality - The City of Bonners Ferry currently measures turbidity responses in the municipal watershed at their intake site. They will continue to monitor at their current level. There is potential (depending on funds available) for turbidity measurements to be taken at site specific locations during treatment activity. This would be to measure effectiveness of BMPs and insure minimal sediment introduction to the streams. It is suggested that these measurements be taken by the Forest Service or the City of Bonners Ferry.

Channel Stability – Stream morphology surveys would be conducted to establish permanent monitoring sites. This would include, but not be limited to, full cross-section measurements, photo points, bank pins where needed, etc. The measurements would record channel changes (changes in bank widths, depths, bedload, floodplains, entrenchment, etc.) in response to human and natural events. Pre-treatment measurements have been taken by the Forest Service. It is recommended that measurements be taken following treatment and at one-year, three-year, and five years post-treatment. It is also recommended to continue the monitoring every five years thereafter.

Permanent Stream Channel Cross-Sections: Cross-sectional profiles and dominant substrate have been measured in Myrtle and Snow Creek. Measurements would continue to occur, as appropriate, following post treatment activities to determine if any changes in stream channel morphology occur.

Bank Mass Failures – Bank mass failures, and causes for failures, would be recorded so as to monitor sediment introduction into the streams. This would be done through field observations and photo documentation. It is recommended that measurements be taken pre-treatment, post-treatment, then biannually thereafter.

Road Erosion – Road erosion, and causes of erosion, would be recorded to monitor sediment introduction into the streams. This would include effectiveness monitoring of established BMPs. Erosion risk ratings would be assigned to each road and road decommissioning sites would be identified and prioritized for maintenance. It is recommended that measurements be taken pre-treatment, following treatment, one-year, three-year, and five years after. It is also recommended to continue the monitoring every five years thereafter. It is suggested that these measurements be taken by the Forest Service, private industrial landowners, or both depending on location.

Culvert Failures – Culvert failures, and causes for failures, would be recorded to monitor sediment introduction into the streams. Failure risk ratings would be assigned to each culvert and culvert sites would be identified and prioritized for maintenance. It is recommended that measurements be taken pre-treatment, post-treatment, then annually thereafter. It is suggested that these measurements be taken by the Forest Service, private industrial landowners, or both depending on location.

Fisheries – Riparian Habitat Conservation Area requirements of INFS are monitored prior to treatment activities to verify compliance with INFS RHCA widths. At least 25 percent of the treatment units with RHCAs would be monitored.

2.10-B.2 Other Resources:

Wildlife: On a Forest-wide basis, northern goshawk nesting sites are currently being monitored. Known nesting sites are being visually inspected to determine occupancy. The monitoring frequency varies, based on funding. Surveys are conducted for additional nesting sites during project planning or implementation if nests are sighted.

The IPNF North Zone (Bonners Ferry, Sandpoint, and Priest Lake Ranger Districts) currently monitors core and road density (OMRD greater than 1 mi/square mile and TMRD greater than 2 mi/square mile) percentages in all Grizzly Bear Management Units (BMUs). This monitoring is reported to US Fish & Wildlife Service on an annual basis.

Soils – Treatment units that currently exceed or are at 15% detrimental impacts (Units G3 and G10), would be monitored post-harvest to assess if mitigation objectives were met.

Air Quality – During the burning of timber cutting residues (slash), smoke management guidelines would be followed as prescribed in the Idaho Smoke Management Memorandum of Agreement (1990), and the North Idaho Cooperative Smoke Management Plan (1990). Each airshed has a coordinator responsible for reporting all planned activity to a monitoring unit. The monitoring unit regulates the prescribed burning activities of all participants in the program. The Idaho Division of Environmental Quality recognizes this process as Best Available Control Technology for prescribed burning.

Air quality is monitored by the North Idaho and Montana Airshed Groups during the fall burning season and yearlong by the Idaho Department of Environmental Quality. Restrictions on prescribed burning for local air quality reasons may be implemented in addition to those imposed by the smoke management monitoring unit.

Timber Management - Each active harvest unit would be visited by a certified timber sale administrator at a frequency necessary to assure compliance with the timber sale contract. Minor contract changes or contract modifications would be enacted, when necessary, to meet objectives and standards on the ground.

The timber sale administrator and the engineering contracting officer representative (COR) would assure that timber and road (reconstruction and decommissioning) contract specifications are followed. The district hydrologist would also provide technical assistance and review as needed.

Units that are treated with a regeneration harvest would be surveyed by employees of the Timber Stand Improvement section of the district at one, three, and five year intervals following planting to certify regeneration. (Funding for the monitoring is mandated by the Knudtsen-Vandenburg Act in compliance with the National Forest Management Act and is assured through timber sale base rates.)

Fuels Treatment - The fuels treatments and silvicultural prescriptions and accomplishments are entered into the TSMRS database; also, walk through surveys are normally conducted after the work is completed.

Old growth - Verify applications of fuels reduction / silvicultural prescriptions to monitor whether or not they are in compliance with measures to protect old-growth trees and to determine if predicted results were achieved (post treatment). The stand structure and composition would be monitored through the use of established photo points. As discussed and agreed to during public collaboration, photos would be taken prior to treatment, a second time 30 days following harvest, and a third time after fuel treatment operations are completed. Jerry Pavia of the Idaho Conservation League and personnel from the Bonners Ferry Ranger District would conduct the photo point monitoring. District stand exams would also provide data on the stand structure and composition.

Snag Retention - A sample or portion of treatment units would be surveyed to evaluate the influences of forest management practices on wildlife tree retention practices and determine if predicted or stated objectives were achieved.

Noxious Weeds - Pretreatment of service landings and equipment as proposed (Features Common to All Action Alternatives) would be documented on sale inspection reports. The effectiveness of seeding disturbed areas would be evaluated upon completion of the activity. Treated areas would be surveyed and monitored according to treatment priorities established in the Bonners Ferry Noxious Weed Control Project FEIS.

TES Plants - Monitoring of sensitive plant populations where the proposed activity was modified by buffering to avoid adverse effects would be conducted to validate the effectiveness of mitigation measures during and following the activity.

Access Management - Proposed road obliteration work would be monitored during the implementation phase of the project and following the project to determine the effectiveness of obliteration methods.

2.11 - Comparison of Alternatives:

2.11-A Summary of No Action (Alternative 1), Proposed Action (Alternative 2) and Alternative 5

The maps and tables in this section present summaries and comparisons of all alternatives. Acreages and lengths of road segments are estimates based on field visits, aerial photo interpretation, TSMRS database information, and GIS/GPS data.

Table 2.11 Vegetation Treatment, Fuels Reduction & Transportation - Summary and Comparison

Feature	Alt 1	Alt 2	Alt 5
Regeneration Prescriptions (acres)			
Irregular Shelterwood (ISW)	0	867	206
Group Selection (GS)	0	1030	522
Total Regeneration Treatments	0	1897	728
Partial Cut Prescriptions (acres)			
Commercial Thin (CT)	0	189	139
Total Partial Cut Prescriptions	0	189	139
Total Acres of Vegetation Treatments	0	2086	865
Logging Systems (acres)			
Ground based	0	540	292
Skyline	0	417	203
Helicopter	0	1129	370
Fuels Treatment (acres)			
Grapple Pile	0	1022	346
Underburn	0	1064	519
Total Acres of Fuels Treated	0	2086	865
Transportation System Management (miles)			
Temporary Road Reconstruction – *decommission following use	0	0.6	0.6
Road Improvements	0	29	22
Identified for Road Decommissioning**	0	1	1

*Approximately 0.6 mile of Road 402-C would be reconstructed. Following post-harvest activities, this road plus an additional 0.4 mile to the junction with main Road 402 would be decommissioned.
** Road 1309-UA which is approximately 1 mile in length.

2.11-B Aquatics Effects by Issue Indicator

These tables summarize current conditions and estimated effects. No activities are proposed in the upper portion of Myrtle Creek or the upper portion of Snow Creek. Several issue indicators have common thresholds as shown (additional information is included in the Watershed Hydrology sections of Chapters 3 and 4, and Appendix D). The thresholds for water quality were supplied by the City of Bonners Ferry (the project file contains the Environmental Protection Agency's listing of national primary drinking water standards, received from the City). See Table 2.2 for descriptions of the indicators and the items used to measure existing conditions and degree of change.

Effects of No Action - Alternative 1: This alternative does not include road re-opening (Road 402-C), road decommissioning, silvicultural or fuels reduction treatments; thus there would be no effects to hydrology from such types of activities. However, no restoration or watershed improvement, or fuels reduction treatments would occur either. Not treating stands currently at high risk may increase the risk of the following events: stand loss due to wildfire, severe burning, erosion, and negative impacts to water quality, water yield, and peak flows.

Silvicultural (fuels reduction) treatments would not occur and stand conversion toward more desirable conditions would be delayed compared to Alternatives 2 or 5. The continued accumulation of dead and down fuels would contribute to an increased potential for locally severe fire effects on hydrology, including increased erosion, increased peak flows, increased water yields, and degradation of water quality. In the event of a fire or rain-on-snow event, the risk of roads that are not maintained contributing to sediment production would not be lessened.

Table 2.12 Aquatics – Summary and Comparison of Effects by Alternative

Entire Myrtle Creek Watershed

Issue Indicator	Common Threshold	Existing Condition	Alt 1 Change	Alt 2 Change	Alt 5 Change
Water Yield	10 to 20 percent	6% above baseline	See Effects of No Action, above.	2 % increase●	0% change
Peak Flow	10 to 20 percent	6% above baseline		2 % increase●	0% change
Sediment Erosion	Clean Water Act guidelines for municipal watersheds	33% above baseline		1 % increase●	0% change
Equivalent Clearcut Area	< 15% = Low, 15-30% = Moderate, >30% = High	14 percent		4 % increase○	0% change
Watershed Condition (density in mi/square mi.)	Level of Watershed Disturbance – Road Density ≤1.5 = Low, 1.5 to 3.0 = Moderate, >3.0 = High	Road Density is 2.51 mi/ sq mi		<1% decrease○	0% change
Channel Morphology – Risk of Change	Not Properly Functioning	Currently Functioning-at-Risk		Low ●	Low
Water Quality – Risk of Change	# See Note A below Mack Creek table			Low	Low

Lower Myrtle Creek (includes the area of the 2003 Myrtle Creek Fire)

Issue Indicator	Common Threshold	Existing Condition	Alt 1 Change	Alt 2 Change	Alt 5 Change
Water Yield	10 to 20 percent	17% above baseline	See Effects of No Action, above.	2 % increase●	0% change
Peak Flow	10 to 20 percent	16% above baseline		4 % increase●	0% change
Sediment Erosion	Clean Water Act guidelines for municipal watersheds	20% above baseline		1 % increase●	0% change
Equivalent Clearcut Area	< 15% = Low, 15-30% = Moderate, >30% = High	33 percent		6 % increase○	0% change
Watershed Condition	Level of Watershed Disturbance – Road Density ≤1.5 = Low, 1.5 to 3.0 = Moderate, >3.0 = High	Road Density is 1.25 mi/ sq mi		<1% decrease○	1% increase
Channel Morphology - Risk of Change	Not Properly Functioning	Currently Functioning-at-Risk		Low●	Low
Water Quality – Risk of Change	# See Note A below Mack Creek table			Low	Low

● Short-Term Change ○ Long-Term Change

Table 2-12 Continued, Aquatics – Summary and Comparison of Effects by Alternative

Mack Creek

Issue Indicator	Common Threshold	Existing Condition	Alt 1 Change	Alt 2 Change	Alt 5 Change
Water Yield	10 to 20 percent	4% above baseline	See Effects of No Action, above.	3 % increase •	0% change
Peak Flow	10 to 20 percent	5% above baseline		3 % increase •	0% change
Sediment Erosion	Clean Water Act guidelines for municipal watersheds	17% above baseline		5 % increase •	0% change
Equivalent Clearcut Area	< 15% = Low, 15-30% = Moderate, >30% = High	7 percent		6 % increase ○	0% change
Watershed Condition	Level of Watershed Disturbance – Road Density ≤1.5 = Low, 1.5 to 3.0 = Moderate, >3.0 = High	Road Density is 1.25 mi/ sq mi		0% change ○	0% change
Channel Morphology - Risk of Change	Not Properly Functioning	Currently Functioning-at-Risk		Low •	Low
Water Quality – Risk of Change	# See Note A below			Moderate	Low

• Short-Term Change ○ Long-Term Change

Note A – Effects to Water Quality: The City of Bonners Ferry monitors physical characteristics (such as turbidity, temperature, alkalinity) of the municipal water (see project files). Daily measurements of turbidity and pH at the intake of the water treatment plant show that the beneficial use for municipal water quality is fully supported.

Entire Snow Creek Watershed

Issue Indicator	Common Threshold	Existing Condition	Alt 1 Change	Alt 2 Change	Alt 5 Change
Water Yield	10 to 20 percent	3% above baseline	See Effects of No Action, above.	4 % increase •	2% increase
Peak Flow	10 to 20 percent	4% above baseline		4 % increase •	2% increase
Sediment Erosion	Clean Water Act guidelines for municipal watersheds	18% above baseline		2 % increase •	1% increase
Equivalent Clearcut Area	< 15% = Low, 15-30% = Moderate, >30% = High	6 percent		6 % increase ○	4% increase
Watershed Condition	Level of Watershed Disturbance – Road Density ≤1.5 = Low, 1.5 to 3.0 = Moderate, >3.0 = High	Road Density is 2.96 mi/ sq mi		< 1% decrease ○	< 1% decrease
Channel Morphology – Risk of Change	Not Properly Functioning	Currently Functioning-at-Risk		Low•	Low
Water Quality – Risk of Change				Low	Low

Lower Snow Creek

Issue Indicator	Common Threshold	Existing Condition	Alt 1 Change	Alt 2 Change	Alt 5 Change
Water Yield	10 to 20 percent	5% above baseline	See Effects of No Action, above.	6 % increase •	4% increase
Peak Flow	10 to 20 percent	5% above baseline		8 % increase •	6% increase
Sediment Erosion	Clean Water Act guidelines for municipal watersheds	23% above baseline		3 % increase •	1% increase
Equivalent Clearcut Area	< 15% = Low, 15-30% = Moderate, >30% = High	8 percent		13 % increase ○	10% increase
Watershed Condition	Level of Watershed Disturbance – Road Density ≤1.5 = Low, 1.5 to 3.0 = Moderate, >3.0 = High	Road Density is 3.2 mi/ sq mi		1% decrease ○	< 1% decrease
Channel Morphology - Risk of Change	Not Properly Functioning	Currently Functioning-at-Risk		Low •	Low
Water Quality - Risk of Change				Moderate	Moderate

• Short-Term Change ○ Long-Term Change

Table 2-12 Continued, Aquatics – Summary and Comparison of Effects by Alternative

Deep Creek (in the Cumulative Effects Area)

Issue Indicator	Common Threshold	Existing Condition	Alt 1 Change	Alt 2 Change	Alt 5 Change
Water Yield	10 to 20 percent	5% above baseline	See Effects of No Action, above.	0 % increase ●	0% change
Peak Flow	10 to 20 percent	5% above baseline		0 % increase ●	0% change
Sediment Erosion	Clean Water Act guidelines for municipal watersheds	23% above baseline		1 % increase ●	0% change
Equivalent Clearcut Area	< 15% = Low, 15-30% = Moderate, >30% = High	8 percent		1 % increase ○	0% change
Watershed Condition	Level of Watershed Disturbance – Road Density ≤1.5 = Low, 1.5 to 3.0 = Moderate, >3.0 = High	Road Density is 3.03 mi/ sq mi		0% change ○	0% change
Channel Morphology - Risk of Change	Not Properly Functioning	Currently Functioning-at-Risk		Low ●	Low
Water Quality - Risk of Change				Low	Low

● Short-Term Change ○ Long-Term Change

2.11-C Fire and Fuels

Table 2.13 Fuels - Summary of Direct and Indirect Effects for Each Alternative.
Fire behavior indicator values are for periods of high fire danger – a hot and dry year.

Indicator	Alternative 1 (No Action)	Alternative 2 (Proposed Action)		Alternative 5	
Improvement in Condition Class (Acres)	0	2,086 total		865 total	
		Myrtle Cr 900	Snow Cr 1186	Myrtle Cr 96	Snow Cr 769
Fuels					
Fuel Model	10	8		8	
Crown Fire Hazard					
Potential Flame Length (Feet)	29.0	1.3		1.3	
Canopy Base Height (Approx. Feet)	1.0	6.0		6.0	
Canopy Bulk Density (Approx. kg/m^3)	0.30	0.15		0.15	
Change in Predicted Fire Type (measured on the treated acres) (This is not a prediction of the size of fire should one occur.)	Crown Fire No change from existing conditions	Change from Crown Fire to Surface Fire on 2086 Acres Total		Change from Crown Fire to Surface Fire on 865 Acres Total	
		Myrtle Cr 900	Snow Cr 1186	Myrtle Cr 96	Snow Cr 769
Potential Rate of Spread (Chains/hour)	68.6	2.5		2.5	
Risk to Life and Resources - Suppression Capabilities					
Direct Attack by Hand Crews	No	Yes		Yes	
Production Rates	Low	High		High	
Fire Severity *	Mod.-High	Low		Low	

*** Fire Severity**: A product of fire intensity and residence time - the time, in seconds, required for the flaming front of a fire to pass a stationary point at the surface of the fuel (the total length of time that the flaming front of the fire occupies one point). Generally greater in a Fuel Model 10 as compared to a Fuel Model 8 due to the presence of heavy down woody material that contributes to longer burn periods and smoldering (Brown, Reinhardt, Kramer 2003).

2.11-D Forest Vegetation – Old Growth Stands

Table 2.14 Old Growth – Summary and Comparison of Effects by Alternative

Effects to the Dry Forest Old Growth Stands					
Alt 1		**Alt 2**		**Alt 5**	
Acres trended toward restoration of long-lived seral species such as ponderosa pine and western larch. Restoration and maintenance of these dry forest types is a primary concern for their short and long term resilience to drought, insects and disease.	0	Acres trended towards restoration of long-lived seral species such as ponderosa pine and western larch. Restoration and maintenance of these dry forest types is a primary concern for their short and long term resilience to drought, insects and disease.	242	Acres trended towards restoration of long-lived seral species such as ponderosa pine and western larch. Restoration and maintenance of these dry forest types is a primary concern for their short and long term resilience to drought, insects and disease.	0
Reduction of risk of stand replacement fire in old growth stands.	None	Reduction of risk of stand replacement fire in old growth stands.	62% in treated stands	Reduction of risk of stand replacement fire in old growth stands.	55% in treated stands

2.11-E Roadless Areas

The following table summarizes the anticipated effects of implementing the following alternatives. See the Chapter 4 Roadless Area discussion for more information.

Table 2.15 Selkirk Inventoried Roadless Area

Characteristic	Alternative 1 (No Action)	Alternative 2 (Preferred Alternative)	Alternative 5
Road Construction	0 miles	0 miles	0 miles
Changes in Natural Integrity	Fuels treatments would not be implemented in either of the IRAs. Untreated stands would continue to trend away from sustainable conditions and the natural integrity.	Fuels reduction treatments will trend toward improvement of the natural integrity, as well as reducing fire risks in the watershed.	Fuels treatments would not be implemented in either of the IRAs. Untreated stands would continue to trend away from sustainable conditions and natural integrity.
Changes in Natural Appearance	Changes in appearance would continue to occur as vegetation species composition and structure change. Although it would appear "natural" to the casual visitor, the area would continue to trend away from the historic vegetation species composition and structure.	Short-term effects such as stumps will be evident, but lessen over time following burning to treat fuels. Treated areas will have a more open park-like appearance than adjacent untreated stands. However, the more open appearance would be within the historic range of what the stands of vegetation looked like as a result of the natural fire regime.	No fuels treatments would be implemented in either of the IRAs. However, changes in appearance would continue to occur as vegetation species composition and structure change. Although it would appear "natural" to the casual visitor, the area would continue to trend away from the historic vegetation species composition and structure.
Changes in Opportunity for Recreation, Solitude	No Change	No Change	No Change
Amount & location of acres affected within the IRA	No Change	Approximately 424 acres of fuels treatments or 0.5% of the entire Selkirk IRA. Treatment areas B1, B4, B5 are adjacent to Myrtle Creek Road. Unit B5 is adjacent to private land. Units B6 and B3 follow Mack Creek and Adverse Creek toward their headwaters	No Change
Changes to Manageability or Boundaries	No Change	No Change - Treatments meet the management area goals identified in the Forest Plan; therefore, they would not likely influence any changes to the manageability of the roadless area or the boundaries.	No Change

Characteristic	Alternative 1 (No Action)	Alternative 2 (Preferred Alternative)	Alternative 5
Kootenai Peak	**Inventoried Roadless Area**		
Amount of Road Construction	0 miles	0 miles	0 miles
Changes in Natural Integrity	Fuels treatments would not be implemented in either of the IRAs. Untreated stands would continue to trend away from sustainable conditions and the natural integrity.	Fuels reduction treatments will trend toward improvement of the natural integrity, as well as reducing fire risks in the watershed.	Fuels treatments would not be implemented in either of the IRAs. Untreated stands would continue to trend away from sustainable conditions and natural integrity.
Changes in Natural Appearance	Changes in appearance would continue to occur as vegetation species composition and structure change. Although it would appear "natural" to the casual visitor, the area would continue to trend away from the historic vegetation species composition and structure.	Short-term effects such as stumps, skyline corridors in E3 and skid trail corridors in G8 will be evident, but lessen over time following fuels treatments and revegetation. Treated areas will have a more open park-like appearance than adjacent untreated stands.	No fuels treatments would be implemented in either of the IRAs. However, changes in appearance would continue to occur as vegetation species composition and structure change. Although it would appear "natural" to the casual visitor, the area would continue to trend away from the historic vegetation species composition and structure.
Changes in Opportunity for Recreation, Solitude	No Change	No Change	No Change
Amount & location of acres affected within the IRA	No Change	About 734 acres of fuels treatments (approx. 9% of the IRA) Portions of Units D1, D6, and all of D9 are in the narrow stringer along Myrtle Creek in the northwestern part of the roadless area. All three units are adjacent to Road# 1309 that gated through the summer for bear security.	No Change
Changes to Manageability or Boundaries	No Change	No Change - Fuel reduction treatments meet the management area goals identified in the Forest Plan; therefore, they would not likely influence any changes to the manageability of the roadless area or the boundaries.	No Change

2.11-F Soil and Soil Productivity

Table 2.16 Soil Issues and Indicators

Issue and Indicators	Alt 1	Alt 2	Alt 5
Soil Disturbance			
Number of Treatment Units at or below 15%	N/A	23 of 24 units	12 of 13 units
Number of Treatment Units with scheduled net improvements	N/A	2	2
Amount of Predicted Detrimental Disturbance -- Total Acres affected	N/A	Total = Approximately 151 acres (includes 57 acres pre-existing disturbance)	Total = Approximately 87 acres (includes 47 acres pre-existing disturbance)
Number of Treatment Units that would meet soil quality requirements post treatment	N/A	24 of 24 units	13 of 13 units
Nutrients - Potential Effects and Mitigation	No Change	Reduced nutrients on site; mitigated by over-wintering in all units. Slash from the tops, limbs and sub merchantable trees would be over wintered, providing nutrient recycling material.	Reduced nutrients on site; mitigated by over-wintering in all units. Slash from the tops, limbs and sub merchantable trees would be over wintered, providing nutrient recycling material.
Soil Productivity			
Coarse Woody Debris - Retained at appropriate levels	See Note 1	Yes	Yes
Areas of soil sterilization, reduced water infiltration, and lost ground cover below burn piles. – Short term, less than 10 years.	See Note 1	Effects would be localized and duration of effects would be short term (less than 10 years).	Effects would be localized and duration of effects would be short term (less than 10 years).
Reduction in ground cover (due to prescribed burns, skid trails, skyline corridors)	See Note 1	Reduction would be short-term (less than 10 years).	Reduction would be short-term (less than 10 years).
Risk of mass failure – Measured as Change in Risk – Generally, limited to steep slopes with saturated soils. Risk is highest for a few years after a stand replacement fire if the dead trees and their root systems fail to anchor the soil profiles. Risk diminishes as the slopes regenerate with young trees and brush, (short term < 10 years).	See Note 1	May increase below units B1, E3, E8, F1, D1, and D2. Concerns limited to steep slopes and roads below units. Adjacent past harvest treatments from the 1980s have since regenerated and no mass failures have occurred.	May increase below units D1 and D2. Risk is low because slopes are moderate and the past adjacent harvest treatments from the 1980's have since regenerated and no mass failures have occurred.

Net Improvement of Soils in Activity Areas with Predicted Detrimental Disturbance: Rehabilitation work is planned for areas that currently exceed or are at soil quality standards due to past impacts. Once proposed silvicultural treatments and site preparation activities are completed, the skid trails/rutting and an old road bed would be rehabilitated, thereby moving towards a net improvement in soil quality. This would be accomplished through decompaction, addition and incorporation of organic matter, seeding, and weed control. See section 2.9-B.2 Features Designed to Protect Soil and Soil Productivity for more information.

Table 2.16 Soil Issues and Indicators continued

Issue and Indicators	Alt 1	Alt 2	Alt 5
Risk from Wildfire, Degree of Fire Severity•			
Soil Erosion and Mass Movement Potential	See Note 1	Minor Potential Possibility of limited effects, depending on location.	Minor Potential Possibility of limited effects, depending on location.
Soil Health and Productivity Degree of change and level of effects	See Note 1	Small, and in most cases, acceptable affects would influence soil health and productivity.	Small, and in most cases, acceptable effects would influence soil health and productivity.
Chances for High Severity Fire Effects Change compared to No Action	See Note 1	Likely to be Reduced in Treated Areas (approximately 2086 acres)	Likely to be Reduced in Treated Areas (approximately 865 acres)

• Fire Severity: A product of fire intensity and residence time, it is the time (in seconds) required for the flaming front of a fire to pass a stationary point at the surface of the fuel (the total length of time that the flaming front of the fire occupies one point). See the Fire and Fuels discussions for more information. The fire severity affects the surface fuels, duff layer, and upper layer of soil to varying degrees.

Note 1 – Effects of Alternative 1: This alternative does not include road re-opening (Road 402-C), road decommissioning, silvicultural or fuels reduction treatments; thus there would be no effects to soils from such types of activities. However, no soil restoration or watershed improvement, or fuels reduction treatments would occur either. Not treating stands currently at high risk will increase the risk of stand loss due to wildfire, severe burning, erosion concerns, and loss of soil nutrients. The introduction of weeds and unwanted flora following a fire could lead to higher competition between less desirable plants and native vegetation.

Silvicultural treatments would not occur and stand conversion toward more desirable conditions would be delayed compared to Alternatives 2 or 5. The continued accumulation of dead and down fuels would contribute to an increased potential for locally severe fire effects on soil, including physical alteration of soil structure and development of hydrophobic layers. In the event of a fire or rain-on-snow event, the risk of roads contributing to sediment production would not be lessened.

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Chapter 3 -- Affected Environment

3.1-A Introduction

This chapter describes the current condition of the resources as related to the key issues. These issues represent components of the environment that would affect, or that could be affected by the alternatives. Much of the information in this chapter incorporates findings from the Upper Columbia River Basin study (http://www.icbemp.gov/) and the IPNF North Zone Geographic Assessment (NZGA). The North Zone geographic area consists of approximately one million acres (Bonners Ferry, Sandpoint, and Priest River Ranger Districts) of the northern portion of the IPNF. Assessments of individual sub-basins (essentially ranger districts) were also conducted. For this document the Kootenai River sub-basin is essentially the Bonners Ferry Ranger District (BFRD) and accounts for roughly 400,000 acres.

Resources topics are discussed in the following order:

- Watershed Hydrology
- Fire and Fuels
- Old Growth - Vegetation
- Soils
- Roadless Areas

Changes between the Draft and Final EIS

To aid the reader's understanding of the Myrtle Creek HFRA project, the format for this Final EIS was improved in the following ways:

- **Watershed Hydrology** – A Summary of Existing Conditions has been included immediately following the description of the Scope of Analysis and Cumulative Effects Area. Various portions of this discussion have been reorganized and much of the supporting data has been moved from Chapter 3 to Appendix D (for example, Channel Morphology definitions are now in Appendix D). Information about the assumptions and limitations of computer models used in the analysis is located in Appendix D. Maps are now located in the Map Appendix. Please refer to these appendices as noted in the Watershed Hydrology discussions.
- **Fire and Fuels** – There is further discussion of fire regimes and an overall summary has been added. Some of the maps are included in the map appendix.
- **Vegetation and Old Growth** – There have been only small changes, in particular the addition of greater discussion on the regulatory framework, including compliance with the Healthy Forests Restoration Act, and moving the map of past harvest activities to the Map Appendix.
- **Soil Resources** – This documentation was moved from Appendix A to Chapters 3 and 4; see maps in the Map Appendix.
- **Roadless Areas** – Discussion of roadless areas was also moved from Appendix A to Chapters 3 and 4; see maps in the Map Appendix.

3.2 - Watershed Hydrology

3.2-A Scope of the Analysis and Cumulative Effects Area

The watershed resources section considers physical processes, such as, water yield and sediment yield, including effects on channel morphology and water quality. It is closely linked to the Soils and Fisheries sections, generally deriving information from Soils and contributing information to Fisheries.

The geographic scope of the analysis for watershed resources includes two 5th code watersheds, Kootenai River Below Bonners Ferry (1711010405) and Deep Creek (1701010404). Kootenai River contains six 6th code subwatersheds (also known as prescription watersheds). Project activities are located in only one of the six 6th code subwatersheds of Kootenai River: the Myrtle Creek subwatershed (170101040502). Deep Creek contains eight 6th code subwatersheds. Project activities are located in two of the eight subwatersheds of Deep Creek: the Snow

HUC: Hydrologic Unit Code

A nested hierarchical system for delineating watersheds. Land units are based on hydrologic divides. The larger the HUC ranking, the smaller the watershed. For example, a 6th code HUC is a smaller watershed than a 4th code HUC.

The 6th codes within the Myrtle Creek HFRA analysis area are: 170101040502 (Myrtle Creek), 170101040408 (Snow Creek), and 170101040405 (Deep Creek).

Creek subwatershed (170101040408) and the Deep Creek subwatershed (170101040405). The Watershed Boundaries Map (Map Appendix – Aquatics Map 1) shows the project area watersheds. The affected area for cumulative effects analysis includes the Myrtle Creek, Snow Creek, and Deep Creek subwatersheds.

The time period for the water and sediment yield analysis from project activities is approximately 10 years. Most effects from proposed fuels reduction treatments should be manifested within 10 years (Hydrology Project Files). Water and sediment yield effects from logging activities have been considered since the late 1950s (King, 1989; Elliot and Foltz, 2001) which corresponds to the period when timber harvest programs on National Forests expanded to help the nation meet the lumber needs for the post World War II housing.

Sediment yield effects from silvicultural activities are expected to be recovered within that time period; whereas roads are considered to have sediment yield effects throughout their life (Beschta 1978; Bilby et al. 1989; Burroughs and King, 1989; Elliot and Foltz, 2001).

3.2-B Summary of Existing Conditions

3.2-B.1 Conditions Common to Myrtle and Snow Creeks

Both streams are long, perennial streams within glaciated valleys with frequent tributaries (including Mack, White Pine, and Yellow Pine Creeks in the Myrtle Creek watershed, and Curve Creek and three unnamed tributaries in the Snow Creek watershed). The tributaries are frequently intermittent and are deeply incised. Bedrock, boulder, and outwash associated with the historic glaciation control the deeply entrenched main channels.

Elevations are very similar, ranging from 1797 feet to 5375 feet in Myrtle Creek and 1760 feet to 5921 feet in Snow Creek. Annual precipitation averages 36 inches in Myrtle Creek and 40 inches in Snow Creek. Portions of both drainages are within the rain-on-snow elevational zone (approximately 28 percent of Myrtle Creek and 39 percent of Snow Creek). The dominant channel forming and sediment transport events are associated with spring runoff.

National Forest System lands make up the largest land ownership in both watersheds (78 percent of Myrtle Creek and 73 percent of Snow Creek). Forest Capital Partners are the largest private landowners/managers of industrial timber lands in the drainages (18 percent of Myrtle Creek and 23 percent of Snow Creek). The bulk of their land is located in a checkerboard pattern in the upper portions of the drainages. Minor amounts of land (from one to four percent) are owned/managed by the US Fish and Wildlife Service (Kootenai National Wildlife Refuge), State of Idaho Department of Lands, US Bureau of Land Management, and smaller private landowners. (See Figure 1-1 Vicinity Map.)

For this analysis, the existing condition represents the conditions that existed in the years 2004 and 2005. The following features are found in the two major drainages included in the project area/cumulative effects area:

- Rain-on-snow and resulting flash floods or debris flows, or both, are natural processes within the Selkirk Mountains.
- Under the pending status of the TMDLs, there will be no net increase in temperature or sediment due to management activities in Myrtle, Snow or Deep Creek.
- Surface erosion is the dominant erosion process on roads.

Designated beneficial uses, which are fully supported, are as follows:

- cold water communities,
- salmonid spawning, and
- primary contact recreation.

No tributaries in the project area have designated beneficial uses, but existing uses generally include cold-water communities, salmonid spawning and secondary contact recreation.

Roads (including culverts) were the main indicator for assessing Watershed Condition in the project area. Surface erosion is the dominant erosion process on roads within both watersheds. Almost all of the roads in the two watersheds were constructed or improved before BMPs were established. With regard to road density, Myrtle Creek and Snow Creek are in the moderate condition category; with approximately 1.33 stream/road crossings per square mile in each entire watershed. (See Aquatics Map 5 in the Map Appendix.)

3.2-B.2 Conditions in Myrtle Creek Watershed

The entire Myrtle Creek Watershed, on the east slopes of the Selkirk Mountains, is approximately 21,760 acres in size.

Although past timber harvests and wildfires have affected water yield and timing of flows in portions of the watershed, these changes are not making enough difference to be measured at the City's municipal water intake facility. The main channel is in fair to good condition with fair to good stability and is considered to be functioning-at-risk (as is the watershed as a whole). In most areas, riparian vegetation is abundant. The drainage exhibits signs of a mildly impaired watershed with variable stream bank stability. Although there is erosion of banks and sediment transport in some reaches, the system has been able to accommodate and contain the resulting energy and material.

Water yield for Myrtle Creek is currently estimated at 6% above baseline.
Peak flow for Myrtle Creek is currently estimated at 6% above baseline.
ECA for Myrtle Creek is currently estimated at 14% above baseline.

Designated beneficial uses in addition to those listed above, are as follows:

- public water supply (municipal water) for the City of Bonners Ferry.

Myrtle Creek has been the municipal water source for the City of Bonners Ferry since 1928 and currently serves roughly 3,500 people (including the Kootenai Tribe of Idaho). The City has two water rights totaling 8.8 cubic feet per second. Water quality monitoring by the City indicates that the beneficial use for municipal water quality is being fully supported.

TMDLs, currently in the process of development, are for water temperature and sediment (siltation). Six segments (which are not all within the activity area) are listed (for temperature modifications) in the 2002 TMDL Integrated Report.

The Myrtle Creek Fire in 2003 increased the sensitivity of the watershed (affects of the fire are discussed throughout the various resource sections of Chapter 3 – Fire/Fuels, Vegetation, Soils; and Appendix A – Wildlife, and Fisheries). In the event of another fire, the additive impacts would be greater than would have occurred if the areas had not experienced a fire in 2003.

3.2-B.3 Conditions in Snow Creek Watershed

The entire Snow Creek Watershed, on the east slopes of the Selkirk Mountains, is approximately 14,464 acres in size.

Past timber harvest and wildfires have affected water yield and timing. The following increased percentages above background are due to timber harvest and road construction that were carried out before the development and required use of Best Management Practices (BMPs).

Water yield for Snow Creek is currently estimated at 3% above baseline.
Peak flow for Snow Creek is currently estimated at 4% above baseline.
ECA for Snow Creek is currently estimated at 6% above baseline.

Snow Creek is considered to be functioning-at-risk and in fair to poor condition for morphology, with fair to poor stability; as a whole the watershed is considered poor to moderate in aquatic habitat quality and aquatic organism support. However, large woody debris is abundant in most areas. It exhibits signs of a mildly impaired watershed with variable stream bank stability. Although there is erosion of banks and sediment transport in some reaches, the system has been able to accommodate and contain the resulting energy and material.

Two segments are listed (for temperature modifications) in the 2002 TMDL Integrated Report.

3.2-B.4 Conditions in Deep Creek Watershed

The Deep Creek watershed is the smallest of the three (about 12,871 acres), and also has the least amount of National Forest System lands (approximately 47 percent). Other federal and state agencies own approximately 39 percent, Forest Capital Partners own less than one percent, the remaining approximately 14 percent is privately owned.

Due to the fact that silvicultural treatments are proposed for only approximately 0.3 percent of the watershed, the location of the activities, and that only 18 percent of the watershed is within this project's cumulative effects area, the potential for affecting Deep Creek is almost negligible.

A brief description of the watershed is included in section 3.3-C.

3.2-C Regulatory Framework

The principle regulatory framework governing management of watershed resources on the Idaho Panhandle National Forests (IPNF) for the analysis includes the following regulations:

- National Forest Management Act of 1976 (NFMA)
- Idaho Panhandle National Forests Land and Resource Management Plan (Forest Plan) (USDA 1987)
- Federal Water Pollution Act (Clean Water Act) as amended (33 U.S.C. §§ 1251-1387, October 18, 1972, as amended)
- State of Idaho's implementation of the Clean Water Act
- Rules pertaining to the Idaho Forest Practices Act (Title 38, Chapter 13, Idaho Code 2000)
- Idaho Stream Channel Protection Act (IDAPA 37.03.07)
- Executive Order 11988 - Management of Floodplains
- Executive Order 11990 – Management of Wetlands
- Executive Order 13084 – Consultation and Coordination with Indian Tribal Governments
- Safe Drinking Water Act of 1974, as amended

a. The National Forest Management Act of 1976 (NFMA)

The National Forest Management Act of 1976 (NFMA) requires that the Forest Service manage for a diversity of fish habitat to support viable fish populations (36 CFR 219.19). Direction is also included in the Idaho Panhandle National Forests Forest Plan (USDA 1987). The Inland Native Fish Strategy (INFS; USDA 1995) amended some Forest Plan direction regarding stream and fish habitat protections measures (see Fisheries Report).

b. Idaho Panhandle National Forests Land and Resource Management Plan

The IPNF Forest Plan directs that water resources be managed at levels designed to meet management objectives for watersheds. Riparian areas are to be managed to feature dependent resources (fish, water quality, maintenance of natural channels, certain vegetation, and wildlife communities) while producing other resource outputs at levels compatible for the objective for dependent resources (IPNF Forest Plan Section II-6).

Management activities will comply with state water quality standards through the use of Best Management Practices (BMPs) and through scheduling the rate and location of activities to ensure that State Water Quality Standards are met or surpassed (IPNF Forest Plan Section II-9) (IPNF Forest Plan Section II-33). The outcome of these BMPs will be monitored to determine their effectiveness. Water quality that is below Forest standards will be improved through restoration projects. Management activities on Forest lands will not significantly impair the long-term productivity of the water resources and ensure that state water quality standards will be met or surpassed (IPNF Forest Plan Section II-33).

Lands within public water systems will be managed for multiple-uses within the water quality standards for public water supplies. The application of appropriate conservation practices will ensure that the quality of individual water bodies will not be significantly affected by sediment production (BMP Guidelines).

The IPNF Forest Plan Section II-33 also indicates that it is the intent of the Forest Plan that models be used as a tool to approximate the effects of National Forest activities on water quality values. The models will be used in conjunction with field data, monitoring results, continuing research and professional judgment, to further refine estimated effects and to make recommendations.

c. Federal Water Pollution Act (Clean Water Act) and Idaho State Water Quality Standards

The Clean Water Act stipulates that states are to adopt water quality standards. Included in these standards are provisions for identifying beneficial uses, establishing the statutes of beneficial uses, setting water quality criteria, and establishing BMPS to control non-point sources of pollution. The "no net increase" criterion is a provision in the Idaho Water Quality Standards for high priority water bodies prior to approval of a Total Maximum Daily Load (TMDL). See Appendix D, Section D.2 for more information regarding TMDLs.

Idaho Water Quality Standards designate beneficial uses for Myrtle Creek, Snow Creek and Deep Creek. They are as follows:

a) Myrtle Creek: public water supply (municipal water) for the City of Bonners Ferry, cold water communities, salmonid spawning, and primary contact recreation.
b) Snow Creek: cold water communities, salmonid spawning, and primary contact recreation.
c) Deep Creek: cold water communities, salmonid spawning, primary contact recreation, domestic water supply, and special resource water.

Tributaries of Myrtle Creek, Snow Creek, and Deep Creek within the project area do not have designated beneficial uses. However they do support existing beneficial uses and these are protected under the water quality standards.

The Watershed Boundary Map (Map Appendix – Aquatics Map 1) displays the Hydrologic Unit boundaries in the general area of this project. The darker grey area in the northern half of the map portrays the 5th Code Kootenai River HUC, which is then subdivided into smaller 6th code HUCs including Myrtle Creek in the center of the map. The lighter grey area in the southern half of the map represents the 5th Code Deep Creek HUC, which is subdivided into smaller 6th Code HUCs including Snow Creek and Deep Creek below Brown Creek (center of the map).

A Kootenai River Subbasin Assessment and development of TMDLs has been conducted through a joint effort of the Idaho Department of Environmental Quality, the Environmental Protection Agency, and the Kootenai Tribe of Idaho (IDEQ, et. al. 2005). The IPNF participated in the process with technical input and representation on the Kootenai Valley Resource Initiative (KVRI) Watershed Advisory Group. This comprehensive analysis determines whether water bodies meet state water quality standards and support beneficial uses, or if additional pollution controls are needed. The TMDL "Integrated Water Quality Monitoring and Assessment Report" (Integrated Report) is required by the Clean Water Act (IDEQ, et.al. 2005). The TMDLs applicable to the project area, which are currently in the process of development, are for water temperature and sediment

Using the currently approved 2002 integrated report (approved by EPA in December 2005 (Hydrology Project Files), the following TMDL Assessment Units are within the project area and cumulative effects analysis area.

Table 3.1 2002* TMDL Assessment Units in the Myrtle HFRA Cumulative Effects Analysis Area.

Unit	Stream	Support	#Section Status	Miles	Pollutant of Concern
**013_02	Jim Creek	Not Assessed	3	2.54	Thermal Modifications
**013_02	Mack Creek	Not Assessed	3	2.73	Thermal Modifications
**013_02	Myrtle Creek	Not Assessed	5 & 3	3.99	Thermal Modifications
**013_03	Myrtle Creek	Not Supporting	5 & 3	11.2	Thermal Modifications
**013_02	Peak Creek	Not Assessed	3	1.9	Thermal Modifications
**013_02	Cooks Creek	Not Assessed	3	2.38	Thermal Modifications
**016_02	Snow Creek	Not Supporting	5	4.61	Thermal Modifications
**016_03	Snow Creek	Not Supporting	5	7.4	Thermal Modifications
**015_04	Deep Creek	Not Supporting	5 & 3	4.31	Siltation, Suspended Solids, Thermal Modifications
**018_04	Deep Creek	Not Supporting	5 & 3	4.01	Siltation Thermal Modifications
**019_04	Deep Creek	Not Supporting	5	4.63	Siltation, Suspended Solids, Thermal Modifications
**022_03	Deep Creek	Not Supporting	5 & 3	6.58	Siltation, Thermal Modifications
**023_0L	Deep Creek	Not Assessed	3	1.91	Not Assessed
**025_02	Deep Creek	Not Supporting	5 & 3	4.12	Thermal Modifications

* Approved by EPA, December 2005

** Units numbers all start with ID17010104PN, for example the full number for the first unit is ID17010104PN013_02

Section Status definitions are described in Appendix D.2 In summary, The Integrated Report classifies all of the state's waters into one or more of five different categories, which correspond to the five sections of the report: Section 1: Water of the State Attaining All Standards; Section 2: Waters of the State Attaining Some (most) Standards; Section 3: Waters of the State with Insufficient Data and Information to Determine if Any Standards are Attained; Section 4: Impaired or Threatened for One or More Standards but Not Needing a TMDL; Section 5: TMDL Needed

Under the pending status of the TMDL, there will be no net increase in sediment or temperature due to management activities in Myrtle Creek, Snow Creek, and Deep Creek Watersheds. Please see Appendix D.2-Total Maximum Daily Loads, for a more comprehensive definition of the TMDL section listings and its process. See Hydrology Project Files for the Assessment Unit Status Reports for the segments listed above. The supporting status of the beneficial uses is also described in more detail in the Hydrology Project Files.

d. Idaho Forest Practices Act

The Idaho Forest Practices Act regulates forest practices on all land ownerships in Idaho. Forest practices on National Forest System lands must adhere to the rules pertaining to the Act (IDAPA 20.02.01). The Forest Service has agreements with the State to implement Best Management Practices or Soil and Water Conservation Practices for all management activities. Proposed activities will be in compliance with the guidelines in the Soil and Water Conservation Handbook (Forest Service Manual 2509.22), which outlines Best Management Practices that meet the intent of the water quality protection elements of the Idaho Forest Practices Act.

e. Idaho Stream Channel Protection Act

The Idaho Stream Channel Protection Act regulates stream channel alterations between mean high water marks on perennial streams in Idaho. Instream activities on National Forest System lands must adhere to the rules pertaining to the Act (IDAPA 37.03.07). The rules are also incorporated as BMPS in the Idaho Water Quality Standards.

f. Executive Order 11988 – Protection and Management of Floodplains

Federal Executive Order 11988 provides for the protection and management of floodplains. The rules are also incorporated as BMPS in the Idaho Water Quality Standards.

g. Executive Order 11990 – Protection and Management of Wetlands

Federal Executive Order 11990 provides for the protection and management of wetlands. The rules are also incorporated as BMPS in the Idaho Water Quality Standards.

h. Executive Order 13084 – Consultation and Coordination with Indian Tribal Governments

Federal Executive Order 13084 deals with the consultation and coordination with Indian Tribal Governments.

i. Safe Drinking Water Act

Under the Safe Drinking Water Act Amendments of 1996, all states are required by the U.S. Environmental Protection Agency to assess every source of public drinking water for its relative sensitivity to contaminants regulated by the Act. This assessment is based on a land use inventory of the designated assessment area and sensitivity factors associated with the watershed characteristics. Source water protection activities for the City of Bonners Ferry should continue to focus on preventing sediment into Myrtle Creek. Coordination with the U.S. Forest Service and other land owners is critical to ensure the watershed continues to provide high quality water. Due to the fairly short time associated with the movement of surface water, source water protection activities should be aimed at both short-term and long-term management strategies to counter any future contamination threats. The Source Water Protection BMPs (dated October 12, 2005 Draft) under the Safe Drinking Water Act are being implemented at this time, even though they are still labeled as "draft". The BMPs are intended to be a "living document" and may be updated periodically.

3.2-D Analysis Methods and Key Issue Indicators

The assessment of existing condition describes the current condition of the project area, and provides a basis for comparing the effects of management alternatives. Existing condition synthesis was obtained from historical and current fieldwork, GIS-generated reports, historical hydrology files, historical records, aerial photographs, published scientific literature, model outputs, roads analysis and current on-going research. The analysis compares the effects of management proposals on five watershed resource indicators, detailed below. Though discussed independently, there is considerable interaction between these indicators within the watershed and stream channel system.

The watershed key issue indicators and their importance for this project are as follows:

- Watershed Condition – helps gage the effects of past natural disturbances and management in the Myrtle and Snow Creek drainages. Road density is used as a proxy, in part because the amount of roads also gives an indication of the degree of past management activities.
- Water Yield – the amount of water coming off a location affects the peak flows in a channel and could affect the water discharge in Myrtle and Snow Creeks.
- Sediment Yield – sediment content is of concern in a municipal watershed, such as Myrtle Creek (per the Safe Drinking Water Act).
- Channel Morphology – serves as a means of measuring the function status of a channel based on physical dimensions, patterns, and profile.
- Water Quality – physical and chemical characteristics could affect the quality of the municipal water (per the Safe Drinking Water Act).

Throughout Chapter 3, concerns in the existing condition of the watershed resource will be discussed, as will the aspects of the watershed that are currently meeting or exceeding guidelines or standards. The proposed action and alternatives have been designed to address resource concerns; however, for concerns that could not be minimized or avoided through the design criteria, mitigation measures would be used to lessen these concerns (see Chapter 2 Design Features and Mitigation Measures).

3.2-D.1 Indicator 1 – Watershed Condition

Watershed condition indicators are a series of metrics that can be used to index the level of disturbance in a watershed. They are usually expressed as densities or discrete amounts of various disturbances within a watershed. For example, road density expressed in miles of road per square mile (mi/mi2) of watershed area is a common watershed condition indicator. Extensions of that include road density within Riparian Habitat Conservation Areas (RHCAs) or Landslide Prone Terrain (LSP). Other indicators include various forms of timber harvest density, such as percent of the watershed harvested, percent of RHCAs harvested and percent of LSP terrain harvested.

Various guidelines have been employed to rate watershed condition based on these indicators (NOAA, et. al 1998; Pfankuch, 1975; Rosgen, 2001; Patten, 1989; IPNF NZ HUC Model).

Equivalent Clearcut Area (ECA) analysis is a tool used to index the relationship between vegetation condition and water yield from forested watersheds. The basic assumptions of the procedure are that removal of forest vegetation results in water yield increases and that ECA can be used as an index of these increases. Depending on the interaction between water yield, sediment yield, peak flows, and stream channel conditions, such increases could have impacts on stream channels.

Water yield increases can be directly modeled, but equivalent clearcut area (ECA) is often used as a surrogate. ECA is used to estimate changes in canopy opening resulting from forest practices or treatments (roading, timber harvest, and fires), which remove or reduce vegetative cover, and is usually expressed as a percent of watershed area (Belt, 1980).

For purposes of assessing effects of this project, ECA was used to index changes in water yield through time based on timber harvest and roading disturbances. The ECA of the project area was derived using WATSED. The ECA associated with historic wildfires is also considered in the cumulative effects analysis.

There are a number of physical factors that determine the relationship between canopy conditions and water yield; thus, it is important to take all factors into consideration when determining overall watershed health. These include interception, evapotranspiration, shading effects and wind flux. These factors affect the accumulation and melt rates of snow packs and how rainfall is processed. ECA analysis takes into account the initial percentage of crown removal and the recovery through vegetative re-growth since the initial disturbance in the case of silvicultural treatments or fire. Within the habitat types being treated under this project, the time frame for complete ECA recovery to occur is estimated to be 65 to 85 years (USDA FS, 1974).

Additional factors affecting water yield include compacted surfaces due to roads, skid trails, and landings. Existing and new roads are considered as permanent openings in the ECA model.

> **Bankfull Discharge –** Channel maintaining discharge that fills the channel to bankfull level, just before reaching the floodplain.
>
> The bankfull stage and its attendant discharge serve as consistent morphological indices, which can be related to the formation, maintenance, and dimensions of the channel as it exists under the modern climatic regime.

Various ECA thresholds of concern have been in use in the Northern Region since the 1960s (Gerhardt, 2000). Early cutting guides recommended a limit of 20-30 percent ECA within a watershed (Haupt, 1967). Currently, ECAs ratings of less than 15% equal Low, 15 to 30% equal Moderate, and greater than 30 percent equal to High are often used (Kootenai National Forest, USDA Nez Perce National Forest.) Belt (Belt, 1980)concluded that the ECA procedure is a rational tool for evaluation of hydrologic impacts of forest practices.

3.2-D.2 Indicator 2 – Water Yield

Water yield increases can be directly modeled, but equivalent clearcut area (ECA) is often used as a surrogate. ECA is used to estimate changes in canopy opening resulting from forest practices or treatments (roading, timber harvest, and fires), which remove or reduce vegetative cover, and is usually expressed as a percent of watershed area (Belt, 1980).

For purposes of assessing effects of this project, water yield was used to index changes in water yield through time based on timber harvest and roading disturbances. The water yield of the project area was derived using WATSED. The water yield associated with historic wildfires is also considered in the cumulative effects analysis.

Concern over water yield changes relative to stream channel condition has focused on smaller headwater catchments. Research in small watersheds have demonstrated instantaneous peak flow increase up to 34 percent and maximum daily flow increases up to 87 percent, resulting from road construction and timber harvest in small catchments (King, 1989). Recent observations have suggested that channel erosion from these streams may be contributing to increased bedload sediment in the 3rd order receiving channel (Gerhardt, 2000).

To understand changes and fluctuations with historic water yield and peak flow conditions, peak flows were modeled using WATSED. It is evident that peak flows are not static, but dynamic following disturbances. Following fires it is evident that peak flows are higher than background rates. Historically, when stand replacing fires removed the forest vegetation, water yield values rose sharply, then gradually declined to baseline condition (Patten, 1989). Research in the region has shown that causes of some peak flows are also associated with less frequent mid-winter rain-on-snow events and spring rain-on-snow events (MacDonald and Hoffman 1995). Their research showed that spikes were usually higher and over a shorter duration than what is currently modeled. WATSED cannot predict peak flows from these events because the timing and magnitude are unpredictable; they do not occur on an annual basis and are dependent on certain climatic conditions such as air temperature, intensity and duration of precipitation, rain-on-snow elevations, and snowpack characteristics (Berris and Harr 1987). However, it can be assumed that Myrtle Creek has been subjected to larger peak flows than what is modeled through WATSED. The Myrtle Creek drainage is a snowmelt-dominated stream, where peak flows are generated during the spring melt periods. A complete discussion of WATSED, its capabilities, and its limitations is located in Appendix D.3.

3.2-D.3 Indicator 3 - Sediment Yield, including methodologies

Sediment yield is defined as the movement of sediment past a point in the stream system over a period of time. On the Idaho Panhandle National Forests, sediment yield is modeled using WATSED and WEPP.

> Models are not designed to produce precise solutions; rather they are tools intended to provide a method to objectively compare relative differences among alternatives.

a. WATSED Model

On the Idaho Panhandle National Forests, sediment yield is generally modeled using the R1/R4 Sediment Guides (USDA 1981) and the WATBAL Technical User Guide (Patten 1989). The version calibrated for the Idaho Panhandle National Forests is known as WATSED. WATSED is an analysis tool that spatially and temporally organizes typical watershed response relationships as a result of forest practices. The estimated responses are combined with other sources of information and analyses to help determine the findings of probable effects.

WATSED estimates a series of anticipated annual values over a period of years. The model predicts an estimate of most likely mean annual sediment loads (reported as tons per square mile per year), and the expected sediment load modifications over time. The estimate of additional loading is expressed as a percent of the "natural" (i.e., historic mean load prior to significant development activities) sediment load, which is based on the history of disturbances and average climate patterns in the watershed. In this analysis, the existing condition represents the years 2004 and 2005, which is prior to any anticipated disturbances related to the proposed activities.

Further discussion and disclosures of WATSED model assumptions and limitations are found in Appendix D.3.

b. Water Erosion Prediction Project Models (WEPP)

To estimate soil erosion and sediment yield to streams, the Water Erosion Prediction Project (WEPP) was employed in the project area. WEPP is a physically-based soil erosion model that describes the processes that cause erosion. WEPP considers site-specific information on climate, texture, ground cover, and topographic settings (Elliot et al. 1997, 2001, 2004). WEPP was also used to estimate average annual erosion and sediment yield (in tons per year) for each land management unit under existing baseline conditions and the proposed vegetation treatments.

WEPP Components

The following four components of the model were used to determine the total sediment yield and delivery in the project area:

- **Disturbed WEPP** for hillslope erosion predictions related to management actions,
- **Road:WEPP** for road erosion predictions,
- **GeoWEPP** for hillslope erosion predictions and cumulative effects predictions related to fire, and
- **WEPP: FuME** (Fuel Management Erosion), a culmination of all three programs described above.

Further discussion and disclosures of the assumptions and limitation of the WEPP models and its components are found in Appendix D.3.

c. Road Drainage Structure Inventory and Assessment

Road drainage structures (e.g. culverts) at stream crossings are common sites of ongoing or potential erosion and sediment sources. Failures occur when debris flows plug culverts and either concentrate water over the tops of road fills or divert water down the road or ditch and onto hillslopes unaccustomed to concentrated overland flow. Both scenarios produce large concentrations of sediment, which can scour the receiving channel bed and banks adding to the total sediment delivery. This detrimentally affects water quality and habitat for aquatic organisms.

Road drainage crossings were inventoried (Hydrology Project Files) to assess erosional hazards and risks to aquatic ecosystems, using the *Methods for Inventory and Environmental Risk Assessment of Road Drainage Crossings* (Flanagan et al, 1998). Crossings were analyzed by collecting site-specific data organized into four categories:

- Culvert Hazard - the likelihood of culvert capacity being exceeded and potentially failing;
- Fill Hazard – the likelihood of the stream crossing fill failing;
- Consequences – the erosion effects of culvert failure, and;
- Impacts – the effects of culvert failure on downstream resources.

Factors in each category are given scores that are then weighted based on importance. Using the Environmental Risk Score (Flanagan et al, 1998) and professional judgment, stream-crossing sites were then identified as high, medium and low priority sites, or high, medium, and low erosion risk. See Appendix D.8 and D.9.

Further discussion and disclosures of the assumptions and limitations of the Road Drainage Structure Inventory and Assessment are found in Appendix D.3.

d. Use of Model and Assessment Results

Modeling results are not the sole source of information for making resource decisions and rarely should they be the only tools utilized for analysis of watershed responses. Modeling results are incorporated with other information such as:

- Locally-derived monitoring or monitoring of similar systems;
- Reviews of pertinent scientific literature and reports;
- Reasonable local calibration references for the driving variables used in the models
- Reference to validation of the model application using data for major geomorphic groups present on the Forest
- Professional judgments by watershed-related specialists based on education and experience, and who have made and documented conditions and observations in the analysis area, and who have knowledge of hydrologic processes and local existing conditions.

Soil erosion by water is a complex process resulting from the interactions among a number of factors including weather patterns, soils properties, topography, the influences of surface vegetation, and the spatial distribution of the disturbances. Natural variability is a dominant characteristic of each of these factors, which makes predicting soil erosion rates difficult. However, the preceding models aid in the analysis of erosion prediction following fire, logging, and road disturbances and cumulative watershed effects. These sources in combination with modeling results provide a clear understanding of expected potential hydrologic responses and changes produced by each management action.

The proposed fuels reduction treatments, road activities and watershed improvement activities could affect sediment yield over time. No new roads will be constructed. However, existing roads currently yield chronic sediment (Hydrology Project Files) and opportunities exist to improve road drainage and reduce road density (Hydrology Project Files). Certain watershed improvement projects have the potential to produce sediment in the short-term (e.g. road decommissioning), but they are designed to result in long-term reductions in sediment yield. Sediment yield modeling is used as one indicator to determine trends in water quality and fish habitat conditions. Effects of activities on sediment yield are further analyzed by applying accumulated scientific knowledge and field observations of erosion, delivery, transport and storage processes.

Sediment yield is of concern to water quality and fisheries in terms of suspended sediment and turbidity. Bedload sediment is closely associated with deposition in the stream substrate. Deposition of fine sediment (less than 6 mm) can affect spawning success, winter carrying capacity and macro invertebrate production. Deposition of coarse sediment can affect channel morphology and fish habitat.

3.2-D.4 Indicator 4 - Channel Morphology

a. Introduction

Changes in the magnitude, duration of peak flows and sediment yields have the potential to change stream channel characteristics. Stream channels that are primarily alluvial systems, formed by erosional depositions of sediment, are the most susceptible to stream bank erosion, changes in sediment supplies, and large woody debris removal (Chamberlin et al 1991, Rosgen 1996). Stream channels where the substrate is composed of bedrock and boulders that have a good portion of large woody debris jams and are more confined within the valley bottom, are more stable with respect to fluctuations in flow and sediment yields (Chamberlin et al 1991, Rosgen 1996).

Water and sediment yield can interact to change channel morphology conditions through erosion of stream channels or deposition of sediment. Channel morphology can also be affected directly through activities such as road encroachment,

stream crossings and in-channel improvements. Sediment delivery and routing processes vary by upland settings, stream types and disturbance level and type.

Sediment routing considers the disposition of sediment within the watershed system, including processes of erosion, deposition, storage and transport. It includes upslope and instream components. The upslope component includes initial detachment, erosion and delivery efficiency. The instream component includes suspended and bedload sediment yields, as well as substrate deposition and composition. The instream component also includes consideration of streamflow and channel morphology, both of which influence the capability of the stream to transport or deposit sediment.

Rosgen Classification System (Stream Type): A classification of a stream that assigns an alphanumeric designation (e.g. C3) to a stream reach based on observable physical features that depict dimension, pattern, and profile of the channel.

The third descriptors (i.e. a, b, or c) describe a very high gradient or a very low gradient. If the stream has an average gradient for that stream type, then no third descriptor is needed.

Please see Appendix D for Rosgen Stream Typing Chart.

Rosgen Stream Type Example: E4b

E - explains the entrenchment, which initially designates the stream type. In this example, E means a slightly entrenched channel.

4 - explains the substrate size. In this example, 4 means a gravel channel.

b - explains the stream gradient. In this example, b means 2% to 3.9% slope, which is considered high for an E4 stream.

The survey and inventory methods used to establish the existing condition of aquatic resources and to predict the effects of the proposal and alternatives are all accepted procedures used within the disciplines of wildland hydrology and fisheries management today (Bengeyfield, 1999; Rosgen, 1998, 1999; Rosgen, 2001). No single inventory or sampling procedure effectively answers all questions or paints a total picture of a given situation, thus it is chosen to utilize several methods of inventory to more completely describe the existing condition. All methods utilize data collected within the analysis area (Hydrology Project Files). Mapping inventories, quantitative stream surveys, and qualitative field assessments (Hydrology Project Files) were all utilized in determining the existing conditions of the watersheds. Quantitative stream surveys are the most powerful tool employed, followed by qualitative field assessments.

Equally important to realize is that no single method or combinations of methods provides a definitive assessment of stream function. The final analysis will always be based on professional judgment of the current science, IPNF Monitoring Reports, and existing data. The inherent temporal and spatial variability in aquatic systems, coupled with the lack of quantitative standards for most aquatic parameters, necessitates a qualitative approach to a final "assessment". Consequently, determination of the condition of aquatic resources is very much an exercise in interdisciplinary professional judgment, and the various inventories and assessments provide a basis for any determination.

Quantitative stream surveys are the most powerful tool employed, followed by qualitative field assessments. Equally important is that no single method or combinations of methods provides a definitive assessment of stream function. The final analysis will always be based on interdisciplinary professional judgment of current science, IPNF monitoring reports and the existing data.

Recent inventories have been more qualitative than quantitative, but in all cases the more specific data have substantiated the qualitative assessments made in previous years. Quantitative stream surveys began within the analysis area in the 1970s as a means to gather data on stream conditions. Data collection was sporadic throughout the 1980s and 1990s. Data collection continued in 2005, adding new surveys within the area, and re-measuring some past survey sites (Hydrology Project Files).

The stream surveys are reach-specific and designed to classify that reach as to stream type (Rosgen, 1994; Rosgen, 1996; Rosgen, 2001). The surveys also include additional inventory methods to further describe the reach (Pfankuch, 1975; Rosgen, 1999).

Measured components of the survey designed to determine stream types are: (Pfankuch, 1975; Rosgen, 1999; Rosgen, 2001):

- Bank Erosion Hazard Index
- Channel Stability Evaluation
- Entrenchment Ratio
- Stream Gradient
- Particle Size Distribution
- Sinuosity
- Width/Depth Ratio

Channel Morphology Definitions are located in Appendix D

b. Using Reference Reach Comparison Analysis

Stream survey data are analyzed so that the reach in question ("project" reach) can be compared to a reference reach from a watershed that is of similar characteristics (Rosgen, 1998). Valley Bottom Width and Valley Bottom Gradient are often, but not solely, the dominant predictors of identifying a comparable reference reach (Bengeyfield, 1999), with drainage area being the least robust of the parameters (Bengeyfield, 2003), but not always. The values compared do not need to be exact, just to within a reasonable range, as determined by the knowledge of the area and hydrologic processes.

> Reach: A term used to identify a section of the stream that is being referred to or analyzed
>
> Reference Reach: An undisturbed or minimally disturbed reach that shows the desired future condition. This reach is used as a means of comparing other reaches in order to determine the functioning status. It shows the characteristics a properly functioning reach should have.

The concept of using reference reaches is an evolving one, but the method has gained much support, use, and analysis, as shown in recent literature (Bengeyfield, 1999; Rosgen, 1998; Rosgen, 2001). By comparing reference and "project" reaches, an assessment of the stream's function can be made (Rosgen, 1998; Rosgen, 1999). The reference reach is used as a comparison with the project reach to show the effects of management. The concept of using minimally disturbed sites as references has appeared in literature (Dissmeyer, 1993). Recent methodologies for analyzing watershed conditions (USDA 1981, and USDA 1995) recommend the use of reference watersheds as a means of determining the effects of land management. Within each watershed, designated reference reaches, or portions of channels of similar morphology are identified by the project hydrologist (Hydrology Project Files).

Further discussion on using Reference Reach Comparison Analysis is located in Appendix D.6.

3.2-D.5 Indicator 5 - Water Quality

Water quality includes physical and chemical characteristics of water. Parameters commonly measured include turbidity, pH, alkalinity, hardness, specific conductance, nutrients, metals, sediment and water temperature. Many of these parameters are affected only to a slight degree, or not at all, by forest practices. Water temperature controls the rate of biologic processes, is of critical concern for fish populations and is a primary indicator of habitat conditions. It is also a key parameter in the Deep Creek TMDL.

The Bonners Ferry Ranger District currently does not sample water quality. However, the functioning status of the streams and their morphology is monitored. It is from this data and status support of beneficial uses, that the water quality can be inferred. If a stream is in good, properly functioning condition, then the water quality of the stream can often be concluded as such from these results. The water quality concerns are most likely to appear in the not-properly-functioning reaches of the streams.

Because Myrtle Creek is a municipal watershed for the City of Bonners Ferry, water quality is measured by the City – both pre-treatment and post-treatment. The City Water Department personnel also utilize the Myrtle Creek SNOTEL Data Report via the internet. This site is provided by the National Resource Conservation Service and primarily measures precipitation and ambient temperature in the Myrtle Creek drainage.

Due to the foundational role that water temperature plays in the function of aquatic ecosystems and because many human activities impact temperature, water temperature criteria have been adopted into the Idaho Department of Health and Welfare rule, Title 01, Chapter 02, "Water Quality Standards and Wastewater Treatment Requirements," also known as IDAPA 1.01.02 (Idaho Department of Health and Welfare 1999). Numeric water temperature criteria are included in the water quality standards. The Bonners Ferry Ranger District currently uses StowAway TidbiT temperature loggers (called Hobos) to record temperature information in sections of Myrtle and Snow Creeks. See Map Appendix – Aquatics Map 7, for the map of Stream Cross-Sections and Temperature Gage (Hobos) Locations. See Hydrology Project Files for user's manual and product specifications.

3.3 - Hydrology Existing Condition

The purpose of this section of Chapter 3 is to provide a context for understanding watershed processes which are important within the project watersheds. Past and present processes, resource values, and management activities are considered. The information in this section forms the basis for the effects analysis and comparisons made in Chapters 4 and 2.

3.3-A Myrtle Creek Watershed

3.3-A.1 Description of the Watershed

The Myrtle Creek Watershed is approximately 21,760 acres (34 square miles) in area, and is on the east slopes of the Selkirk Mountains. Acreages of ownership within the Myrtle Creek portion of the project area are approximately 1% BLM, 1% State of Idaho, 1% private ownership, 1% US Fish and Wildlife Service, 18% Forest Capital, and 78% National Forest Land. Major tributaries of Myrtle Creek include Yellow Pine Creek, Adverse Creek, Mack Creek, White Pine Creek, Jim Creek, Peak Creek, Slide Creek, Toot Creek, and Cooks Creek. Myrtle Creek flows generally eastward from the Selkirk Crest into the Kootenai River, seven miles to the northwest of the City of Bonners Ferry. Although the entire Myrtle Creek watershed is within the cumulative effects area, only approximately the lower half of the stream would be potentially affected by the proposed actions due to the location of project activities.

Based on findings from the soils scientist, fisheries biologist, and hydrologist, the project area was divided into several sections for analysis purposes. See Map Appendix – Aquatics Map 3, "Water/Soil/Fisheries Analysis Sections", for section delineations:

A – Headwaters
B – Mid-valley south facing slopes – unburned
C – South facing slopes – burned by 2003 Myrtle Creek Fire
D – Mid-valley north facing slope – unburned
E – North facing slopes – burned by 2003 Myrtle Creek Fire
F – Front range
G – Snow Creek

Model runs were conducted in the entire Myrtle Creek watershed with WATSED. However; since no treatments are proposed in upper Myrtle Creek or the 2003 Myrtle Creek Fire area (Sections A and C), WEPP models runs were only conducted in Mack Creek and Lower Myrtle Creek sections (B, D, and E).

The geology, soils and landforms of the watershed are described in the Soil Resource section. The stream channels in this watershed are low to high gradient, with higher gradient channels in the uplands of the tributaries. Elevation in the Myrtle Creek watershed ranges from approximately 5375 feet at the headwaters to approximately 1797 feet at the mouth. Precipitation averages 36 inches per year. The glaciated drainage is characterized by a long steep high-energy, higher-order stream with frequent low-order streams draining the valley walls. Bedrock, boulder, outwash and valley trains associated with historic glaciation control the main channel. The main channel is entrenched deeply within an outwash terrace. Side slopes are dominated by plastered glacial tills, mostly of granitic origin and overlain by variable depths of volcanic ash. The underlying geology is derived from the Kaniksu Batholith (granitic).

Myrtle Creek is a large perennial stream with expected approximate flow characteristics of Average Annual Flow Discharge of Qaa = 92 cfs, and peak flows discharge for a 2-year return interval of Q2 = 710 cfs and discharge for a 100-year return interval of Q100 = 2000 cfs. There is a narrow band of metamorphosed belt rocks along the Selkirk face, as well. There are also lakebed sediments present along the Kootenai Valley Wall. Stream channels draining the valley walls are frequently ephemeral and deeply incised. Flows from them are flashy (intense and short duration) as a result of individual meteorological events.

Flow Definitions:

Q = Discharge
cfs = cubic feet per second
aa = Average Annual Flow
2 = 2-year return interval
100 = 100-year return interval

3.3-A.2 Beneficial Uses

Under the Idaho Water Quality Standards, designated beneficial uses in Myrtle Creek are public water supply (municipal water) for the City of Bonners Ferry, cold water communities, salmonid spawning, and primary contact recreation. No tributaries in the project area have designated beneficial uses, but existing uses generally include cold-water communities, salmonid spawning and secondary contact recreation.

Myrtle Creek has been the municipal water supply for the City of Bonners Ferry since 1928. Daily usage ranges from 700,000 gallons per day during low season use to 2.3 million gallons in the summer (Myrtle-Cascade FEIS, 2001). The City only has 800,000 gallons of storage capacity, so a continuous supply of high quality water is especially critical (Myrtle-Cascade FEIS, 2001). The utility serves roughly 3,500 people. The City regularly monitors water quality for inorganic, organic, microbial, and radioactive contaminants, and pesticides and herbicides to assure compliance with State and Federal Water Quality Standards. This monitoring indicates that the beneficial use for municipal water quality is being fully supported (Hydrology Project Files).

3.3-A.3 Rain-on-Snow Events

Changes in forest vegetation resulting from management or natural events can affect the magnitude of rain-on-snow events (Harr 1986). Corporate databases and GIS overlays show that 28% of Myrtle Creek is within the rain-on-snow zone. This is an elevation zone between 3,000 feet and 4,500 feet, where the snow pack generally accumulates all season long but is constantly near isothermal[•]. When warm air masses associated with moisture raise the freezing level to above 4,500 feet, rain falling below the freezing level results in rapid snow pack melting and flash flooding.

Rain-on-snow and resulting flash floods and/or debris flows are natural processes with the Selkirk Mountains. In the event of a flash flood, the impacts to stream channels are often caused by road-stream crossing failures. See the Model section of Appendix D.3.

Within the Myrtle Creek watershed, spring snowmelt runoff events when with consistent bank full flows may last many weeks. These flows provide energy to move large amount of sediment stored in gravel bars and channel banks and transport this material downstream. Natural disturbance events, such as occasional long duration Pacific cyclonic rain producing storms saturate soils and can result in large scale flooding and related channel adjustment. These storms can occur, following snow pack accumulation that may add to the magnitude of the response. Wildfires followed by high intensity convectional storms can also cause intermittent or ephemeral channel scour and add large amounts of new sediment to downstream lower gradient reaches.

3.3-A.4 Risks Associated with Drainage Structures

Road drainage structures (e.g. culverts) at stream crossings are common sites of ongoing or potential erosion and sediment sources. Failures occur when debris flows plug culverts and either concentrate water over the tops of road fills or divert water down the road or ditch and onto hillslopes unaccustomed to concentrated overland flow. Both scenarios produce large concentrations of sediment, which can scour the receiving channel bed and banks adding to the total sediment delivery (USDA 1999b). Please see "models" in the Model section of Appendix D.3 for further explanation on the model used to analyze these risks. Roads (which includes culverts) were the main indicator for assessing Watershed Condition in the project area.

3.3-A.5 Indicator 1 – Watershed Condition

Existing watershed condition indicators were compiled for Myrtle Creek using corporate databases (IPNF NZ HUC model), GIS overlays, field surveys, and the road drainage crossing model (the IPNF NZ HUC Model Database used a different methodology for calculating ECA than the WATSED model results). They are summarized in the tables below.

The following table (presented on two lines) displays the various indicators used to assess the overall Watershed Condition of the Myrtle Creek watershed, which is approximately 43 square miles in size.

Table 3.2 Watershed Condition Indicators – Myrtle Creek

Watershed Sensitivity	Watershed Disturbance	Riparian Disturbance	Detrimental Disturbance	Sensitive Landtype	ECA*	Riparian ECA
Moderate	Moderate	High	4%	19%	21%	15%

Table 3.2 Continued – Watershed Condition Indicators – Myrtle Creek

Road Density (mi/mi^2)	Roads in Sensitive Landtypes (miles)	Roads Density in Sensitive Landtypes (mi/mi^2)	Stream Crossing Frequency (mi/mi^2)	RHCA* Road Density (mi/mi^2)	Watershed Condition
2.6	0.6	3.1	1.33	2.1	Functioning-at-risk

***ECA = Equivalent Clearcut Area *RHCA = Riparian Habitat Conservation Area**

Various watershed road density criteria have been used to assess watershed condition. One example of local guidelines that have been developed, suggests less than 1.5 mi/mi^2 is an indicator of a low risk watershed condition, 1.5 to 3 mi/mi^2 is

[•] An isothermal snow pack is when the entire snow pack reaches the temperature of 32 degrees Fahrenheit.

moderate, and greater than 3 mi/mi^2 is high (USDA Kootenai NF, and Nez Perce NF). With regard to road density, Myrtle Creek is in the moderate condition category.

The density and distribution of roads, as well as field observations of ditchline and road conditions within most of the watershed, indicate there is a moderate probability that the hydrologic regime (i.e., timing, magnitude, duration, and spatial distribution of runoff) is altered. Road surfaces limit infiltration, which causes surface runoff during storm events and snowmelt. Insloped roads with ditches have the greatest effect. Native surface roads with traffic can often develop ruts, which cause runoff to be concentrated on the road surface. Roads are also subject to surface and mass erosion. Surface erosion is the dominant erosion process on roads in the Myrtle Creek watershed. Field inventories have identified problem areas and prioritized needs (Hydrology Project Files).

Past timber harvest and fire have affected portions of Myrtle Creek within and outside the RHCAs. This has affected water yield and timing through reductions in forest canopy and soil compaction from skid trails and landings. Timber harvest and road construction has occurred on private, corporate, and BLM land (where the Idaho Forest Practices Act would apply). Management induced or natural changes in water yield are most discernable in first and second order streams (MacDonald, 1989). Currently, these changes are not large enough to be measured at the municipal water intake.

Structures that are used to cross streams have a limited life span and capacity. There is always some period of time or flood or landslide event that will exceed the capacity of the crossing to safely pass water and debris. When stream crossings fail, large amounts of road fill can be directly delivered to streams, detrimentally affecting water quality and habitat for aquatic organisms. The sediment then comes directly from the throughfill over the crossing or from the road prism in cases where the culvert failure diverts all or a portion of streamflow down along sections of the road prism or ditch line. These types of events can scour the receiving channel bed and banks adding to the total sediment delivery.

Some crossings in Myrtle Creek increase the velocity of streamflow enough to scour the channel below the culvert outlet for up to a few hundred feet (see Hydrology Project Files). There are approximately 1.33 stream/road crossings per square mile in the Myrtle Creek Watershed. The indicators for this issue will be a calculated risk associated with the inventoried crossings and the potential for roads prisms and ditch lines to capture stream flow. The locations of inventoried roads and crossings are displayed in Map Appendix – Aquatics Map 5- "Inventoried Roads and Treatment Areas". Risk at stream crossings is a combination of two factors – probability of failure, and the cost (in terms of sediment delivery) of failure. Risk is managed by reducing the probability of failure, and the cost (in terms of sediment delivery) if a failure were to occur. See Appendix D.8, and the Hydrology Project Files, for Road Erosion Risk Criteria.

Almost all roads in Myrtle Creek drainage were built or improved between 1950 and 1970, before BMPs were established. Therefore, many of the drainage relief culverts and stream crossings are 30 to 50 years old. The designed life expectancy for culverts is typically 20 years. This increases the need for and importance of upgrading existing road improvements. Some facilities were replaced as a result of damages incurred from climatic events in 1974, 1985, and 1997, but even pipes installed in 1985 are now nearing the end of their expected service life. (Historic hydrology and road inventory reports, Hydrology Project Files). The actions that would be taken with this project to alleviate these concerns to varying degrees are discussed in Chapter 4 descriptions of Alternatives 1, 2, and 5.

Due to the number of crossings per road in the Myrtle Creek Watershed, individual roads were assigned high, moderate, or low risk to failure using the road drainage crossing results from the model. This information is displayed in the following table. Erosion risk rating is developed from the following factors: models (Road WEPP and the culvert model), road surveys and culvert surveys (see project files.) See Appendix D.8, and the Hydrology Project Files, for Road Erosion Risk Criteria.

See the Appendix D table which displays the roads/road segments in the Myrtle Creek Watershed area, and their current decommissioning priority. For Road Locations see Map Appendix – Aquatics Map 4 "Project Area Roads and Trails,". Based on the culvert analysis, road field surveys, culvert field surveys, and other current and historical data, the roads and/or road segments were prioritized for decommissioning. For further explanation on road erosion risks and supporting evidence for decommissioning prioritization, see Appendix D.9 and the Hydrology Project Files.

Table 3.3 Existing Condition for Road Risks in Myrtle Creek Watershed within the project area

Road Number	Erosion Risk Rating	Ownership
633	Moderate	Mix
633A	Moderate	Mix
633C	High	USFS
633D	High	USFS
633E	Moderate	USFS
633UB	High	Forest Capitol
658	Moderate	Mix
661	Moderate	Mix
661A	Moderate	Mix
661UA	High	Mix
1309	Low	Mix
2400 & 1309C	High	Mix
1309UA	High	Mix
1309UB	High	Forest Capitol
1309UC	Moderate	Forest Capitol
1309UD	Moderate	Forest Capitol
1309UF & UE	Moderate	Forest Capitol & Mix
1309UG	Moderate	Forest Capitol
2190	Low	USFS
2405	High	Mix
2405A	High	Mix
2405AUA	High	USFS
2405AUD	High	USFS
2405B	High	USFS
2405C	High	USFS
2405D	High	USFS
2405DUB	High	USFS
2405UA	High	USFS
2405UN	High	USFS
2406	Moderate	Mix
2406A	Low	Mix
2409	High	USFS
2409UA top	High	USFS
2409UA	High	Mix
2409UB	High	Forest Capitol
2409UE	High	Forest Capitol
2409UG	High	USFS
2405UC	Moderate	USFS
2405CUB	Moderate	USFS

The main contributing factor to human-caused sediment in the channels is from the roads on the landscape (Hydrology Project Files). More information on roads and their characteristics can be found in the Hydrology Section of Chapter 4. For supporting evidence for decommissioning priority, please see the Hydrology Project Files.

3.3-A.6 Indicator 2 – Water Yield

Changes in duration and intensity of peak flows are often associated with changes in water yield from changing vegetation conditions. Openings created by large stand-consuming fires, forest insects and diseases, and silvicultural treatments can alter snowmelt patterns (McCaughey et al. 1997, King 1993, Megahan 1983). The timing and duration of summer or base flows can also be altered through vegetation changes. Keppeler (1998) found that when 50 percent or greater of the drainage basin had been harvested, summer flows were altered during the long dry summer season, with an increase in runoff and annual water yield.

WATSED Modeling

To understand changes and fluctuations within historic water yield and peak flow conditions, peak flows were modeled using WATSED. The modeling started with the year 1920. It is evident that peak flows are not static, but dynamic, following disturbances. Following fires it is evident that peak flows are higher than background rates. Historically, when stand replacing fires removed the forest vegetation, water yield values rose sharply, then gradually declined to baseline condition (Patten, 1989). Research in the region has shown that causes of some peak flows are also associated with less frequent mid-winter rain-on-snow events and spring rain-on-snow events (MacDonald and Hoffman 1995). Their research showed that spikes were usually higher and over a shorter duration than what is currently modeled. WATSED cannot predict peak flows from these events because the timing and magnitude are unpredictable; they do not occur on an annual basis and are dependent on certain climatic conditions such as air temperature, intensity and duration of precipitation, rain-on-snow elevations, and snowpack characteristics (Berris and Harr 1987). However, it can be assumed that Myrtle Creek has been subjected to larger peak flows than what is modeled through WATSED. The Myrtle Creek drainage is a snowmelt-dominated stream, where peak flows are generated during the spring melt periods. A complete discussion of WATSED, its capabilities, and its limitations is located in Appendix D.3.

Existing Conditions

- Water yield for Myrtle Creek is currently estimated at 6% above baseline. This was estimated using land management and fire events in the WATSED model starting with the year 1920.
- Peak flow for Myrtle Creek is currently estimated at 6% above baseline. This was derived using the WATSED model starting with the year 1920.
- ECA for Myrtle Creek is currently estimated at 14% above baseline. This was derived using the WATSED model starting with the year 1920.

These increased percents above baseline are due to the past fires, timber harvest and road systems that are now a part of the existing condition of the landscape within the Myrtle Creek watershed. Any affect from the increase in water yield is currently well within the capabilities of the watershed.

Presently, the City of Bonners Ferry has two water-rights totaling 8.8 cubic feet per second (cfs). For bankfull it was estimated that discharged based on a 1-1/2 year return interval equals 324 cfs (Q1.5=324) and discharge based on a 2 year- 4 month return interval equals 424 cfs (Q2.3=424 cfs) occur from March 15 to June 15. Therefore, during the period of March 15 through June 15, when streamflow is equal or exceeds 324 cfs, all the flow up to 424 cfs shall be bypassed, except for the amount (8.8 cfs) diverted.

3.3-A.7 Indicator 3 – Sediment Yield

Sediment production and delivery, as used in this analysis, refers to landslide potential and surface erosion. Roads are the primary focus for this issue, although harvest and site preparation activities will be discussed when they have the potential to create or increase erosion. Roads can potentially increase the natural rate of landslide occurrence by creating unstable road cut and fill slopes and by greatly expanding the number of ways and locations where ground water can be intercepted, rerouted and concentrated. Surface erosion occurs on most forest roads because their surfaces, cutslopes, fillslopes and associated drainage structures are usually composed of erodible material and are exposed to rainfall and concentrated surface runoff. Minimizing the potential for roads to intercept, concentrate, and route water to streams and unstable slopes can reduce sediment production and delivery. Maintaining soil organic layers and functioning riparian zones are also strategies that are used to minimize sediment production and delivery. See Chapter 4, Soils and Hydrology Sections, for more information on organic layers and riparian zones. See Chapter 2, Design Features and Mitigation Measures for more information on methods to minimize or avoid affects.

The faulting and glaciation that created the Purcell Trench lowered the base elevation of the Kootenai River. This has caused Myrtle Creek to aggressively scour down in elevation to try to match grade with the Kootenai River (Myrtle-Cascade FEIS, 2001). As a result, lower Myrtle Creek has steep V-shaped valley slopes, which are naturally more prone to landslides than

surrounding slopes and has steep stream gradients. The presence of Myrtle Falls, near the bottom of the drainage, illustrates that the stream is still not at grade with the Kootenai River. U-shaped valleys resulting from alpine and continental ice masses characterize the upper potion of the watershed. The slopes in upper Myrtle Creek are more likely to have compacted till near the soil surface, which perches the water table. As a result, the upper portion of the watershed creates more of a water yield response per unit area than the lower section of Myrtle Creek. A report by Taylor and Olson (1956), and the Soils Project File, provides a more detailed characterization of soils and geology within the Myrtle Creek watershed.

> Landtypes are used to indicate the areas where more careful planning and use of mitigation measures or restoration will usually be needed to avoid or reduce resource impacts.

The different landforms in the geographic areas have been characterized as distinct landtypes. Landtype mapping combines bedrock geology, surface geology, landforms, soils, slope gradients, aspects, elevation, amount of rock outcrop or talus, presence of avalanche chutes, rain-on-snow zones and canopy cover. The analysis area includes many combinations of these landtype characteristics with many different implications for management. If a particular combination is abundant on the Forest and has management interpretations, which are different from the other combinations, it is mapped as a landtype and assigned a unique code. Some landtypes are more responsive to disturbances. The "responsive" areas include riparian zones (which range from low to high mass failure potential) and known landslide prone areas. Mass failures or surface erosion will not definitely happen if management activities occur in these areas. Instead, the landtypes are used to indicate the areas where more careful planning and use of mitigation measures or restoration will usually be needed to avoid or reduce resource impacts.

Disturbances, such as fire and rain-on-snow events, are distinct in time and space and can occur anywhere across the landscape. Random sediment inputs to stream channels occur as a complex series of pulses that are delivered and stored within low order, high gradient stream channels (Benda and Dunne 1997). Sediment accumulates for centuries within these channels before being transported or "flushed" downstream by episodic events with large increases in water yield (Kirchner et al 2001).

Following a high erosional event, large volumes of sediment are concentrated in different sections of the stream channel, mainly near tributary junctions along the larger order, lower gradient sections. The stream channel transports bed material downstream from these storage sites at different rates. The bed material travels slowly, creating temporary patterns of sediment transport, sediment storage and channel morphology throughout the stream channel (Benda and Dunne 1997a). This process has been active over centuries within Myrtle Creek, especially following the fires and rain-on-snow events that resulted in flooding. Within Myrtle Creek, management-related sediment sources have been from non-maintained roads and road construction activities (Hydrology Project Files). The construction of many of the roads in Myrtle Creek occurred before standard best management practices were required and presumably produced more sediment. This is consistent with research findings that have shown when roads are designed with specific criteria and best management practices they produce less sediment yields (Megahan et al 1992). Numerous research studies have documented that forest roads are usually the leading contributor of sediment to stream channels (Gucinski et all 2001, Bilby et al 1989, Duncan et al 1987).

Sediment Production and Delivery Indicators

Results from WATSED and WEPP modeling, and the amount of activity and reduction of risks on sensitive landtypes, are used as indicators for the potential of production and delivery of sediment. While interpreting the sediment yield increase above natural[♦], it is important to consider that WATSED assumes that a road prism stays open and is maintained for perpetuity and continues to generate a base level of sediment. In reality, several of the roads in the project area are revegetated which reduces actual surface erosion; and some are poorly maintained which produces even more than what is predicted. For this reason, the estimates of sediment yield increase above natural are somewhat over or understated. The way in which this was accounted for is explained in the following paragraph.

WATSED generally understates stream-crossing risk. Also, a road that is revegetated can still be a concern if it intercepts, concentrates, and re-routes substantial amount of ground water and if it increases the natural potential for mass erosion. Therefore, it is best to use the yield increase estimates as a relative indicator of sediment regime alteration rather than taken as an absolute. That is why the WEPP tools were used and incorporated into the sediment estimates above baseline. WEPP has the ability to distinguish more differences in road activity, level of use, and effects.

Effects of Wildfire in the Watershed

Prior to fire suppression, wildfire altered the structure and composition of forest stands within the assessment area. See the Fire and Fuels and Vegetation sections of Chapter 3. At times site conditions following fires would coincide with wet climatic conditions in a season, year, or period of years, that would trigger landslides or surface erosion. Several landslides that occurred after the 1926 wildfire can be seen on the 1935 aerial photos in lower Myrtle Creek on the south facing slopes and on

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♦ "Natural" (i.e., historic mean load prior to significant development activities) See information for the WATSED model on page 3-5.

stream break lands. Debris avalanches, shallow seated planar slides, and debris torrents were the most common types of failures. Failures were most common along the steep stream break lands such as those found in Myrtle Creek.

In 2003, a fire in the Myrtle Creek watershed burned 3450 acres (approximately 13% of the watershed) of primarily south facing slopes and some pockets of the middle to lower lying north-facing mountain side. The fire burned in the lower portion of the watershed immediately above the mouth and the location of the City's municipal water intake diversion. Distribution of soil burn severity was equally distributed with 31% having a high, 34% having a moderate, and 35% having a low rating. Hydrophobic soils were initially estimated at a total of 7% of the total burn area and were limited to south-facing, dry site Ponderosa Pine/brush areas (Janicki 2003, Myrtle BAER reports in Hydrology Project Files).

Predicted erosion and sediment rates: Prediction erosion rates were about five tons per acre on the high severity/non-hydrophobic steep slopes; lower rates of 1.5 tons per acre were predicted on the moderate severity areas; and first year soil loss averaged over the burned area was modeled at 2.3 tons per acre (see Myrtle BAER reports in the project files). Steep, south-facing, first order drainages with high and moderate severity burn, delivered the most sediment. Modeled results showed sediment delivery to the mouth of these drainages varied from 1.3 tons/acre/year to 3.9 tons/acre/year. Yellow Pine, a previously untreated, subwatershed delivered an estimated 2.4 tons/acre. The average was 2.8 tons/acre for the south-facing slopes. North-facing slopes delivered less sediment and delivered an average of one ton/acre. Not all of this sediment delivered to the mouth of the first order drainages such as Yellow Pine Creek, will make it to the mouth of Myrtle Creek (to the Intake facility). A delivery coefficient of 0.6 was used to route sediment from the mouth of first order drainages to the intake (see Myrtle BAER reports in the project files). Using this factor, final sediment delivery to the intake was predicted to be about one ton/acre.

Post-fire effects to the water supply were relatively short-term. Burned Area Emergency Response (BAER) efforts, a mild winter and spring, and overall low intensity precipitation events assisted in the rapid growth and establishment of vegetation, which helped to stabilize the burned soils. However, a high intensity summer storm in July of 2004 created a debris torrent that was intercepted at the main Myrtle Road 633 (project file). Accumulation of runoff and overland flow from the still hydrophobic upper portions of that drainage was the likely cause in this response (see soils field notes and BAER reports in project files). The effects of the Myrtle Fire of 2003 increased the sensitivity of the watershed; which is why the Myrtle HFRA project is excluding Section C (south facing slopes burned) from proposed management action.

Sediment Yield Indicator

The indicator used for sediment yield is tons per year, expressed as a percent over natural baseline sediment yield. Base or natural yield represents the tons of sediment that are produced and subsequently transported out of the subwatershed each year under natural conditions. The existing sediment yield over base represents activity generated tons of sediment transported annually, produced by previous activities or disturbances such as roads, timber harvest and fire. Sediment yield was modeled for each prescription watershed.

Based on the areas where the management activities are proposed, Myrtle Creek watershed was divided into five components for the WATSED runs:

- Upper Myrtle Creek,
- Yellow Pine Creek,
- Mack Creek,
- Lower Myrtle Creek, and
- Entire Myrtle Creek watershed.

The sediment yield results for the components were: Upper Myrtle Creek 47% above baseline, Yellow Pine Creek (previously untreated tributary) 41% above, Mack Creek 17 % above, Lower Myrtle Creek (includes the area of the 2003 fire) 20% above baseline, and overall the entire Myrtle Creek watershed at 33% above baseline. Baseline is defined as the historic mean amount prior to significant development activities, see information for the WATSED model.

The 2003 fire and subsequent salvage in the fire area (approximately 230 acres of dead trees) are still having an affect on the Myrtle Creek Watershed and will continue to have affects for several more years. Of the annual sediment production, it is estimated that one percent is being routed annually to the main channel of Myrtle Creek.

WEPP runs (WEPP: FuMe, WEPP: Road, GeoWEPP, Disturbed: WEPP) were conducted for Analysis Sections B, D, E, and F. Approximately 457 tons of on-site sediment is being generated annually in the Lower Myrtle Creek watershed, with 27 tons routed to the main channel of Myrtle Creek. Approximately 69 tons of on-site sediment is being generated annually in Mack Creek, with 31 tons routing to the main channel of Mack Creek, which flows into Myrtle Creek.

3.3-A.8 Indicator 4 – Channel Morphology

Stream surveys and fish habitat surveys were conducted in the project area throughout various years (most recently 2004 and 2005). The survey reports are found in the Myrtle Creek Hydrology Project files. For location of cross-section surveys, see Map Appendix – Aquatics Map 7 "Stream Cross-Section and Temperature Gage Locations".

Channel morphology in project subwatersheds has been altered through two primary processes: sediment deposition and channel encroachment. Sediment deposition has occurred in areas subjected to roading and timber harvesting. Channel encroachment has occurred where roads and timber harvesting have taken place adjacent to streams and their floodplains.

The channel morphology for the individual reach sections is displayed in a table that allows for the comparison of the 2005 survey to a specific reference reach♦, as well as "typical" reference criteria. The data shows how much this specific reach has deviated from a reference reach condition and how far it is from a desired future condition (DFC). Function status condition calls are per reach segment for those specific reach/channel segments and not the entire watershed. The overall watershed function status call is then made after taking all components into consideration.

A properly functioning reach supports its designated beneficial uses.

A functioning-at-risk stream reach can still support its designated beneficial uses. The functioning-at-risk status indicates that the reach has been affected by past management, wildfires and other natural disturbances, and the potential for continued or increased degradation is higher than that of a properly functioning reach. A functioning-at-risk reach may or may not be stable; and may or may not support its designated beneficial uses.

A not-properly-functioning reach does not support its designated beneficial uses and is degraded.

Not all reaches or tributaries were surveyed in 2005. The survey sites were prioritized and conducted where management activities were proposed. Eight tributaries of Myrtle Creek were not surveyed. Eight reaches of the main channel of Myrtle Creek were surveyed. For Mack Creek, one survey was conducted in 2005 and four were conducted in 2004. For Cooks Creek, four surveys were conducted in 2004. The main channel of Myrtle Creek and Mack Creek were deemed to have the highest priority for analysis due to the locations of the proposed actions relative to the survey reaches (Hydrology Project Files).

The table on the following page summarizes the existing stream type and corresponding function call for the reaches that have been surveyed.

♦ Refer to Appendix for an in-depth explanation of using reference reach comparisons for stream reach analysis. The site-specific stream reach data and analysis are located in Appendix D.. See Appendix D for further explanation of DFC and function status calls.

Table 3.4 Summary of Existing Stream Type and Function Call.

Watershed	Stream	Reach No.	Year of Most Recent Survey	Existing Stream Type	Function Call
Myrtle Creek	Myrtle Creek	1	2005	B3/1a	Functioning-At-Risk
		2	2005	B3/1a	Functioning-At-Risk
		3	2005	B3/1a	Properly-Functioning
		4	2005	B3/1a	Functioning-At-Risk
		5	2005	B3a	Functioning-At-Risk
		6	2005	B4c	P-F-C to F-A-R
		7	2005	B4c	P-F-C to F-A-R
		8	2005	A3a+	Properly-Functioning
		1a	2005	A3a+	Properly-Functioning
	Cooks Creek (this stream is not within the project area)	1	2004	A4a+	Properly-Functioning
		2	2004	A3	Functioning-At-Risk
		3	2004	A2a+	Properly-Functioning
		4	2004	B3a	Properly-Functioning
	Mack Creek	1a	2005	A3a+	Functioning-At-Risk
		1	2004	A3a+	Functioning-At-Risk
		2	2004	A3	Properly-Functioning
		3	2004	A2a+	Functioning-At-Risk
		4	2004	A3a+	Functioning-At-Risk

P-F-C = Properly-Functioning Condition F-A-R = Functioning-At-Risk

Myrtle Creek main channel, classified as functioning-at-risk, is in fair to good condition. Stability is good to fair; three reaches are properly-functioning, three reaches are functioning-at-risk, and two reaches are borderline properly-functioning to functioning-at-risk. Riparian vegetation is abundant in most areas. -A substantial amount of logging and road building have taken place in this watershed in the past (refer to Tables of Past Activities located in Chapter 3). Tree stumps from the earliest logging operation were- seen well within the riparian zone, in some places within a few meters of the main channel. This past logging evidence was when there were no Best Management Practices (BMPs) in effect. Several small openings from more recent logging operations, on private property, were in close proximity to the riparian zone. This feature was noticed in many of the reaches in private property. Skid trails are accessible and logged clearings are open with some brush vegetation present. This system shows signs of a catchment that is mildly impaired. Stream bank stability varied throughout the main channel, and for the most part, while erosion of banks and sediment transport occurs in these reaches, the system is able to accommodate and contain the energy and materials. The 2003 Myrtle Creek wildfire had a substantial impact on the sediment being delivered into the main channel (see project file BAER Report) as described above in *Effects of Wildfire in the Watershed*. The effects of the fire of 2003 will be visible for several more years.

Cooks Creek is considered to be properly-functioning and in good condition. Stability is good to fair; three reaches are properly functioning and one reach is functioning-at-risk. Riparian vegetation is abundant in most areas. Logging and road building have taken place in this watershed in the past. Tree stumps from the earliest logging operations were seen well within the riparian zone, in some places within a few meters of the main channel. This logging evidence from the past was when there were no Best Management Practices (BMPs) in effect. Stream bank stability varied throughout the channel, and for the most part, while erosion of banks and sediment transport occurs in these reaches, much of it is natural and the system is able to accommodate and contain the energy and materials.

Mack Creek is considered to be functioning-at-risk and in fair to poor condition. Stability is moderate to low; one reach is properly-functioning and four reaches are functioning-at-risk. Riparian vegetation is abundant in most areas. This system shows signs of a catchment that is impaired. Stream bank stability varied throughout the channel; bank failures and sediment erosion and transport occur along several of these reaches. This system is flashy and typically transports influxes of sediment and woody debris.

Myrtle Creek Watershed as a whole is functioning-at-risk. Stability is good to fair; seven reaches are properly-functioning, nine reaches are functioning-at-risk, and two reaches are borderline properly-functioning to functioning-at-risk. The watershed

is still able to meet its designated beneficial uses. The bedrock and boulders present in the channel have helped to maintain some stability in several of the reaches.

As discussed above, logging and road building have taken place throughout the management history of the Myrtle Creek watershed. However, since the earlier activities, logging practices have changed and now provide for better protection of aquatic resources. With the implementation of BMPs and other design features and mitigation practices (such as INFS), timber harvesting can occur, even in impaired watersheds, without detrimentally contributing to the watershed condition. In some instances the use of new management practices can actually improve watershed conditions and aid in the recovery of impaired areas. In the case of the Myrtle Creek Watershed the improvements and recovery would come from road decommissioning, culvert improvements, road resurfacing, and road drainage improvements. (These items are included in the proposed action (Alternative 2) and to a lesser degree in Alternative 5 – see Chapters 2 and 4 for more information.)

The Myrtle Creek drainage exhibits signs of a mildly impaired (functioning-at-risk) watershed. Stream bank stability varies throughout the channel and although the erosion of banks and sediment transport occurs in some reaches, the system has been able to accommodate and contain the resulting energy and material. Many of these channels formed in response to large events, such as high floods; thus, they are somewhat resilient to these kinds of events.

3.3-A.9 Indicator 5 – Water Quality

The Bonners Ferry Ranger District currently does not sample water quality. However, the functioning status of the streams and their morphology is monitored. It is from this data and status of support of beneficial uses, that the water quality can be inferred. If a stream is in good, properly functioning condition, then the water quality of the stream can often be concluded as such from these results. Water quality concerns often appear in the not-properly-functioning and functioning-at-risk reaches of the streams. This is not always the case, though.

The City of Bonners Ferry's drinking water is supplied from Myrtle Creek with an emergency backup intake in the Kootenai River. The City regularly monitors water quality for inorganic, organic, microbial, and radioactive contaminants, and pesticides and herbicides to assure compliance with State and Federal water quality standards. The City measures turbidity of Myrtle Creek at the intake of their water treatment plant. Surface water is diverted from the creek through an intake pipe and transported several miles through a pipeline to a treatment facility. The water is distributed over a wide area from that point after some primary treatment. The monitoring indicates that the beneficial use for municipal water quality is being fully supported (Hydrology Project Files).

Turbidity associated with heavy storm water runoff with sediment from land disturbances is the greatest threat to water quality (DEQ 2000). Radionuclides in concentrations below the Maximum Contaminant Level (MCL) have been detected in the water since 1979. Nitrate (MCL = 10.0 mg/l) at a concentration of 0.055 mg/l was detected in 1988 and 1992. It has not been detected since. (DEQ 2000). Water quality in the Kootenai River (Myrtle Creek is a tributary to the river) has been threatened by train derailments in the tributary Moyie River watershed (upstream from Myrtle Creek).

The Bonners Ferry drinking water system consists of two intakes that provide surface water for domestic and industrial uses. The ways in which the intakes were constructed directly affects the ability of the intakes to protect the water supply from contaminants. The intakes are 1) a concrete diversion dam with a screened inlet in Myrtle Creek, located above the Kootenai Wildlife Refuge, and 2) a screened intake in about 15 feet of water on the south side of the Kootenai River below the filter plant. Water from both sources is treated, monitored and distributed from a central filtration plant.

A turbidity metering system, consisting of one solar-powered monitoring station, has been provided by Idaho DEQ at the City's diversion dam and intake on Myrtle Creek. The primary measurement is turbidity, but water temperature is also measured (Hydrology Project Files).

An automated alarm is sent over a phone link to the City's water treatment facility when the turbidity exceeds a field-alterable threshold. This alarm activates an automatic system that shuts down the water treatment plant and notifies the appropriate personnel.

At the City's water treatment facility, influent raw water from Myrtle Creek is analyzed daily for turbidity and pH. Detailed information is located in the Hydrology Project Files.

Due to the foundational role that water temperature plays in the function of aquatic ecosystems and because many human activities impact temperature, water temperature criteria have been adopted into the Idaho Department of Health and Welfare rule, Title 01, Chapter 02, "Water Quality Standards and Wastewater Treatment Requirements," also known as IDAPA 1.01.02 (Idaho Department of Health and Welfare, 1999). Numeric water temperature criteria are included in the water quality standards. The Bonners Ferry Ranger District currently uses StowAway TidbiT temperature loggers (called Hobos) to record temperature information in sections of Myrtle Creek. See Map Appendix – Aquatics Map 7.

Cooks Creek, Mack Creek, and Myrtle Creek (two segments), as well as Jim Creek and Peak Creek, are assessment units listed in the DEQ 2002 Integrated Report for impaired streams. All six streams/segments are listed/categorized for temperature modifications. Please refer to the Regulatory Framework-Clean Water Act for the TMDL Assessment Units in the Myrtle Creek HFRA Project Area. See Fisheries Report for more information regarding temperature.

3.3-B Snow Creek Watershed

3.3-B.1 Description of the Watershed

The Snow Creek Watershed is approximately 14,464 acres (23 square miles) in area. Ownership within the Snow Creek portion of the project area is approximately 4% private ownership, 23% Forest Capital, and 73% National Forest Land. Major tributaries of Snow Creek include Curve Creek and three unnamed tributaries. Snow Creek flows into Deep Creek approximately four miles upstream from its confluence with the Kootenai River. Although the entire Snow Creek watershed is within the cumulative effects area, only approximately the lower half of the stream would be potentially affected by the proposed action due to the location of project activities.

Based on findings from the soils scientist, fisheries biologist, and hydrologist, the project area was divided into several sections for analysis purposes. See Map Appendix – Aquatics Map 3 for the map of "Water/Soil/Fisheries Analysis Sections" for section delineations:

A – Headwaters
B – Mid-valley south facing slopes – unburned
C – South facing slopes – burned by 2003 Myrtle Creek Fire
D – Mid-valley north facing slope – unburned
E – North facing slopes – burned by 2003 Myrtle Creek Fire
F – Front range
G – Snow Creek

Model runs were conducted in the entire Snow Creek watershed with WATSED. However, since no treatments are proposed in Upper Snow Creek, WEPP model runs were only conducted in Curve Creek, three unnamed tributaries and Lower Snow Creek (Section G).

The geology, soils and landforms of the watershed are described in the soil resource section. The stream channels in this watershed are low to high gradient, with higher gradient channels in the uplands of the tributaries. Elevation in the Snow Creek watershed ranges from approximately 5921 feet at the headwaters to approximately 1760 feet at the mouth. Precipitation averages 40 inches per year. The glaciated drainage is characterized by a long steep high-energy higher-order stream with frequent tributaries draining the valley walls. Bedrock, boulder, outwash and valley trains associated with historic glaciation control the main channel. The main channel is entrenched deeply within an outwash terrace. Side slopes are dominated by plastered glacial tills, mostly of granitic origin and overlain by variable depths of volcanic ash. The underlying geology is derived from the Kaniksu Batholith (granitic).

3.1-A.1 Beneficial Uses

Under the Idaho Water Quality Standards, designated beneficial uses in Snow Creek are cold water communities, salmonid spawning, and primary contact recreation. No tributaries in the project area have designated beneficial uses, but existing uses generally include cold-water communities, salmonid spawning and secondary contact recreation.

3.3-B.2 Rain-on-Snow Events

Changes in forest vegetation resulting from management or natural events can affect the frequency and magnitude of rain-on-snow events (Harr 1986). Corporate databases and GIS overlays show that 39% of Snow Creek is within the rain-on-snow zone. This is an elevation zone between 3,000 feet and 4,500 feet, where the snow pack generally accumulates all season long but is constantly near isothermal[•]. When warm air masses associated with moisture raise the freezing level to above 4,500 feet, fog and rain falling below the freezing level results in rapid snowpack melting and flash flooding. See the Model section of Appendix D.3.

[•] An isothermal snow pack is when the entire snow pack reaches the temperature of 32 degrees Fahrenheit.

Rain-on-snow and resulting flash floods and/or debris flows are natural processes with the Selkirk Mountains. In the event of a flash flood, the impacts to stream channels are often caused by road-stream crossing failures: see "Sediment Risk Associated with Drainage Structures" under D.3-D in the Model section of Appendix D..

Within the Snow Creek watershed, the dominant channel forming and sediment transport events are associated with spring runoff. Snow Creek is fairly stable and resilient because it developed in response to the variability of the climatic processes and the dominant geology of the basin.

3.3-B.3 Risks Associated with Drainage Structures

Road drainage structures (e.g. culverts) at stream crossings are common sites of ongoing or potential erosion and sediment sources. Failures occur when debris torrents plug culverts and either concentrate water over the tops of road fills or divert water down the road or ditch and onto hillslopes unaccustomed to concentrated overland flow. Both scenarios produce large concentrations of sediment, which can scour the receiving channel bed and banks adding to the total sediment delivery (USDA 1999b). Please see "models" in the Model section of Appendix D for further explanation on the model used to analyze these risks. Roads, including culverts, were the main indicator for assessing Watershed Condition in the project area.

3.3-B.4 Indicator 1 – Watershed Condition

Existing watershed condition indicators were compiled for Snow Creek using corporate databases (IPNF NZ HUC model), GIS overlays, field surveys, and the road drainage crossing model (the IPNF NZ HUC Model database used a different methodology for calculating ECA than the WATSED model results). They are summarized in the tables below:

The following table (presented on two lines) displays the various indicators used to assess the overall Watershed Condition of the Snow Creek watershed, which is approximately 21 square miles in size.

Table 3.5 Watershed Condition Indicators – Snow Creek Watershed

Watershed Sensitivity	Watershed Disturbance	Riparian Disturbance	Detrimental Disturbance (%)	Sensitive Landtype (%)	ECA (%)	Riparian ECA (%)
Moderate	**Moderate**	**Moderate**	**6**	**11**	**25**	**7**

Road Density (mi/mi^2)	Roads in Sensitive Landtypes (miles)	Roads Density in Sensitive Landtypes (mi/ mi^2)	Stream Crossing Frequency (mi/ mi^2)	RHCA Road Density (mi/ mi^2)	Watershed Condition
2.9	**0.3**	**3.0**	**1.33**	**2.1**	**Functioning-at-risk**

Road Density Ranges:

Low = $\leq$ 1.5 mi/mi^2
Mod = 1.5 to 3.0
High = > 3.0 mi/mi^2

***RHCA = Riparian Habitat Conservation Area *ECA = Equivalent Clearcut Area**

Various watershed road density criteria have been used to assess watershed condition. One example of local guidelines that have been developed, suggest less than 1.5 mi/mi^2 is an indicator of a low risk watershed condition, 1.5 to 3 mi/ mi^2 is moderate, and greater than 3 mi/ mi^2 is high (USDA, Kootenai NF and Nez Perce NF). With regard to road density, Snow Creek is in the moderate condition category.

The density and distribution of roads, as well as the field observations of ditchlines and road conditions within most of the watershed indicates there is a high probability that the hydrologic regime (i.e., timing, magnitude, duration, and spatial distribution of runoff) is altered. Road surfaces limit infiltration, which causes surface runoff during storm events and snowmelt. Insloped roads with ditches have the greatest effect. Native surface roads with traffic can often develop ruts, which cause runoff to be concentrated on the road surface. Roads are also subject to surface and mass erosion. Surface erosion is the dominant erosion process on roads in the Snow Creek watershed. Field inventories have identified problem areas and prioritized needs (Hydrology Project Files).

Past timber harvest and fire have affected the Snow Creek Watershed, especially in the RHCAs. This has affected water yield and timing through reductions in forest canopy and soil compaction from skid trails and landings. Timber harvest and road construction has occurred on private, corporate, and BLM land, before the establishment of BMPs.

Structures that are used to cross streams have a limited life span and capacity. There is always some period of time or flood or landslide event that will exceed the capacity of the crossing to safely pass water and debris. When stream crossings fail, large amounts of road fill can be directly delivered to streams, detrimentally affecting water quality and habitat for aquatic

organisms. The sediment then comes directly from the throughfill over the crossing or from the road prism in cases where the culvert failure diverts all or a portion of streamflow down along sections of the road prism or ditch line. These types of events can scour the receiving channel bed and banks adding to the total sediment delivery.

Several crossings in Snow Creek increase the velocity of streamflow enough to scour the channel below the culvert outlet for up to a few hundred feet (see Hydrology Project Files). There are approximately 1.33 stream/road crossings per square mile in the Snow Creek Watershed. The indicators for this issue will be a calculated risk associated with the inventoried crossings and the potential for roads prisms and ditch lines to capture stream flow. The locations of inventoried roads and crossings are displayed on the "Inventoried Roads Map" in Map Appendix – Aquatics Map 5. Risk at stream crossings is a combination of two factors – probability of failure, and the cost (in terms of sediment delivery) of failure. Risk is managed by reducing the probability of failure, and the cost if a failure were to occur. See Appendix D.8, and the Hydrology Project Files, for Road Erosion Risk Criteria.

Due to the number of crossings per road in the Snow Creek Watershed, the individual roads were assigned a rating of high, moderate, or low risk to failure, using the road drainage crossing results from the model.

Table 3.6 Existing Condition for Road Risks in the Snow Creek Watershed project area.

Road Number	Erosion Risk Rating	Ownership
402	High	Mix
402UF	Low	Mix
402A	Moderate	Mix
402AUX	Low	Mix

Almost all roads in Snow Creek were built or improved between 1950 and 1970, before the establishment of BMPs. Therefore, many of the drainage relief culverts and stream crossing are 30 to 50 years old. The designed life expectancy for culverts is typically 20 years. This increases the need for and importance of upgrading existing road improvements. Some facilities were replaced as a result of damages incurred from climatic events in 1974, 1985, and 1997, but even pipes installed in 1985 are now nearing the end of their expected service life (Historic hydrology and road inventory reports in the Hydrology Project Files). The actions that would be taken with this project to alleviate some of these concerns are discussed in Chapter 4 descriptions of Alternatives 2, and 5.

See the table in Appendix D that displays the roads/road segments in the Snow Creek Watershed Project area, and their current decommissioning priority. For road locations see the "Project Area Roads and Trails," map in Map Appendix – Aquatics Map 4. Based on the culvert analysis, road field surveys, culvert field surveys, and other current and historical data, the roads and/or road segments were prioritized for decommissioning. For further explanation on road erosion risks and supporting evidence for decommissioning prioritization, see Appendix D and the Hydrology Project Files.

The main contributing factor to human-caused sediment in the channels is from the roads on the landscape (Hydrology Project Files). More information on roads and their characteristics can be found in the Hydrology Section of Chapter 4. For supporting evidence for decommissioning priority, please see Hydrology Project Files.

3.3-B.5 Indicator 2 – Water Yield

Changes in duration and intensity of peak flows are often associated with changes in water yield from changing vegetation conditions. Patterns of large stand-consuming fires, forest insects and diseases, and regeneration cutting can alter snowmelt patterns (McCaughey et al. 1997, King 1993, Megahan 1983). The timing and duration of summer or base flows can also be altered through vegetation changes. Keppeler (1998) found that when 50 percent or greater of the drainage basin had been harvested, summer flows were altered during the long dry summer season.

<u>WATSED Modeling</u>

To understand changes and fluctuations with historic water yield and peak flow conditions, peak flows were modeled using WATSED. It is evident that peak flows are not static, but dynamic following disturbances. Following fires it is evident that peak flows are higher than background rates. Historically, when stand replacing fires removed the forest vegetation, water yield values rose sharply, then gradually declined to baseline condition. Research in the region has shown that causes of some peak flows are also associated with less frequent mid-winter rain-on-snow events and spring rain-on-snow events (MacDonald

and Hoffman 1995). From their research, spikes were usually higher and over a shorter duration, than what is currently modeled. WATSED cannot predict peak flows from these events because the timing and magnitude are unpredictable; they do not occur on an annual basis and are dependent on certain climatic conditions such as air temperature, intensity and duration of precipitation, rain-on-snow elevations, and snowpack characteristics (Berris and Harr 1987). However, it can be assumed that Snow Creek has been subjected to larger peak flows than what is modeled through WATSED. The Snow Creek drainage is a snowmelt-dominated stream; where peak flows are generated during the spring melt periods.

Existing Conditions

- Water yield for Snow Creek is currently estimated at 3% above baseline. This was estimated using land management and fire events in the WATSED model starting with the year 1920.
- Peak flow for Snow Creek is currently estimated at 4% above baseline. This was derived using the WATSED model starting with the year 1920.
- ECA for Snow Creek is currently estimated at 6% above baseline. This was derived using the WATSED model starting with the year 1920.

"Natural" (i.e., historic mean load prior to significant development activities) see information for the WATSED model on page 3-5.

These increased percents above baseline are due to the past timber harvest and road systems, before BMPs, that are now a part of the existing condition of the landscape within the Snow Creek Watershed. Refer to Tables Past Activities located in Chapter 3).

3.3-B.6 Indicator 3 – Sediment Yield

Sediment production and delivery, as used in this analysis, refers to landslide potential and surface erosion. Roads are the primary focus for this issue, although harvest and site preparation activities will be discussed when they have the potential to create or increase erosion. Roads can potentially increase the natural rate of landslide occurrence by creating unstable road cut and fill slopes and by greatly expanding the number of ways and locations where ground water can be intercepted, rerouted and concentrated. Surface erosion occurs on most forest roads because their surfaces, cutslopes, fillslopes and associated drainage structures are usually composed of erodible material and are exposed to rainfall and concentrated surface runoff. Minimizing the potential for roads to intercept, concentrate, and route water to streams and unstable slopes can reduce sediment production and delivery. Maintaining soil organic layers and functioning riparian zones are also strategies that are used to minimize sediment production and delivery. See Chapter 2 Design Criteria and Mitigation Measures for ways in which potential effects are avoided or minimized.

The different landforms in the geographic areas have been characterized as distinct landtypes. Landtype mapping combines bedrock geology, surface geology, landforms, soils, slope gradients, aspects, elevation, amount of rock outcrop or talus, presence of avalanche chutes, rain-on-snow zones and canopy cover. The analysis area includes many combinations of these landtype characteristics with many different implications for management. If a particular combination is abundant on the Forest and has management interpretations, which are different from the other combinations, it is mapped as a landtype and assigned a unique code. Some landtypes are more responsive to disturbances. The "responsive" areas include riparian zones (which range from low to high mass failure potential) and known landslide prone area. Mass failures or surface erosion will not definitely happen if management activities occur in these areas. Instead, the landtypes are used to indicate the areas where more careful planning and use of mitigation measures or restoration will usually be needed to avoid or reduce resource impacts.

Disturbances such as fire and rain-on-snow events are distinct in time and space and can occur anywhere across the landscape. Random sediment inputs to stream channels occur as a complex series of pulses that are delivered and stored within low order, high gradient stream channels (Benda and Dunne 1997).

Following high erosional event, large volumes of sediment are concentrated in different sections of the stream channel, mainly near tributary junctions along the larger order, lower gradient sections. The stream channel transports bed material downstream from these storage sites at different rates. The bed material travels slowly, creating temporary patterns of sediment transport, sediment storage and channel morphology throughout the stream channel (Benda and Dunne 1997a). This process has been active over centuries within Snow Creek, especially following the fires and rain-on-snow events that resulted in flooding. Within Snow Creek, management-related sediment sources have been from non-maintained roads and road construction activities, and past timber harvest activities. The construction of many of the roads in Snow Creek occurred before standard best management practices were required and presumably produced more sediment. This is consistent with research findings that have shown when roads are designed with specific criteria and best management practices they produce less sediment yields (Megahan et al 1992). Numerous research studies have documented that forest roads are usually the leading contributor of sediment to stream channels (Gucinski et all 2001, Bilby et al 1989, Duncan et al 1987).

Sediment Production and Delivery Indicators

Results from WATSED and WEPP modeling, and the amount of activity and reduction of risks on sensitive landtypes, are used as indicators for the potential of production and delivery of sediment. While interpreting the sediment yield increase above natural, it is important to consider that WATSED assumes that a road prism stays open and maintained for perpetuity and continues to generate a base level of sediment. In reality, many of the roads in the project area are revegetated which reduces actual surface erosion; and some are poorly maintained which produces even more than what is predicted. For this reason, the estimates of sediment yield increase above natural are somewhat overstated. The way in which this is accounted for is described in the following paragraph.

A road that is revegetated can still be a concern if it intercepts, concentrates, and re-routes substantial amount of ground water and if it increases the natural potential for mass erosion. Therefore, it is best to use the yield increase estimates as a relative indicator of sediment regime alteration rather than taken as an absolute. That is why the WEPP tools were used and incorporated into the sediment estimates above baseline. WEPP has the ability to distinguish more differences in road activity, level of use, and effects.

Effects of Wildfire in the Watershed

Prior to fire suppression, wildfire altered the structure and composition of forest stands within the assessment area (see the Fire and Fuels and Vegetation sections of Chapter 3). At times site conditions following fires would coincide with wet climatic conditions in a season, year, or period of years that would trigger landslides or surface erosion. Several landslides occurred after the 1926 wildfire can be seen on the 1935 aerial photos in Lower Snow Creek on the south facing slopes and on stream breaklands. Debris avalanches, shallow seated planar slides, and debris torrents were the most common types of failures. Failures were most common along the steep stream breaklands such as those found in Lower Snow Creek.

Sediment Yield Indicator

The indicator used for sediment yield is tons per year, expressed as a percent over natural baseline sediment yield. Base or natural yield represents the tons of sediment that are produced and subsequently transported out of the subwatershed each year under natural conditions. The existing sediment yield over base represents activity generated tons of sediment transported annually, produced by previous activities or disturbances such as roads, timber harvest and fire. Sediment yield was modeled for each sub-watershed.

Based on the areas where the management activities are proposed, Snow Creek Watershed was divided into three components for the WATSED runs:

- Upper Snow Creek,
- Lower Snow Creek, and
- Entire Snow Creek Watershed.

The modeled sediment yield results (percent above baseline) were as follows: Lower Snow Creek, 23%; Upper Snow Creek, 13%; overall Snow Creek watershed, 18%.

An estimated 830 tons of sediment erosion is being generated annually from the Snow Creek Watershed. Approximately 25 tons of that sediment is being delivered annually to the main channel of Snow Creek.

WEPP (WEPP: FuMe, WEPP: Road, GeoWEPP, Disturbed: WEPP) runs were conducted for Analysis Section G – Lower Snow Creek. Lower Snow Creek is currently on a recovery path from the effects of activities in the 1990s (i.e. timber harvesting, road building and maintenance). (Hydrology Project Files)

3.3-B.7 Indicator 4 – Channel Morphology

Stream surveys and fish habitat surveys were conducted in the project area throughout various years. The survey reports are found in the Snow Creek Hydrology Project Files. For location of cross-section surveys, please see Map Appendix – Aquatics Map 7 – Stream Cross-Sections and Temperature Gage Locations.

Channel morphology in project subwatersheds has been altered through two primary processes: sediment deposition and channel encroachment. Sediment deposition has occurred in areas subjected to roading and timber harvesting, before the advent of BMPs (refer to Table of Past Activities in Chapter 3). Channel encroachment has occurred where roads and timber harvesting have taken place adjacent to streams and their floodplains.

Please refer to Appendix D.6 for in-depth explanation of using reference reach comparisons for stream reach analysis.

The site-specific stream reach data and analysis are located in Appendix D.10. Throughout the individual reach sections, the channel morphology is displayed in a table that allows for the comparison of the 2005 survey to a specific reference reach, as

well as "typical" reference criteria. The data shows how much this specific reach has deviated from a reference reach condition and how far it is from a desired future condition (DFC) (see Appendix D.7 for further explanation of DFC and function status calls). Function status condition calls are per reach segment and are for those reach/channel segments and not the entire watershed. The overall watershed function status call is then made after taking all components into consideration.

Not all reaches or tributaries were surveyed in 2005. The survey sites were prioritized and conducted where management activities were proposed. Three tributaries of Lower Snow Creek were not surveyed. Three reaches of the main channel of Snow Creek (in the lower section) were conducted in 2005. The main channel of Lower Snow Creek was deemed to have the highest priority for analysis due to the locations of the proposed actions relative to the survey reaches (Hydrology Project Files).

The following table summarizes the existing stream type for the reaches that were surveyed and their corresponding function call.

Table 3.7 Existing stream type and function call.

Watershed	Stream	Reach	Year of Most Recent Survey	Existing Stream Type	Function Call
Snow Creek	Snow Creek	#1	2005	B3a	Properly-Functioning
		#2	2005	B3a	Functioning-At-Risk
		#3	2005	B3	Not-Properly-Functioning

Snow Creek is considered to be functioning-at-risk and in fair to poor condition for morphology. As a whole, the watershed is degraded and is poor to moderate in habitat quality and aquatic organism support (Hydrology Project Files, DEQ). Stability is fair to poor; the three reaches range from properly-functioning, to functioning-at-risk, to not-properly-functioning. Large woody debris is abundant in most areas.

As discussed above, wildfires, logging and road building have taken place throughout the management history of the Snow Creek watershed (refer to Table of Past Activities in Chapter 3). However, since the earlier activities, logging practices have changed and provide for better protection of aquatic resources. With the implementation of BMPs and other mitigation practices, such as INFS, timber harvesting can occur, even in impaired watersheds, without detrimentally contributing to the watershed condition. In some instances the use of new management practices can actually improve watershed conditions and aid in the recovery of impaired areas. In the case of the Snow Creek Watershed the improvements and recovery would come from road decommissioning, culvert improvements, road resurfacing, and road drainage improvements. These items are included in the proposed action (Alternative 2) and to a lesser degree in Alternative 5..

The Snow Creek drainage exhibits signs of a mildly impaired (functioning-at-risk) watershed. Stream bank stability varies throughout the channel and several mass failures were recorded. Although the erosion of banks and sediment transport occurs in some reaches, the system has been able to accommodate and contain the resulting energy and material.

3.3-B.8 Indicator 5 – Water Quality

The Bonners Ferry Ranger District currently does not sample water quality. However, the functioning status of the streams and their morphology is monitored. It is from this data that the water quality can be inferred. If a stream is in good, properly-functioning condition, then the water quality of the stream can often be concluded as such from these results. Water quality concerns often appear in the not-properly-functioning and functioning-at-risk reaches of the streams.

The City of Bonners Ferry does not monitor water quality for Snow Creek because it does not affect the municipal water system of Myrtle Creek.

Numeric water temperature criteria are included in the water quality standards. The Bonners Ferry Ranger District currently uses StowAway TidbiT temperature loggers (called Hobos) to record temperature information in sections of Snow Creek. Refer to Map Appendix – Aquatics Map 7.

Two segments of Snow Creek are assessment units listed in the DEQ 2002 Integrated Report for impaired streams. Both stream segments are listed for temperature modifications. Refer to the table in the section on Regulatory Framework-Clean Water Act for the TMDL Assessment Units in Snow Creek for the Myrtle Creek HFRA Project Area. See Fisheries Report for more information regarding temperature.

3.3-C Deep Creek Watershed

3.3-C.1 Description of the Watershed

The Deep Creek Watershed is approximately 12,871 acres (20 square miles) in area. Ownership within Deep Creek of the project boundary area is approximately 5.5% BLM, 23% State of Idaho, 14% private ownership, 10% US Fish and Wildlife Service, 0.5% Forest Capital, and 47% National Forest System Land. Deep Creek is a low gradient stream that flows into the Kootenai River approximately 3.5 miles to the west of the City of Bonners Ferry. Deep Creek, along with its tributaries, drains the south end of the Kootenai Valley. It runs through sand-alluvial soils, which are part of the historical lakebed of Kootenay Lake.

Due to the location of project activities, the small percentage of acres being treated in the Deep Creek Watershed (0.3%), and the fact that only a very small portion (18%) of the Deep Creek watershed is within the cumulative effects area, the potential risk for affecting Deep Creek is small, almost negligible.

Based on findings from the soils scientist, fisheries biologist, and hydrologist, the project area was divided into several sections for analysis purposes. See Map Appendix – Aquatics Map 3 "Water/Soil/Fisheries Analysis Sections" for section delineations:

A – Headwaters
B – Mid-valley south facing slopes – unburned
C – South facing slopes – burned by 2003 Myrtle Creek Fire
D – Mid-valley north facing slope – unburned
E – North facing slopes – burned by 2003 Myrtle Creek Fire
F – Front range
G – Snow Creek

Deep Creek is located in Section F.

Deep Creek has been heavily impacted by logging, farming, fire, stream channelization, roads, and pipeline constructions (Panhandle Bull Trout Technical Advisory Team, 1998 (PBTTAT)). Six segments of Deep Creek (which are not in the project area) are currently considered by DEQ to not be fully supporting its designated beneficial uses due to thermal modifications, siltation and suspended solids (see Table D-1 and Appendix D for more information regarding TMDLs and DEQ determinations).

WATSED model runs were conducted in the Deep Creek Watershed. The effects would most likely register in the Myrtle Creek watershed rather than in the Deep Creek watershed due to the location of proposed activities. Because of the size and location of proposed activities in this watershed, only preliminary WEPP model runs were conducted in the Deep Creek portion of Section F. The geology, soils and landforms of the watershed are described in the soil resources section.

Due to the minor amounts of management activities proposed in the Deep Creek watershed, a full-scale analysis was not conducted on Deep Creek Watershed. There would be site-specific effects, but any on-site effects would be mitigated with Required Design Features (as discussed in Chapter 4 and Chapter 2).

3.4 - Fire and Fuels

The fuels in the Myrtle HFRA project area, like in any forested environment, are dynamic and ever-changing. Thus, expected fire behavior changes as stands age and succession leads to changes in structure, function, and species composition. Tree mortality caused by any number of natural and human caused events can lead to increases in standing and down woody debris, increasing surface fuel loads. In-growth of new trees and other vegetation can affect the abundance of ladder and crown fuels over time. Even though fuels are constantly changing, the current condition of the surface, ladder, and crown fuels, and expected fire behavior in the event of a wildfire, can be summarized.

This section of Chapter 3 describes the regulatory framework for fire and fuels management and the affected environment of the Myrtle HFRA analysis area as related to fire by the following indicators:

- Fuels (surface, ladder, crown fuels),
- Crown Fire Hazard
- Fire Regime Condition Class (FRCC)
- Capabilities of fire suppression resources in the event of a wildfire

3.4-A Regulatory Framework

Four guiding documents (listed below) establish the direction for fire management. These documents provide the framework for fire management and provide specific goals, standards, and objectives for implementing a fire management program. In addition, the local community has developed the Boundary County Idaho Wildland/Urban Interface Fire Mitigation Plan (August 2003) (discussed further in this section), which provides recommendations for projects such as this one. Fire handbooks, guides, research, and technical papers provide further direction.

Guiding Documents	Direction
The IPNF Forest Plan	Provides standards and goals that Management Plans need to address on the Forest as well as provides Forest-wide and Management Area guidelines that define land uses.
The Forest Service Manual	Mandates all National Forests and lists objectives for fuels management.
Federal Wildland Fire Policy	Establishes standardized procedures and policies for Federal wildland fire management agencies.
National Fire Plan	Directs a comprehensive approach to the management of wildland fire, hazardous fuels, and ecosystem restoration on Federal and adjacent State, tribal, and private forest and range lands.

The IPNF Forest Plan objective is to implement efficient fire protection and fire use programs based on management objectives, site-specific conditions, and expected fire occurrence and behavior. The Forest Plan uses the term "fire use" in reference to management ignited fire, or prescribed fire. However, the term Fire Use has been adopted by the Fire and Aviation Program to include the combination of Wildland Fire Use opportunities and prescribed fire applications to meet natural resource objectives. Wildland Fire Use is the management of naturally ignited wildland fires to accomplish specific pre-stated resource management objectives in predefined geographic areas outlined in a Fire Management Plan. The Idaho Panhandle Forest Plan (1987) does not provide direction for Wildland Fire Use on the Bonners Ferry Ranger District. However, the Forest Plan does provide for the use of unplanned ignitions for prescribed fire, provided that NEPA analysis, a prescribed fire plan, and consultation with U.S. Fish and Wildlife Service and the public are complete. Therefore, Fire Use is not synonymous with Wildland Fire Use. The following key standards currently guide the IPNF fire management plan:

- Human life and property will be protected.
- The appropriate suppression response for designated old growth stands in all management areas, except in wilderness, will result in prevention of old growth loss.
- Activity fuels will be treated to reduce their potential rate of spread and fire intensity so the planned initial attack organization can meet initial attack objectives.

The primary **Forest Plan** Management Areas (MA1, MA2, MA7, and MA9 – see Chapter 1) within the Myrtle HFRA proposed treatment area include goals to manage lands suitable for timber production for the long-term growth and production of commercially valuable wood products (MA 1), for timber production while providing for grizzly bear habitat and recovery (MA 2), manage caribou habitat (MA7), and maintain and protect existing improvements and resource productive potential (MA9). The majority of the proposed treatment area is within Management Area 2. The fire protection standard to satisfy the goals is to use the most appropriate management response (confine, contain, and control) to achieve the best benefit based on commercial timber values and where appropriate, wildlife and other resource values. Management Area 7 does not allow for confinement to be the appropriate response for fire protection. Prescribed fire is to be used as needed to meet silvicultural objectives and the objectives of the management area. (A map of the Management Areas and Alternative 2, and Alternative 5 treatment areas is included in the Map Appendix.)

Forest Service Manual (FSM) 5105 defines fuel as combustible wildland vegetative materials, living or dead. The objective of fuel management as stated by FSM 5150.2 is to identify, develop, and maintain fuel profiles that contribute to the most cost-efficient fire protection and use program in support of land and resource management direction in the Forest Plan. Methods used for controlling the flammability and intensity of a fire may include mechanical, chemical, biological, or manual means, including the use of prescribed fire and wildland fire use (FSM 5150).

The "**Federal Wildland Fire Management Policy and Program Review**" was chartered by the Secretaries of the Interior and Agriculture in 1995 to examine the need for modification of and addition to Federal fire policy. Fire suppression policy from

the early 1900s until the late 1970s has been that of total suppression. Only recently has fire policy been modified to recognize the importance of fire in balancing vegetation cycles within the temperate forest. The review recommended a set of consistent policies for all Federal wildland fire management agencies.

In adopting the policy, the Federal agencies recognized the role of wildland fire as an essential ecological process and natural change agent that will be incorporated into the planning process (USDI and USDA 2001a). The severe wildfire seasons in recent years throughout the country have made it clear that fire cannot be excluded from fire-dependent ecosystems. On the other hand, because of developed areas, and commercial forests, fire cannot be fully restored to its historic character without severe consequences to humans, except perhaps in a few of the largest wilderness areas.

The **National Fire Plan** (NFP 2000) originated after the record-breaking wildfire season of 2000. President Bush requested a national strategy for preventing the loss of life, natural resources, private property, and livelihoods in the wildland/urban interface. Working with Congress, the Secretaries of Agriculture and Interior jointly developed the National Fire Plan (www.fireplan.gov) to respond to severe wildland fires, reduce their impacts on communities, and assure sufficient firefighting capabilities for the future. The National Fire Plan (2000) includes five key points:

- Firefighting / preparedness
- Rehabilitation and restoration of burned areas
- Reduction of hazardous fuels
- Community assistance
- Accountability

The NFP is a long-term commitment based on cooperation and communication among federal agencies, states, local governments, tribes and interested publics. The federal wildland fire management agencies worked closely with these partners to prepare a 10-Year Comprehensive Strategy. The four goals of the 10-Year Comprehensive Strategy are to

- Improve fire prevention and suppression
- Reduce hazardous fuels
- Restore fire-adapted ecosystems
- Promote community assistance

In response to the 10-Year Comprehensive Strategy goal to promote community assistance, Boundary County initiated a contract to develop a Wildland/Urban Interface Fire Mitigation Plan (Community Wildfire Protection Plan) to aid in the protection of the communities within the county (This document is available online at the following location: http://www2.state.id.us/lands/nat_fire_plan/county_wui_plans/boundary/boundary_plan.htm).

The goal of the Boundary County Community Wildfire Protection Plan is to:

1. *Assess the wildland urban interface fire risk in Boundary County*
2. *Plan for mitigation of the fire risk*
3. *Prioritize treatments and mitigation of forest fuels*

The fire mitigation plan describes the community of Bonners Ferry and the municipal watershed, as being at high risk to wildfire loss. The Boundary County Community Wildfire Protection Plan defines wildland urban interface as:

> "…two (2) miles outside places of human habitation and/or infrastructure to service these points of habitation. Infrastructure includes power and communication lines and towers, transportation routes for ingress, egress and evacuation, rail lines, and watersheds where citizen groups have organized for joint collection of water for domestic uses. In instances where topography immediately outside the 2-mile zone would allow "anchoring" to good fire control points, such as ridge tops or roads, the zone will be extended to the anchor point."

The **Healthy Forests Initiative** (HFI) passed in 2002 and **Healthy Forests Restoration Act** (HFRA) passed in December 2003, were developed as tools to meet national fuels reduction targets and achieve National Fire Plan objectives; authorizing federal land managers to prioritize and quickly implement projects on lands in or adjacent to the wildland-urban interfaces of at-risk communities through collaboration with local publics and associated agencies. Specifically, the HFRA includes authorization for projects that reduce the risk wildland fires pose to the quality of a municipal water supply or to its maintenance and provides for expedited vegetation treatments on National Forest System lands in Condition Class 3 in all fire regimes and in Condition Class 2 in Fire Regimes I, II, or III (discussed further in this section) that are:

> "…in such proximity to a municipal water supply system or a stream feeding such a system within a municipal watershed that a significant risk exists that a fire disturbance event would have adverse effects on the water quality of the municipal water supply or the maintenance of the system, including a risk to water quality posed by erosion following such a fire disturbance event" (FS-799, 2004)

Using the county definition of wildland-urban interface provided in the Boundary County Fire Mitigation Plan (August 2003, Amendment 1 February 2004) in association with fire risk in the watershed that provides drinking water to the community of Bonners Ferry, this project is an "At-risk municipal watershed" as outlined in the HFRA qualifications for hazardous fuels treatment. The fire regime condition classes (more thoroughly described in subsequent paragraphs) within the project area have been moderately removed from natural range.

3.4-B Air Quality Regulatory Framework

Smoke from fire contains air pollutants, including fine particulate matter, which can cause health problems, especially for people suffering from cardiopulmonary illnesses. Particulate concentrations that exceed health standards may occur several miles downwind of prescribed burns. Smoke from prescribed burns may impact Class 1 airsheds, diminishing scenic vistas.

Boundary County is in Airshed 11 of the Montana/Idaho Airshed Group – the coordinated operations of this group being critical in minimizing cumulative impacts of smoke from prescribed fire activities conducted by its members. Within Airshed 11 there are no areas of concern, non-attainment areas (described in the next paragraph), or Class 1 airsheds. Class 1 areas include Forest Service and Fish and Wildlife Service wilderness areas over 5,000 acres that were in existence before August 1977 and National Parks in excess of 6,000 acres as of August 1977. Designation as a Class 1 area allows only very small increments of new pollution above existing air pollution levels. The nearest Class 1 airshed is the Cabinet Mountains in western Montana – southeast of the project area. The Libby airshed impact zone is approximately 45 miles east.

The framework for controlling air pollutants in the United States is mandated by the 1970 Clean Air Act (CAA), as amended in 1977 and 1990 (42 U.S.C. §7401 et seq.). In 1999, minor revisions addressed visibility in sections 7491 and 7492. These changes were published on July 1, 1999 as the Regional Haze Rules (64 FR 35741). The CAA was designed to "protect and enhance" the quality of the nation's air resources. The Act encourages reasonable Federal, State and local government actions for pollution prevention. State Implementation Plans (SIPs) are developed by each state to implement the provisions of the CAA. The SIPs describe the State's actions to achieve and maintain the "National Ambient Air Quality Standards" (NAAQS) established by the EPA (Environmental Protection Agency) for specific pollutants. If a community or area does not meet or "attain" the standards, it becomes a non-attainment area and must demonstrate to the public and EPA how it will meet standards in the future – as stated, this airshed is in attainment.

3.4-C Desired Conditions

The effects of fires in the Myrtle HFRA analysis area may be detrimental or desirable depending on when and where fires occur and the nature of fires relative to management objectives. Fires occurring across this landscape during the hot dry summer months, when fire danger is very high to extreme, could potentially lead to detrimental effects based on the goals of this project – maintain a continuous source of high quality potable water from Myrtle Creek for the City of Bonners Ferry, reduce the risk of catastrophic wildfire in the watershed, and maintain and restore habitat for fish and wildlife.

According to the IPNF Forest Plan, a desired condition is a sustainable forest system. In terms of fire management this reflects wildland fires that are of low severity, provides for public safety and safety of our neighboring private lands and property (IPNF Fire Management Plan 2005 p.9).

One way to achieve this is to:

> "…emulate the size, pattern, and intensity of disturbances to approximate historical forest structures and conditions – not because they are historical, but because they are sustainable – that is, vigorous, self-perpetuating, and at low risk to biotic agents and catastrophic fire" (Arno and Fiedler 2005 (Fiedler 2000a)).

When planning an activity, the intent is to either maintain a desired condition, or to trend toward the desired condition. If an area is already within the range of desired conditions, a management action should either keep the area within the desired range, or when the action results in moving outside the range, a mechanism to move conditions back into the range should be provided.

3.4-C.1 Fuels

For fire and fuels management, a desired condition is one that is consistent with the strategy of fire and fuels management per Management Area direction in the IPNF Forest Plan – an example would be fuels that contribute to slow rates of spread and low flame lengths even during high to extreme fire danger. The current conditions in the project area as related to forest fuels are outside or are trending away from desired conditions. This may be for several compounding reasons such as fire

suppression and other human influences and based on several factors, including current vs. past fuel composition, structure, size, arrangement, and total fuel load.

Fuel Models

Fire behavior fuel models are sets of mathematical equations that describe physical fuel properties, including fuel loading, fuel bed depth, and moisture of extinction (the fuel moisture content, weighed over all the fuel classes, at which the fire will not spread) (Anderson 1982). These properties are determined based on the vegetative layer that would serve as the primary carrier of a surface fire.

The 13 Fire Behavior Fuel Models, developed by Rothermal (1972) and Albini (1976), and as described in *Aids to Determining Fuel Models for Estimating Fire Behavior* (Anderson 1982) are used in fire behavior prediction modeling for their physical description of the fuels and to estimate potential fire behavior. They are for fire behavior estimation during the "severe period of the fire season when wildfires pose greater control problems and impact on land resources" (Anderson 1982).

The desired fuel model in stands of timber is one with light surface fuels where slow-burning surface fires and generally slow rates of spread are common. Tree crowns are generally spaced to lessen the risk of crown fire, except under extreme weather conditions. From the viewpoint of fuels management and fire suppression, a Fuel Model 8 (as described later along with all the fuel models currently observed in the project area), best fits with the desired condition.

3.4-C.2 Crown Fire Hazard, Including Crown Fire

Condition Class

In forested stands where the fire regime is within natural range, the risk of losing key ecosystem components to fire is low. A desired condition is one where the vegetation attributes are intact and functioning within historic range. A natural condition is one that native species are adapted to and where soil and hydrologic conditions are in sync. In the proposed treatment area – Alternative 2 – the desired condition is an improvement in condition class, which in some stands means a reduced risk of crown fire in the event of a wildfire. This is especially true on dry-site old growth stands, where one of the key ecosystem components are the old growth trees, and are susceptible to being lost in the presence of extreme fire behavior such as torching and crowning.

Fire Behavior

In addition to topography and weather, the fuels - size, structure, distribution, and moisture content - will contribute to the fire behavior. The desired fire behavior in the project area is low intensity, low severity, low flame lengths and corresponding slow rates of spread so that the watershed resources can be protected from negative impacts from crown fire and the high fire severity associated with it. Additionally, low intensity and severity fire characteristics contribute to the number one objective of fire suppression – firefighter and public safety.

3.4-C.3 Suppression Capabilities

The current IPNF fire strategy is suppression (*confine*, *contain*, or *control*) outside of wilderness and proposed wilderness areas. Because the project area is outside of a wilderness or proposed wilderness area, letting a wildfire burn is not an option.

Suppressing a wildfire using direct attack to control a fire is the most desirable tactic to achieve the objectives in the Forest Plan. Suppression actions must hold life, firefighter, and public safety as the highest priority while minimizing resource value loss, economic expenditures, and the use of critical firefighting resources based on values at risk. Direct attack to control a fire is the most rapid and aggressive approach to accomplishing these priorities.

> **Control:** To complete the control line around a fire, any spot fires there from, and any interior islands to be saved.
>
> **Contain:** To surround a fire and any spot fires with a control line.
>
> **Confine:** To limit fire spread within a predetermined area.
>
> (IPNF 2005 Fire Management Plan, p.25)
>
> **Resistance to control:** The relative difficulty of constructing and holding control line as affected by resistance to line construction and fire behavior. (FSM 5105)

Crown fires exhibit a high resistance to control, as do surface fires with flame lengths and rates of spread beyond the curve of safe direct attack suppression. Surface fires, with low flame lengths (<4 feet) are desirable for more safe and effective direct attack suppression tactics and are generally associated with a Fuel Model 8 in forested stands.

3.4-D Existing Conditions

3.4-D.1 Methodology Used to Identify the Existing Condition

For the purposes of this analysis, historic fire occurrence and the existing fuel conditions were obtained through fire archives, research, and modeling, as well as field reviews, photographs, stand exams, and aerial photos. The Idaho Panhandle National Forests GIS reference library was used to access vegetation data on stand structure and forest type for use in Fire Regime Condition Class analysis and used in fire behavior modeling. Data obtained throughout the spring and summer of 2005 was used in determining fuel models, canopy base heights, and estimating canopy bulk densities to be used as inputs to fire models used for estimating fire behavior. Fuel models were determined at the stand level. Other methods used to assign one of the 13 Fuel Models to all of the National Forest System stands in the analysis area included stand exam information (including past timber harvest on National Forest System lands and private lands), fire history, aerial & digital photos, and on-site observations.

Fire Archives and Research

Forest Service fire ignition records for the analysis area cover the years from 1941 to present. These records include the year, size, location, and cause of each fire reported. Awareness of large fires prior to 1941 exists from other sources including media and local knowledge. From the locations available in the data records, a coverage created in ArcView GIS (Geographic Information Systems) was used to show the distribution of fire ignitions across the Myrtle HFRA analysis area.

a. Weather and Topography

The general climate of the area can be summarized as cool-moist with a maritime influence from the Pacific Ocean. Winters are cold and wet with the annual mountain snow pack usually melting in April and May. Summers tend to be very warm and dry, leading to periods of very high to extreme fire dangers in August through early September.

The Myrtle Creek drainage is oriented with the prevailing wind direction - typical winds are light to moderate from the southwest. Late afternoon winds tend to funnel down the Myrtle Creek drainage. This orientation to the wind may aid in fire spread. Strong winds are generally associated with cold fronts, bringing shifts in wind direction and downdrafts. Slopes range from gentle to steep (30-80%), as does elevation (2100’ at creek bottoms to 5500’ on ridgetops). There are steep slopes on both sides of Myrtle Creek. Surface rock and large rock outcrops exist throughout the proposed treatment area, especially observable on the south aspects of both the Myrtle Creek and Snow Creek drainages (Hydrologic Sections B and G).

b. Broad Scale Fire History

In order to assess the current condition of the fuels in the Myrtle HFRA analysis area, it is important to consider historic conditions and the natural disturbance processes that formed them – to understand what factors are contributing to the existing forested environment. Depending on forest type, historic stand conditions may have been different than what is observed today due to post-European influences such as fire suppression, timber harvest and road construction. Success in fire suppression has caused missed fire return intervals on dry forest types such as those that exist on southern exposures of Myrtle and Snow Creeks - altering the historic fire frequency, fire severity and natural fire regime. For Myrtle Creek and Snow Creek the average fire return interval on dry south slopes has been estimated at 38-40 years (Behrens 1999 and Zack 1994). Until the Myrtle Creek Fire in 2003, there had been no large fire event (and still no large natural event) in the project area since 1926 – making the latest return interval 77 years on dry-sites in Myrtle Creek and 80 years in Snow Creek.

The following table displays the years when fires burned in the project area, years since the fire, and the resulting fire interval between fires. The most recent years are listed in the left half of the table (2003 back to 1852) and the later years on the right half of the table (1778 back to 1620).

Table 3.8 Fire History Data – Fire Return Intervals for Dry Forests in Project Area

Year of Fire	Time Since Fire (years)	Interval Between Fires (years)	Year of Fire	Time Since Fire (years)	Interval Between Fires (years)
2003	4	--	1778	229	74
1926	81	77	1746	261	32
1889	118	37	1728	279	18
1872	135	17	1654	353	74
1852	155	20	1620	387	34

Three types of fires occur in forested ecosystems (Zack and Morgan 1994):

- Lethal fires – fires that are stand replacing, removing 90%+ of the live tree dominant upper canopy layer across >90% of the stand across a large, relatively uniform scale. These are commonly crown fires that burn with high severity. Local examples of these types of fires are the Sundance and Trapper Peak fires of 1967 that together burned over 80,000 acres in a short time period during drought conditions
- Non-lethal fires – fires that kill 10% or less of the dominant tree canopy. A much larger percentage of small understory trees, shrubs, and forbs may be burned back to the ground line.
- Mixed severity fires - fires that commonly burn with variable severity across the landscape, producing irregular, patch mosaics; killing more than 10%, but less than 90% of the dominant overstory tree canopy. Fire regimes are considered variable – a short return interval non-lethal fire may occur with occasional long interval lethal crown fires.

> ***Severity***: Degree to which a site has been altered or disrupted by fire; loosely, a product of fire intensity and residence time.
>
> ***Intensity***: The rate of heat release per unit time per unit length of fireline.
>
> ***Flame Length***: The distance between the flame tip and the midpoint of the flame depth at the base of the flame (generally the ground surface); an indicator of fire intensity.
>
> ***Rate of Spread***: The relative activity of a fire in extending its horizontal dimensions. Usually it is expressed in chains or acres per hour for a specific period in the fire's history.
>
> Glossary of Wildland Fire Terminology – NWCG, 2005

In the western United States, millions of acres of forests have accumulations of fuels that are much greater than historical conditions – due to various forms of fire exclusion (Peterson et al. 2005). The fuel build-up has led to an increase in catastrophic wildland fire risk (Pollet and Omi 2002). The Myrtle Creek Fire in 2003 is a good example of a fire burning in heavy, abundant, and generally continuous fuels (Fire Behavior and Weather Report – Myrtle Creek Fire 2003). Another local example is the 1967 Sundance Fire which started on September 1st and grew from 4,000 acres to nearly 56,000 acres in 12 hours, burning across the entire Pack River drainage and other areas of the Selkirk and Cabinet Mountains just missing Bonners Ferry. During the period of the fastest spread, the fire burned at a rate of one square mile (640 acres) every six minutes and produced a column of smoke that rose 35,000 feet into the air.

Wildfires are becoming more intense and severe specifically in areas not historically experiencing them, such as dry-site ponderosa pine stands in the western United States (Arno and Fiedler 2005). In all forest types within the analysis area, dense stands of shade-tolerant (and fire-intolerant) trees are setting forests up for wildfires that could exhibit high resistance-to-control - the more intense and severe the fire, the greater the number and type of resources needed to suppress it. These forests generally have vegetative conditions that seem to be fitting for crown fire behavior – low growing crowns and other ladder fuels, dense canopies, high amounts of heavy timber litter, etc. Ladder fuels are an especially important issue because they create an avenue for surface fires to move into the tree crowns. (See Chapters 2 and 4 for discussion of fire suppression capabilities in surface fires and crown fires.)

c. Fuel Models and Fuel Loading

Composition, abundance, distribution, and structure (including size, distribution, age, etc.) of forest fuels can influence how they will burn and to what severity the environment is affected (Graham, McCafferey, Jane 2004). Discussion on reducing these fuels is generally focused on three layers – surface, ladder, and crown fuels. However, they can be defined even further into six strata (Graham et al 2004) – tree canopy, shrubs/small trees, low vegetation, woody fuels, litter, and ground fuels or duff. Modifications of any of these fuels stratum will have implications on fire behavior and strategies for control (Graham et al 2004). Even the most extreme fires, exhibiting crown fire behavior, start small and begin in the surface (or ground) fuels. Therefore, determining the fire behavior fuel models that exist across a landscape is a key in the process of predicting wildfire behavior and the need for and location of hazardous fuel reduction activities.

Due to elevation, aspect, and other terrain features and vegetation, several different fuel models may have been present throughout the project area historically – likely representing three of the main fuel model groups – grasses (Fuel Models 1-3), brush (Fuel Models 4-7), and timber (Fuel Models 8-10). Fuel Models 11-13 are slash fuel models occurring from logging activities and would have not been present before European settlement. Differences in fire behavior between the groups can be attributed to many factors including fuel size, distribution, and loading, as well as location on slope and aspect, which can influence fuel shading, moisture, and temperature. Several of the 13 fire behavior Fuel Models exist throughout the project area today – at least one from each of the four groups described above is represented.

The majority of the stands with no record of past management, outside of the Myrtle Creek Fire of 2003, can be classified as a Fuel Model 10 (heavy timber litter). Dead, down material, as well as standing live and dead ladder fuels and the structure of the

timber overstory all contribute to this classification. In areas where fire has been excluded from the landscape due to suppression, ground fuel build-up is at a level to support an intense surface fire. Throughout the proposed treatment area, small patches of Fuel Model 2 (grass), Fuel Model 5 (brush), and Fuel Model 8 (light timber litter) exist as well, and expected fire behavior varies for each of them. Continuous patches of these fuel models may alter overall fire behavior, as the fuels driving a fire would change. As mentioned, fuel model determination was made at the stand level, and one fuel model was assigned as the dominant fuel model within each stand, even though more than one may have existed. A map showing the distribution of these fuel models across the project area is available in the project file.

Fuels are known as 1-, 10-, and 100-hour fuels, relating to the size of the fuel and the saturation and drying time. For the project area, the major contributor of surface fire spread is the smaller dead fuels (small material less than 3" diameter that dry out quickly and ignite and burn rapidly). Both of the timber litter models in the project area have an abundance of these fuels, which build up significantly over time in the absence of fire or management activities. In dry forests, frequent, low-intensity fires that occurred historically would have consumed these materials.

Down woody debris (dead material on the forest floor greater than three inches in size) can be a contributor to the spread of surface fires depending on the abundance and distribution. This tends to be the case more so in a Fuel Model 10 than it does in either of the other two Timber Litter Fuel Models.

Fuel Model 2

The main carrier of a fire in this fuel model is the grass under an open timber or brush overstory. Timber litter is involved, but the grass carries the fire.

For the project area, this fuel model would be more typical on dry sites (south and southwest aspects), where timber (ponderosa pine and Douglas-fir) is mature and the canopy is open. Fuel Model 2 is present in the Myrtle Creek Fire area. Outside of these areas, there is currently very little Fuel Model 2 in the project area.

Fuel Model 5

The surface fuels are made up of litter cast by the shrubs and the grasses or forbs in the understory. This would include areas of shrub lands regenerating after a fire, or low green shrubs (like snowberry) growing under Douglas-fir. Surface fuels are generally light, thus fires are not very intense. This fuel model is common after regeneration harvest where most of the heavy fuels have been removed, leaving the regenerating shrubs to be the main carrier of a fire.

There are a few patches of this fuel model spread throughout the analysis area, and it is fairly common in some of the private sections – occurring more at the headwaters of the Myrtle Creek drainage. Stands dominated by healthy subalpine fir and Engelmann spruce occurring below timberline, can also be classified as a Fuel Model 5, due to the brushy forest floor and general lack of continuous timber litter.

Fuel Model 8

This fuel model is typically characterized by a timber overstory with light timber litter. Slow-burning ground fires with low flame lengths are typical, although the fire may encounter occasional heavy fuels. Only under severe weather conditions, with high temperatures, low humidities, and high winds do the fuels pose a fire hazard.

There are few forested stands on National Forest System lands within the analysis area that are currently a Fuel Model 8. They are found on North aspect lower elevation stands with little to no heavy surface fuels as a result of the severe 1926 fire. However, most of these stands are dense and characterized by low growing branches, touching tree crowns, and dead and dying timber that, if left untreated will contribute to the build-up of surface fuels. Crown fires would be possible in these stands where there is enough surface fuel to create the intensity needed to transition a fire to the tree crowns.

Fuel Model 9

Fires run through the surface litter faster in a Fuel Model 9 than in a Fuel Model 8. The long pine needles build up on the forest floor and create a compacted litter layer that burns with greater flame lengths than the less continuous fuels in a Fuel Model 8. Concentrations of dead-down woody materials are available to burn and this material may contribute to tree torching, crowning, and spotting.

In the Myrtle HFRA analysis area, this fuel model is seen in small patches on dry South aspects with closed stands of ponderosa pine dominating the overstory.

Fuel Model 10

Surface fires burning in a Fuel Model 10 generally burn with more intensity than the other timber litter models (Anderson 1982). Flame lengths greater than four feet can be expected and may be greater depending on the influence of slope, wind, and other environmental factors contributing to high fire danger, such as high temperatures and low relative humidities. Rates of

spread vary depending on these factors, but are generally higher and more sustained due to the greater presence of heavy timber litter. This not only makes direct attack suppression with hand crews difficult (flame length limit of 4 feet for direct attack by hand crews) but provides an easier route for fire to reach the ladder fuels and move into the tree crowns. This makes even aerial suppression resources ineffective for direct attack.

As stated above, in the analysis area the majority of the stands with no record of past management, outside of the Myrtle Creek Fire of 2003, can be classified as a Fuel Model 10 (heavy timber litter).

Fuel Model 11 – Light Logging Slash

Light amounts of logging slash, generally produced from thinning operations, intermixed with herbaceous material are the main carriers of a fire burning in this fuel model. Fuel Model 11 has a fuel bed depth of approximately 1.0 foot, and has a total surface fuel loading of approximately 15 tons/acre. Surface fires are common.

Many stands that burned in the Myrtle Creek Fire in 2003 were awaiting treatment of fuels that had been slashed as part of the Mama Cascade timber sale. Although the fire stayed in the surface fuels, the amount of surface fuels created an intense burn that produced enough heat to cause high mortality in the overstory trees. Had these fuels been treated prior to the Myrtle Creek Fire, the fuel model would have been converted to a Fuel Model 8. Most of the National Forest System stands currently in a logging slash fuel model, within the project area, have recently been harvested and are in the process of being treated for activity fuels (see Chapter 4 discussion of reasonably foreseeable activities). Fuel treatments on the district are generally designed to trend the landscape towards a Fuel Model 8, until fuel build-up into the future moves them towards a Fuel Model 10 and they are in need of treatment again. See Chapter 4 discussion of reasonably foreseeable activities for more information concerning fuels treatments.

The following table compares characteristics of the fuel models in the analysis area. The values used in the analysis are described below the table (Anderson 1982).

Table 3.9 Fuel Models: General characteristics, expected fire type and surface fire behavior during periods of high fire danger

Fuel Models*	Fire Spread	Fire Type	Flame Lengths (ft)	Spread Rate (chains/hr)
2	Cured Grass	Surface	6.0	35
5	Shrub litter, grasses, forbs	Surface	4.0	18
8	Needles, leaves, occasional twigs	Ground/Surface	1.0	1.6
9	Long conifer needles	Surface w/possible crowning, spotting, torching	2.6	7.5
10	Heavy timber litter (>3” material)	Frequent crowning, spotting, torching	4.8	7.9
11	Light logging slash	Active surface fire	3.5	6.0

*For timber litter fuel models, the fire intensity and spread rates are for a dead fuel moisture content of 8%, live fuel moisture of 100%, and effective wind speed at mid-flame height of 5 mi/hr (Anderson 1982). Differences in fire behavior among the fuel models are generally contributed to overall fuel load and distribution among fuel size classes.

Canopy Base Heights and Canopy Bulk Density

Canopy bulk density is the dry weight of the available fuels per unit of canopy volume, including the spaces between the tree crowns, expressed in kilograms per cubic meter (kg/m^3). Canopy base height is the lowest height above the ground at which there is enough available canopy fuel to propagate fire vertically into the tree crowns, expressed in feet above the surface fuels (Scott and Reinhardt 2002). Both contribute to crown fire spread – low canopy base heights allow a surface fire to move into the canopy, while a high canopy bulk density means that canopy fuels are denser and can more easily sustain a crown fire.

The majority of the stands within the Myrtle HFRA analysis area can be classified as a Fuel Model 10, with a dense overstory, high surface fuel loadings, and low crown base heights (averaging 1-3 feet due to the large amount of regeneration with low growing crowns). Because the overstory is dense and generally mixed conifer, canopy cover percentages are high (50-80%), thus so are canopy bulk densities, averaging 0.26 - 0.3 kg/m3.

Surface Fuel Loading

Representative transects for heavy surface fuel loading – coarse-woody debris in tons per acre – were completed in each of the proposed treatment units within the analysis area for comparison to recommendations for forest and habitat types. Fuel model values for fine fuels (less than 3-inch) were taken from Anderson (1982) using representative photos for each fuel model as shown in the figure below. Surface fuel loading is important for fire behavior and fire risk determination for several reasons. Not only is fuel loading associated with flame length and rate of spread, but heavy surface fuels could contribute to potentially adverse fire effects.

Coarse-woody debris (CWD - dead standing and downed pieces greater than 3" in diameter) is an important component of a healthy ecosystem. Animal life processes, site productivity and protection all depend on coarse woody debris – finding the right balance is often a hot-topic of discussion by forest managers due to fire danger. (Brown, Reinhardt, Kramer 2003). Small woody material, less than 3" in diameter, generally has the most substantial influence on fire spread rates and fire intensity, which can be accurately predicted with surface fire behavior models. However, large woody fuels can contribute to large fire development and severity (effects to soils, water, and other forest resources) because of prolonged smoldering and persistent burn periods (Brown, Reinhardt, Kramer 2003).

Coarse Woody Debris (CWD)

Habitat Group	Recommended CWD tons/acre
Dry	**6.6 – 13.2**
Moist	**16.5 – 33.0**

Observations for coarse-woody debris on dry sites within the Myrtle HFRA project area (approximately half the proposed treatment area) fell within the average recommendations (6.6-13.2 tons/acre) for soils and other resource productivity. The moist sites trended towards the upper end of the recommendations and higher (16.5-33.0 tons/acre recommended with some areas higher at 46 tons/acre). These sites typically had long fire-free intervals where fuel would build up, and severe fires generally occurred with only extremely dry weather (Smith and Fischer 1997) (such as during 2003). On moist habitat types that had been burned during the 1926 fire, CWD is less, and even absent in small areas, due to consumption of nearly all the fuels during the fire.

The following table describes fuel models used in fire behavior as developed by Rothermal (1972) and Albini (1976) as shown in Table 1 of *Aids to Determining Fuel Models for Estimating Fire Behavior* (Anderson, 1982). Fuel Model 10 (shaded column) represents the conditions in the majority of the stands with no record of past management and outside the area of the Myrtle Creek Fire of 2003. See the previous descriptions of fire behaviors in the discussion of fuel models.

Table 3.10 Sizes and Amounts of Fuels Characteristic of Fuel Models in the Analysis Area

Fuel Type and Size	**Fuel Models**				
Surface Fuels (shown in tons/acre)	**2**	**5**	**8**	**10**	**11**
1 hr	2.00	1.00	1.50	3.00	1.50
10 hr	1.00	0.50	1.00	2.00	4.50
100 hr	0.50	0.00	2.50	5.00	5.50
Live	0.50	2.00	0.00	2.00	0.00
Total Surface Fuel (less than 3 inch)	4.00	3.50	5.00	12.0	11.50
Crown Fuels	**2**	**5**	**8**	**10**	**11**
Canopy Bulk Density (kg/m3)	0.10	0.10	0.15	0.30	0.10
Canopy Base Heights (feet)	20	20	6	1	20

Coarse-woody debris was estimated from samples taken in the field. Canopy bulk density and canopy base heights were estimated for utilization in fire behavior modeling.

d. Fire Regime Condition Class

A natural fire regime is a general classification of the role fire would play across a landscape in the absence of modern human mechanical intervention, but including the influence of aboriginal burning (Agee 1993, Brown 1995). Coarse-scale definitions for natural (historical) fire regimes have been developed by Hardy et al. (2001) and Schmidt et al. (2002) and interpreted for fire and fuels management by Hann and Bunnell (2001).

Fire Regime is the composite result of fire frequency (years between fires) and fire severity to the dominant overstory vegetation (amount of replacement), and other disturbances. There are five natural (historical) fire regimes based on these expected frequencies and severities. They are summarized in the following table:

Table 3.11 Fire Regimes (Hann and Strohm 2003)

Fire Regime	Fire Frequency[1]	Fire Severity[2]
I	0-35	Low severity (Non-lethal)
II	0-35	Stand-replacement severity (Lethal)
III	35-200	Mixed severity
IV	35-200	Stand-replacement severity
V	200+	Stand-replacement severity

[1]Fire frequency is the average number of years between fires.
[2]Fire severity - the effect of fire on the dominant overstory vegetation.

An indicator for evaluating the health of fire-dependant ecosystems at the landscape level is Fire Regime Condition Class (FRCC) as defined on the Interagency and The Nature Conservancy fire regime condition class website (USDA Forest Service, US Department of the Interior, The Nature Conservancy, and Systems for Environmental Management [www.frcc.gov] Hann et al. 2003).

FRCC characterizes the degree of departure from natural fire regimes, determined from changes in vegetative attributes brought on by changes in disturbance patterns, such as fire frequency and severity. Current departure from condition class is comprised of a departure of vegetation-fuel, a departure of fire frequency, and a departure of fire severity. Thus there is a veg-fuel condition class and a frequency-severity condition class and the two together give the overall condition class with the frequency-severity being weighted heaviest. Skipped fire return intervals are associated with success in fire suppression throughout the early and mid-1900's coupled with a lack of fire use. FRCC can be a useful tool for tailoring fuel treatments that move vegetative classes that are overrepresented as compared to natural range to vegetative classes that are underrepresented as compared to natural range, to move the effected landscape towards a condition class 1. There are 3 fire regime condition classes - FRCC 1, 2, or 3. The following table summarizes the definitions for each fire regime condition class (FRCC) rating.

Table 3.12 Fire Regime Condition Class (FRCC)

Condition Class	Fire Regime
1	Fire regimes are within natural range, and risk of losing key ecosystem components is low. Vegetation attributes (species composition and structure) are intact and functioning within historic range. Condition Class 1 – 0-33% Departed
2	Fire regimes have been moderately altered from their natural range. The risk of losing key ecosystem components is moderate. Fire frequencies have departed from natural frequencies by one or more return intervals. Vegetation attributes have been moderately altered. Condition Class 2 – 34-66% Departed
3	Fire regimes have been significantly altered from their natural range. The risk of losing key ecosystem components is high. Fire frequencies have departed from natural frequencies by several return intervals. Vegetation attributes have been significantly altered. Condition Class 3 – 67-100% Departed

(Table taken from Hann and Strohm, 2003)

The fire regime condition classes for the Myrtle HFRA analysis area were determined using the standard landscape form from FRCC version 1.2.2.2 (www.frcc.gov). Potential natural vegetation groups (PNVGs – also called biophysical settings - BpS) were determined across the project landscape; each representing a stratum of the total landscape. PNVGs or BpS refers to the combination of soils, climate, and topography that dictates the composition of the resulting plant communities and natural disturbance regimes. Four PNVGs were determined, through collaboration between the district silviculturist and fuels specialist, using the Idaho Panhandle National Forests GIS vegetation layer and are delineated based on Vegetation Response Units (VRUs –Dry, Moist, Cool/Moist, and Cold/Dry). The vegetation response unit (VRU) is suggested as the basic environmental stratification for relating repeatable landscape patterns to predictable ecological processes. Additionally, it provides a mechanism to interpret existing vegetation in the context of natural disturbance processes and enables a projection of future landscape conditions and a foundation for landscape design. The VRU is intended to be an aggregation of land having similar capabilities and potentials for management. These units have similar patterns in potential natural communities (habitat

types), soils, hydrologic function, landform and topography, lithology, climate, air quality, and natural disturbance processes (fire regimes, succession, productivity, nutrient cycling).

Historic fire frequency and expected historic severity differ between these four PNVG's. Large fires in the recent past have been recorded and include fires in the 1920s and the Myrtle Creek Fire in 2003.

PPDF1 Dry Forest – The dry forest types in the Myrtle and Snow Creek drainages occurring on south to southwest facing aspects and historically consisting of an open, mature overstory of Douglas-fir, ponderosa pine, western larch, and some grand fir. Historically, many of the dry forest types in the west burned frequently and with low to mixed severity fire, and occasionally stand replacing fires occurred (Smith and Fischer 1997). **Fire Regime I**

Potential Natural Vegetation Group – PNVG (also called **Biophysical Settings - BpS**) The combination of soils, climate and topography that dictates the composition of the resulting plant communities and natural disturbance regimes.

Vegetation Response Unit - VRU These units have similar patterns in potential natural communities, soils, hydrologic function, landform and topography, lithology, climate, air quality and natural disturbance processes (fire regimes, succession, productivity, nutrient cycling.)

CHDO Moist Forest– Forests dominated by a mixture of conifer species (western redcedar, western hemlock, western larch, Douglas-fir, western white pine, lodgepole pine, grand fir, etc.). These are the most common forest types on mid-elevation sites in the mountains of the northern Idaho panhandle. These are very productive forests and tend to accumulate a lot of biomass due to relatively long intervals between stand replacing fires. Low, mixed, and stand replacing fire severity can all be noted. **Fire Regime III**

SPFI1 Cool Moist Forest– Moderate and moist grand fir or western hemlock and western redcedar habitat types, very diverse and occurring from valley bottoms to elevations as high as 6500 feet. Productive sites producing heavy fuels (fuel loadings up to 60 tons/acre). Under very dry conditions, duff and woody fuels dry out and surface and ground fires can have persistent smoldering with crown fire possible. **Fire Regime IV**

SPFI2 Cold Dry Forest– Higher elevation stands with restrictive growing environments, often dominated by a mixture of whitebark pine, lodgepole pine, Engelmann spruce, and subalpine fir. There has been discussion of a lot of variability in pre-European times concerning fire regimes on these sites; average fire-free intervals ranged anywhere from 60 years to 300 years – with lethal, non-lethal, and mixed severity fires occurring (Smith and Fischer 1997). Current science suggests that fire exclusion due to fire suppression has had "little to no effect" on the fuels or even forest structure in these forests characterized by high-severity fire regimes (Franklin et al. 2006). However, Smith and Fischer (1997) suggest that fire suppression has removed the intermittent mixed-severity fire that would have occurred between stand replacing events, potentially modifying current vegetative composition and structure. **Fire Regime III-V**

Each biophysical setting is comprised of a reference proportion of succession stages, composition, and structure that would have been expected historically. There are five classes – open (AESP), mid-seral closed (BMSC), mid-seral open (CMSO), late-seral closed (DLSC), and late-seral open (ELSO). In addition, there are uncharacteristic classes, such as uncharacteristic timber management (UTHV), that have no reference condition values. The current proportion of stands within each succession class for a BpS is compared to reference conditions and from there managers can draw conclusions on where to focus treatments to alter successional stages to improve FRCC overall across a landscape.

- AESP – Characteristic; early seral open; post replacement disturbance; young age
- BMSC – Characteristic; mid seral closed; mid successional, mid age; competition stress
- CMSO – Characteristic; mid seral open; mid successional; mid age; disturbance maintained
- DLSO – Characteristic; late seral open; late successional; mature age; disturbance maintained
- ELSC – Characteristic; late seral closed; late successional; mature age; competition stress

The above successional class percentages were cross walked from current structure classes found within each forest type within the analysis area. Structure and size classes were taken from TSMRS (Timber Stand Management Reporting System) and are classified as follows:

- Open-Seedling/Sapling (AESP)
- Pole-Small/Pole (BMSC)
- Very Large - Old Growth (DLSO)
- Immature - Immature/Medium (CMSO)
- Mature - Mature/Large (ELSC)

The following table displays, by forest type (described above), the current percentages of each successional stage, and the percentage that would have been expected historically (reference condition). The shaded columns contain the values for the current conditions; the non-shaded columns contain the values for the reference conditions.

Default reference conditions are available for each succession class for each PNVG. However, site-specific data is available for historic conditions for this project area, and these values were used to replace the default values in the analysis.

Table 3.13 Potential Natural Vegetation Groups – Biophysical Settings

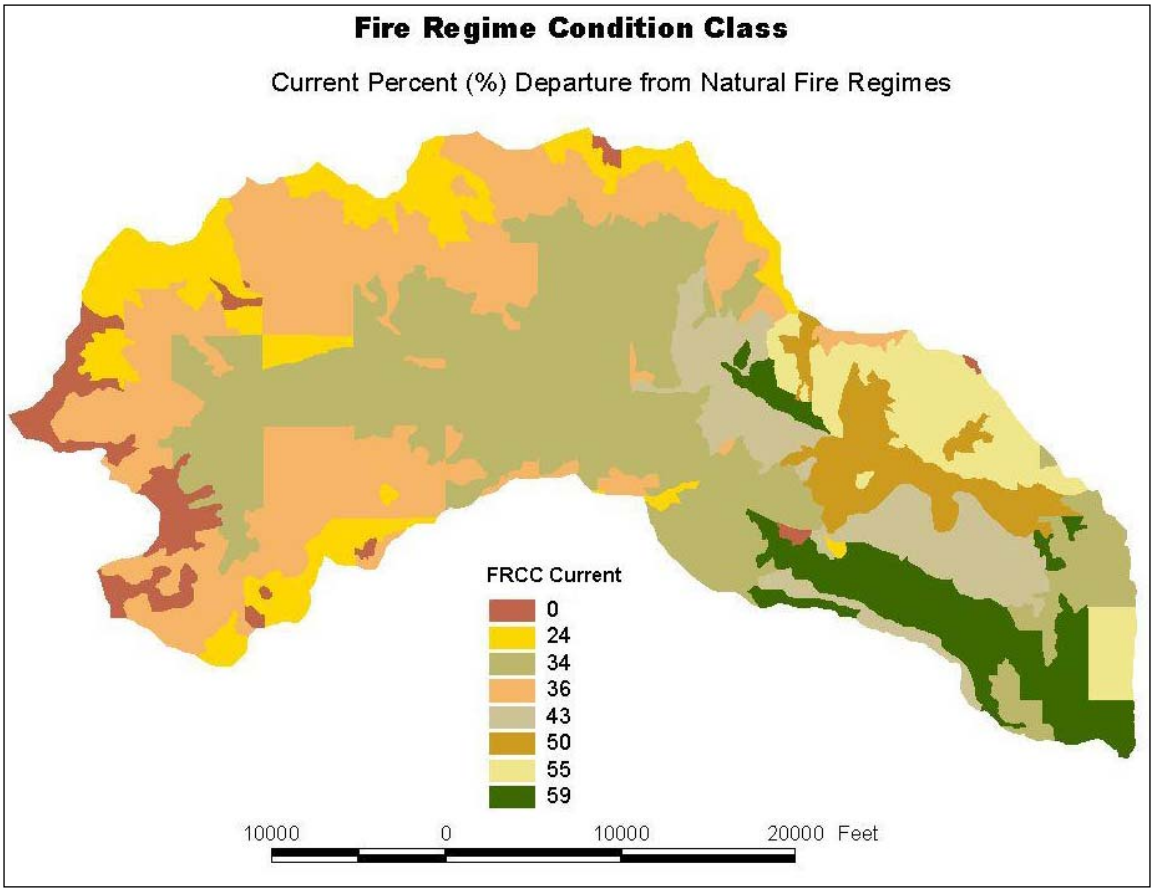
	Dry Forest		Moist Forest		Cool/Moist Forest		Cold/Dry Forest	
FRCC Veg-Fuel Classes	**Current %**	**Reference %**	**Current %**	**Reference %**	**Current %**	**Reference %**	**Current %**	**Reference %**
AESP	**40**	**21**	**29**	**21**	**10**	**20**	**18**	**22**
BMSC	**3**	**11**	**6**	**12**	**0**	**12**	**1**	**13**
CMSO	**29**	**13**	**27**	**20**	**8**	**22**	**21**	**22**
DLSO	**9**	**40**	**19**	**23**	**54**	**21**	**24**	**20**
ELSC	**19**	**15**	**19**	**24**	**28**	**25**	**37**	**23**

Uncharacteristic timber harvest (UTHV) is another option for vegetation class when analyzing FRCC. It can be argued that this has occurred in the Myrtle HFRA analysis area - mostly in Moist and Cool/Moist BpSs due to the amount of those forests privately owned and managed (18% of the CHDO BpS of which 1700 acres has been regeneration harvested and 28% of the SPFI1BpS of which 1200 acres has been regeneration harvested). These sections of land have received multiple entries and predominantly even-aged management accomplished in checkerboard sections (See Vegetation Report in Chapter 3), leading to a uniform pattern, which may make it uncharacteristic. Road and skid trail densities are high in some of these areas (example – Toot Creek area). However, the results of the regeneration harvests at the stand level were open conditions similar in characteristic to what would be expected in AESP. In addition, the FRCC results revealed no difference between including these acres in the UTHV vegetation class and including them in the AESP (early-seral, open) vegetation class. Therefore, for consistency, the regeneration harvested acres in the moist BpS and cool moist BpS were classified as AESP.

Current fire frequency was determined using the number of years since the last fire, examining stumps with known logging dates, using an increment borer to estimate the date of the last fire scar on live trees, or by estimating post-fire regeneration dates for even-aged stands (Described on page 3-17 of the Interagency FRCC Guidebook Version 1.2).

The FRCC analysis was done at the 28,000-acre landscape level and mapped at the stand level. The current overall landscape weighted FRCC departure (from natural range) is 30%. This number can be misleading because the individual strata that make up the overall percentage are all departed at least 34% (Condition Class 2), except for the upper subalpine stands (24% departed) where no treatments are proposed. These stands, along with most of the moderately departed lower-subalpine and mixed-severity moist stands, account for 65% of the larger analysis area and are therefore weighted heaviest in the landscape FRCC.

The proposed treatment area is much more departed. Dry sites (Fire Regime 1) in the Snow Creek drainage are in a Condition Class 2 at 59% departed. This strata is most removed from natural range and although it only comprises 9% of the analysis area, it comprises 50% of the proposed treatment area. The remainder of the proposed treatment area (50%) is on moist sites that burned last in 1926 and are currently departed 43%. Refer to the following figure and table.



This figure shows the percentage departure from natural condition.

Condition Class 1 (0-33%);

Condition Class 2 (34-66%);

Condition Class 3 (67-100%);

0% departure means non-vegetated; such as rock.

The analysis used Standard Landscape Worksheet FRCC version 1.2.2.2 (www.frcc.gov)

Figure 3.1 Estimate of Current Fire Regime Condition Class

The following table displays the approximate percentage of dry and moist forest types that would be treated, the reference fire frequency (in years), the Fire Regime (I or III), and the Fire Regime Condition Class (2) in the proposed treatments areas, and how much the areas are departed from their FRCC.

Table 3.14 FRCC in Proposed Treatment Area and PNVG Associated Reference Condition Characteristics

(Reference Table 4-3, Interagency Fire Regime Condition Class Guidebook, March 2003)

Forest Type (PNVG)	% of Proposed Treatment	Reference Fire-Frequency	Fire Regime	FRCC	% Departure
Dry	**50%**	**38**	**I**	**2**	**59%**
Moist	**50%**	**250**	**III**	**2**	**43%**

The moist stands included in the proposed treatment area burned in 1926. The combination of vegetation, fire frequency and severity make up the final Condition Class by PNVG. Disturbances other than fire (timber harvest, white pine blister rust, insect and other disease epidemics, etc.) are significant because they lead to changes in vegetative structure and affect fire regimes. These kinds of disturbances have contributed to moving the Condition Classes from a 1 to a 2. The standard landscape worksheet and outputs from the FRCC determination are available in the project file.

Analysis of FRCC is important because it enables fire and fuels managers to show improvement trends. FRCC determination aids in planning, as it can identify portions of a landscape where treatment can be focused to modify vegetation or introduce

fire. Although the landscape as a whole is technically within the range of condition class 1 (0-33% departure), every year that passes will bring further departure in vegetative conditions and fire return intervals.

Long-term effects of inaction will lead to continued departure in FRCC. Fuels reduction activities would be expected to trend vegetation structure towards reference condition. Prescribed fire in stands where fire return intervals have been skipped would also trend those stands towards an improved condition class. Depending on the level of departure from reference conditions, several entries and activities may be needed to return stands to a natural range.

e. Crown Fire Behavior

Fire behavior is generally measured by factors such as fire intensity and rates of spread of surface fire. Flame lengths are measured in feet from the base of the flame to the top of the flame, and are directly related to fireline intensity. The rate of spread is how fast the flaming front of the fire moves, and is generally expressed in chains per hour (one chain equals sixty-six feet). Fuel conditions will contribute to the kind of fire observed – ground, surface, or crown. A ground fire is one that burns the organic material in the upper soil layer, a surface fire burns in the surface fuels such as brush and timber litter and may torch single trees or small groups of trees, and a crown fire is one that moves from tree top to tree top while also burning in the surface and ground fuels. Extreme fire behavior generally implies that torching, spotting, or crown fire is occurring.

Crown fire behavior is dependent on surface, ladder, and crown fuels. High surface fuel loads can contribute to higher flame lengths, igniting low growing crowns, moving a surface fire into the tree crowns. If the crowns are spaced close enough together, fire can move from one tree to the next. Most of the stands classified as a Fuel Model 10 have these characteristics that contribute to crown fire behavior under periods of high fire danger

Fire behavior models – as described further in Chapter 4 section 4.2 – can be useful in estimating crown fire behavior. For the current condition of the project area, FlamMap was used to display where surface fire and crown fire would be expected under very-high to extreme conditions, as shown in the figure below.

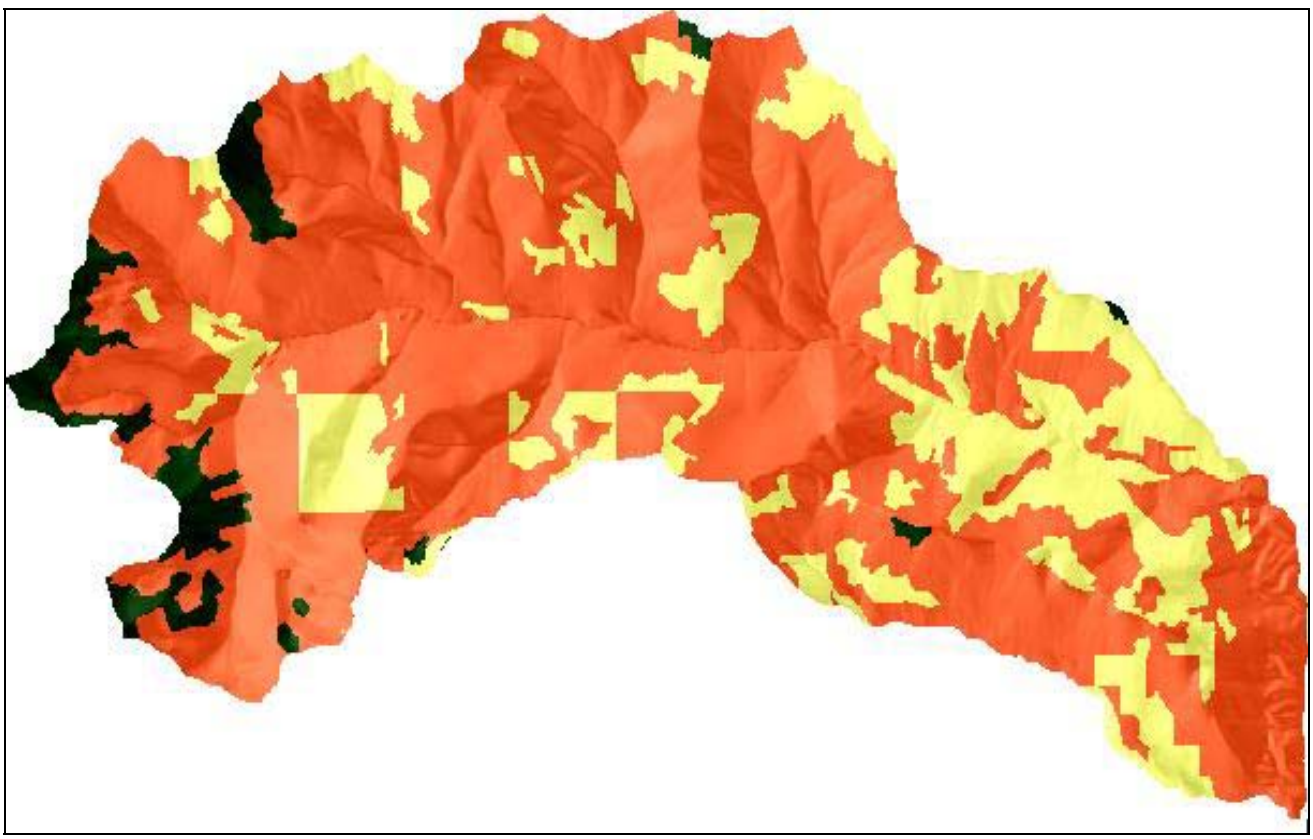


Figure 3.2 Potential Fire Behaviors

Black = No Vegetation (rock, lake, etc,), **Yellow** = Expected Surface Fire, **Orange** = Expected Crown Fire

(Note: the variations in shading (i.e. light and dark orange) show the topography of the area, they are not an additional indication of fire behavior)

f. Suppression Capabilities

Direct attack suppression actions are rapid, aggressive actions to construct a control line around a fire's perimeter or any spot fires, with one foot "in the black" at all times (Idaho Panhandle National Forests 2005 Fire Management Plan). It is the most effective and safest form of attack for suppressing a wildfire because it places a fuel break directly between the burned and unburned fuel, leaving no unburned space for the fire front to build intensity and slop over control lines. Even if resources can be effective in direct attack of a wildfire, fuels, weather, and terrain will dictate the ability of these resources to make progress in attacking a wildfire before it becomes large.

The ability of hand crews to construct direct hand line is limited when flame lengths reach heights greater than four feet, such as would be expected for much of the proposed treatment area with the current fuels conditions. Engines, dozers, and other ground machinery, as well as aerial resources (such as retardant planes and helicopters utilizing bucket water drops) need to be considered over hand crews once flames are greater than four feet long. Even these resources become ineffective once flames reach lengths greater than 11 feet (NWCG 1993).

As reducing unwanted and uncharacteristic fire effects to the watershed is one of the main objectives of this project, being able to suppress future wildfires before they grow to a large scale is important. Tactics that include constructing direct fireline and cooling down hot spots along the fire's perimeter are the safest and most efficient ways to accomplish the goals of fire suppression. Chapter 4 describes suppression capabilities under the current condition of the fuels in the proposed treatment area, especially as compared to the expected suppression capabilities of the two action alternatives. However, with information already provided (such as the predicted flame lengths of 4.8 feet for the current conditions), it is readily apparent that the current suppression capabilities for these fuel models would be outside the limit of direct attack by hand crews.

g. Air Resources

Air Quality in the area of the Myrtle HFRA project is excellent with limited local emissions. Existing sources of emission are generally minimal but include vehicle exhaust, logging and construction equipment, occasional pile burning on both National Forest System lands and private industrial lands within the analysis area, as well as agricultural crop burning in the Kootenai Valley. Wind dispersion is good from the southwest. Boundary County is in Airshed 11 and the entire project area is considered to be in attainment. There is more discussion on air quality in the Fire and Fuels section of Chapter 4.

3.4-D.2 Fire and Fuels Summary

Four guiding documents direct fire management:

- the IPNF Forest Plan,
- the Forest Service Manual,
- the Federal Wildland Fire Policy, and
- the National Fire Plan.

In summary, fuels in the forested environment have the following characteristics:

- Generally classified as a Fuel Model 10 in the proposed treatment areas, although all fuel model groups are represented in the analysis area.
- Heavy surface fuels accompanied by low canopy base heights (approximately one foot in most places), other ladder fuels, and dense crowns are contributing to the risk of extreme fire behavior (crown fire) in a wildfire situation during high fire danger.
- Surface flame lengths would generally be greater than four feet during dry and hot summers, making direct attack by hand crews unrealistic.
- In addition, crown fire initiation would be likely in the event of a wildfire because flame lengths would be predicted to be greater than the void between the surface fuels and ladder fuels (4-ft flames vs. 1-ft canopy base heights). Modification of surface and canopy fuels would create a more predictable fire environment – a lower intensity fire environment where there is less risk of crown fire – allowing for direct attack suppression actions.
- The current condition of the affected environment for this project area is one that is moderately removed from historic fire regimes.

The desired condition as related to fire and fuels management (2005 IPNF Fire Management Plan) would involve management action to trend these stands toward a more natural or historic condition where vegetative attributes, such as long-lived seral species on dry forest sites, are intact and functioning properly.

3.5 - Forest Vegetation and Dry Forest Old Growth

3.5-A Forest Vegetation

The analysis area is made up of ever-changing, dynamic ecosystems; however, current vegetative conditions can be summarized. Timber stands are designated by the characteristics of the vegetation and activities, such as thinning, which have occurred over time. The timber stands are the primary units for collecting, examining, and summarizing tree information in the Timber Stand Management Record System (TSMRS).

One of the primary goals of this project was to assess the changes in forest composition (what the forests are made up of), forest structure (how things are arranged in the forest), and forest disturbance processes (primarily fire and timber harvest) over time. When changes in historic conditions are compared to current conditions, management options can be developed. The existing conditions of the components described in this chapter are also pertinent to the resource issues described in Appendix A.

3.5-A.1 North Zone Geographic Assessment Findings

The North Zone Geographic Assessment (NZGA) defines forests in the Myrtle HFRA where treatments are being proposed as "Low Integrity/High Risk Landscapes, "(Figure 3-1). Some of the specific findings that relate to the Myrtle HFRA project area are:

- These landscapes have changed the most from historic conditions due to major losses of long-lived seral species (ponderosa pine, western larch, and western white pine).
- These landscapes contain large areas of forest types with high probability of major successional change in the next few decades.
- Douglas-fir is at an age where combinations of root diseases and bark beetles begin to create high mortality.
- Dense and multi-storied stands of Douglas-fir or true firs dominate dry habitat types.
- Current forests area dominated by shade-tolerant, and drought- and fire-intolerant species (grand fir, western red cedar, and western hemlock), and short-lived seral species (lodgepole pine and Douglas-fir).
- Natural fuels accumulations are causing an increase in wildfire risk.
- These landscapes are the most heavily altered from historic conditions and contain the greatest need and opportunity for large-scale forest vegetation restoration.

The management recommendations that relate to the Myrtle HFRA project area are specifically focused on the restoration of long-lived early seral species (ponderosa pine, western larch, and western white pine). Some of these recommendations include:

- Use regeneration harvest and prescribed fire to create openings that will favor development of long-lived early succession tree species, including blister rust-resistant white pine.
- Use a variety of silvicultural methods (thinning and regeneration) and prescribed fire to sustain and favor long-lived early succession tree species where they are present.

Restoring long-lived early seral species would:

- Reduce the extent of drought and fire intolerant species (grand fir, western hemlock, and western red cedar) on sites where they are not well-adapted and likely drought stressed.
- Reduce the extent of short-lived early seral forest species (Douglas-fir and lodgepole pine) that are near the end of their pathological rotation age.
- Lower the risk of large, severe disturbances.
-

The graphic on the following page displays the terrestrial integrity of the National Forest System lands in the analysis area and the proposed treatment areas (polygons with dark outlines). The solid dark color indicates High integrity, the horizontal lines indicate Low integrity/High risk, the dotted areas indicate Mixed integrity. The white squares indicate other ownerships.

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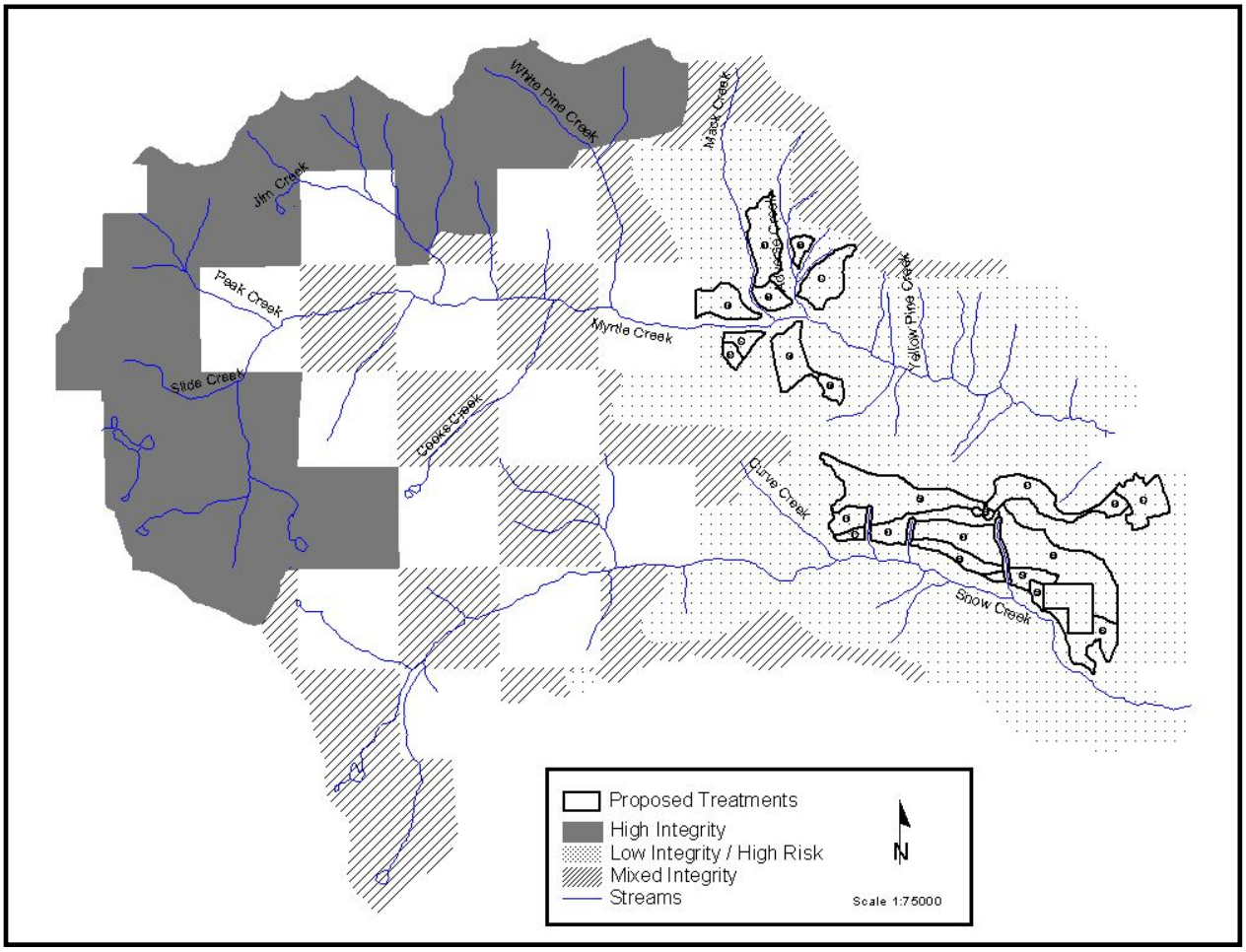

Figure 3.3 Myrtle Creek Terrestrial Integrity

3.5-A.2 Forest Disturbances

The forested hillsides in the analysis area are composed of a wide range of vegetation in various structural conditions. As everywhere, they have changed and will continue to change through time. Various influences have contributed to these changes, both natural and man-caused.

a. Prior to European Settlement

Fire is *the* major disturbance factor that produces vegetation changes in the local forest ecosystems. Many ecosystems are regularly recycled by fire; life for many forest species literally begins and ends with fire. If the role of fire is altered or removed, this will produce significant changes in the ecosystem. Fire has burned in every ecosystem and virtually every square meter of the coniferous forests and summer-dry mountainous forests of northern Idaho, western Montana, eastern Washington and adjacent portions of Canada. Fire was responsible for the widespread occurrence and even the existence of ponderosa pine, western larch, lodgepole pine, and western white pine. Fire maintains ponderosa pine throughout its range at the lower elevations and kills ever-invading Douglas-fir and grand fir (Spurr and Barnes, 1980).

In the following discussion, "severity" refers to the amount of damage a fire causes to stands of timber and "return interval" refers to how often a particular type of fire occurs. Photos and definitions summarize the types of fires that occur in our forested ecosystems.

b. Fire Severity and Return Intervals

Mixed severity fires - fires that kill more than 10%, but less than 90% of the dominant tree canopy (see photo below). Mixed severity fires are commonly patchy, irregular burns, producing a mosaic of different burn severities. Return intervals for mixed severity fires may be quite variable. Figure 3-4 is a good illustration of a mixed severity burn resulting from a lightning strike.

Figure 3.4 Northwest Peak Fire, August, 2000

Northwest Peak was a lightning-caused fire on the Bonners Ferry Ranger District.

Non-lethal fires - fires that kill 10% or less of the dominant tree canopy. Smaller understory trees, shrubs, and forbs may be burned back to the ground line (Figure 3-3).

These are commonly low-severity surface and understory fires, often (but not always) with short return intervals of less than 25 years.

The stand at the right has been commercial thinned and underburned several times in the last 30 years.

Figure 3.5 Example of a non-lethal fire in a managed stand northeast of Bonners Ferry.

Figure 3.6 Northwest Peak Fire -- A Stand Replacing Fire

This photo illustrates lethal fire conditions occur in a stand-replacing fire, and crown fire behavior**.**

Lethal fires - fires that kill 90% or more of the dominant tree canopy are termed "stand-replacing" fires (figure at left). Lethal fires frequently burn with high severity and are commonly (not always) crown fires.

In general, lethal fires have long return intervals (140 to 250+ years apart), but affect large areas when they do occur

Sundance and Trapper Peak Fires (local fires in 1967) burned over 80,000 acres in a short period of time.

The photo to the right shows conditions that are typical after a stand-replacement or lethal fire. Notice that the entire duff (organic) layer was consumed by the fire. Until grasses and forbs become reestablished, the soil, ash cap and associated nutrients are exposed to the elements and at risk from erosion processes.

Post-fire rehabilitation costs to mitigate erosion often exceed $5000 per acre (BAER 2002).

Figure 3.7 Post-fire conditions caused by a lethal fire.

3.5-B Humans in the Myrtle HFRA Ecosystem

3.5-B.1 Early Native American Influence

Human influence has likely been felt in the Myrtle HFRA area for centuries. Archaeological research on the Kootenai River suggests that the Kootenai Indians have inhabited parts of the landscape for at least 3,000 years, and probably much longer (Choquette and Holstine, 1980). The Kootenai Indians inhabited a territory that included the entire drainage of the Kootenai River in Canada and the United States. The area between the Montana-Idaho border and the summit of the Selkirk Range, and between the International Boundary and the divide between the Kootenai and Pend Oreille drainages was part of the territory of the Lower Kootenai (Chatters, 1992). The Lower Kootenai Indians burned parts of the ecosystem to promote a diversity of habitats. They tended to burn during different times of the year, sometimes in the early spring or summer, while at other times in the fall after the hunt and berry-picking seasons were over. Hardly ever did they purposely burn during mid-summer when the forests were most vulnerable to catastrophic wildfire. Often the Indians burned selected areas yearly, every other year, or as long as five years (Chatters, 1992).

3.5-B.2 European Settlement and Recent Influences

Trappers, miners, farmers and ranchers settled in the Kootenai Valley during the early to mid 1800's. During this period, railways, logging, wetland conversion to agricultural fields, and clearing of private lands were common activities. Larger fires in the county included the 1890's fires, the 1910 fires, the 1926 fires, and the Sundance and Trapper Peak fires of 1967. Since European settlement in the area, the landscape has undergone substantial changes. Three main factors have contributed to these changes: fire suppression, past logging practices, and the white pine blister rust fungus (Zack, 1995).

a. Fires and Firefighting Efforts

Firefighting effectiveness increased in the 1940's and the 1950's with additional fire suppression dollars, which allowed for the increased use of trained firefighting crews, smokejumpers, airplanes, helicopters, and bulldozers (Clark and Sampson, 1995).

Helicopters can drop water or fire retardant on "hot spots." Although they carry a smaller load than airtankers or SEATs, they are usually very accurate in pinpointing their target. Helicopters are also used to deliver crews, equipment, and supplies to remote areas.

The basic tasks of building fireline and "mopping up" after a fire is controlled have not changed a great deal over time. Continuous studies of the science of fire and application of new technologies benefit land managers and incident management teams when they are establishing strategies and objectives during both wildfires and prescribed burning projects.

Fire Activity in the Project Area

Based on District fire history data (Allen 1999) approximately 1,500 acres burned every decade in the project area between 1750 and 1926 (see the chart to the right).

1926 Fire – Prior to the 2003 Myrtle Creek Fire the last significant fire in the project area occurred in 1926 (see the map of this fire on the following page).

According to historical accounts (Bonners Ferry Herald, 1926) the fire was started by lightning in the Fall Creek drainage in mid-July and burned northeast into Myrtle Creek drainage until rains in mid-August eventually slowed the fire.

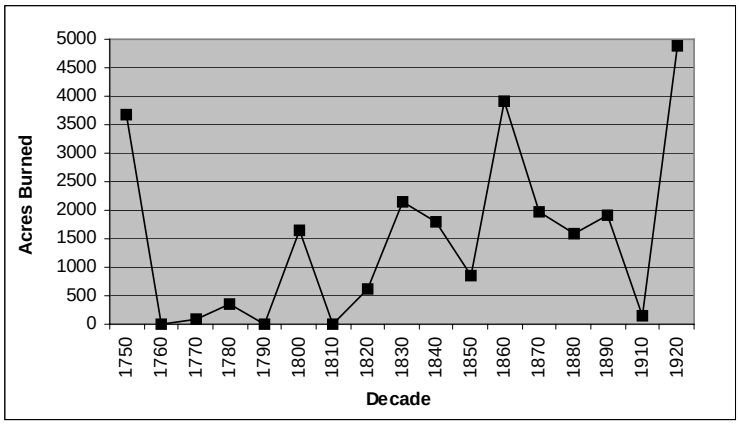

Figure 3.8 Myrtle Creek HFRA Fire History

The fire's origin in Fall Creek was over seven air miles southwest of Snow Creek and about 10 miles from the northernmost point of the fire's spread. It eventually burned over 28,000 acres, about 6,000 acres of which is in the Myrtle HFRA project area.

The 1926 fire represents the last major natural fire event that occurred in the project area prior to the era of successful fire suppression. Attempts were made to suppress the 1926 fire, but access to the fire and firefighting technology were nowhere near what they would become later in the 20th century.

2003 Fire – The 2003 human-caused Myrtle Creek Fire started in logging slash created by the Mama Cascade Timber Sale (one of the three sales from the Myrtle-Cascade EIS) and eventually burned over 3,500 acres. Figures 3-10.a through 3-10.c show a progression of "before and after" pictures taken from the same photo point. Figure 3-10.a (taken in 2001) shows a stand that contained several old growth ponderosa pine, western larch and Douglas-fir, which are not visible because they are crowded by a dense layer of grand fir and Douglas-fir that regenerated after the 1926 fire.

Figure 3-10.b shows the stand in the spring of 2003 after the smaller merchantable trees had been harvested and removed from the sale area; it also shows the unmerchantable trees that were slashed and left for underburning, which was scheduled to start in the spring of 2004. As specified in the Myrtle-Cascade EIS slash was to be left for at least six months prior to burning, to allow for nutrient leaching; spring burning was specified on dry sites instead of fall burning, in order to minimize potential affects on the municipal watershed. Allowing the slash to cure over the summer and fall allows for nutrients like potassium (which the trees use to protect themselves from insects and diseases) to leach back into the soil profile. Figure 3-10.c shows the same stand after the Myrtle Creek Fire burned in early September 2003. In essence, when the fire entered this unit it was burning in a Fuel Model 12, which is a slash model. Fires in these types of fuels can result in rapidly spreading fires with high intensities capable of generating firebrands. When a fire starts, it is generally sustained until a fuel break or change in fuels is encountered (USFS 1982). Given the heavy fuel loads the fire burned with high severity in this area and most of the residual trees were killed because of the excessive heat from the ground fire, not because the fire climbed into the tree crowns.

A second series of photographs (Figures 3-10.d through 3-10.f), also taken from a single photo point, shows how the Myrtle Creek Fire behaved in areas where fuels created by timber harvest were much lighter. The stand in Figure 3-10.d was considerably less dense prior to treatment than the stand in Figure 3-10a. Therefore, fewer small diameter trees were removed, both merchantable and unmerchantable, and thus the treatment generated far less activity fuel (Figure 3-10.e). The resulting fire behavior was much less intense and the effects on the soils and residual trees were much less severe (Figure 3-10.f). In essence, this unit was converted to a Fuel Model 8 where fire behavior generally consists of slow-burning ground fires with low flame lengths (USFS 1982).

Had the District been able to finish converting the unit in the first series of photos to a Fuel Model 8, the fire effects would have been similar to those pictured in Figure 3-10f, i.e., a low intensity underburn.

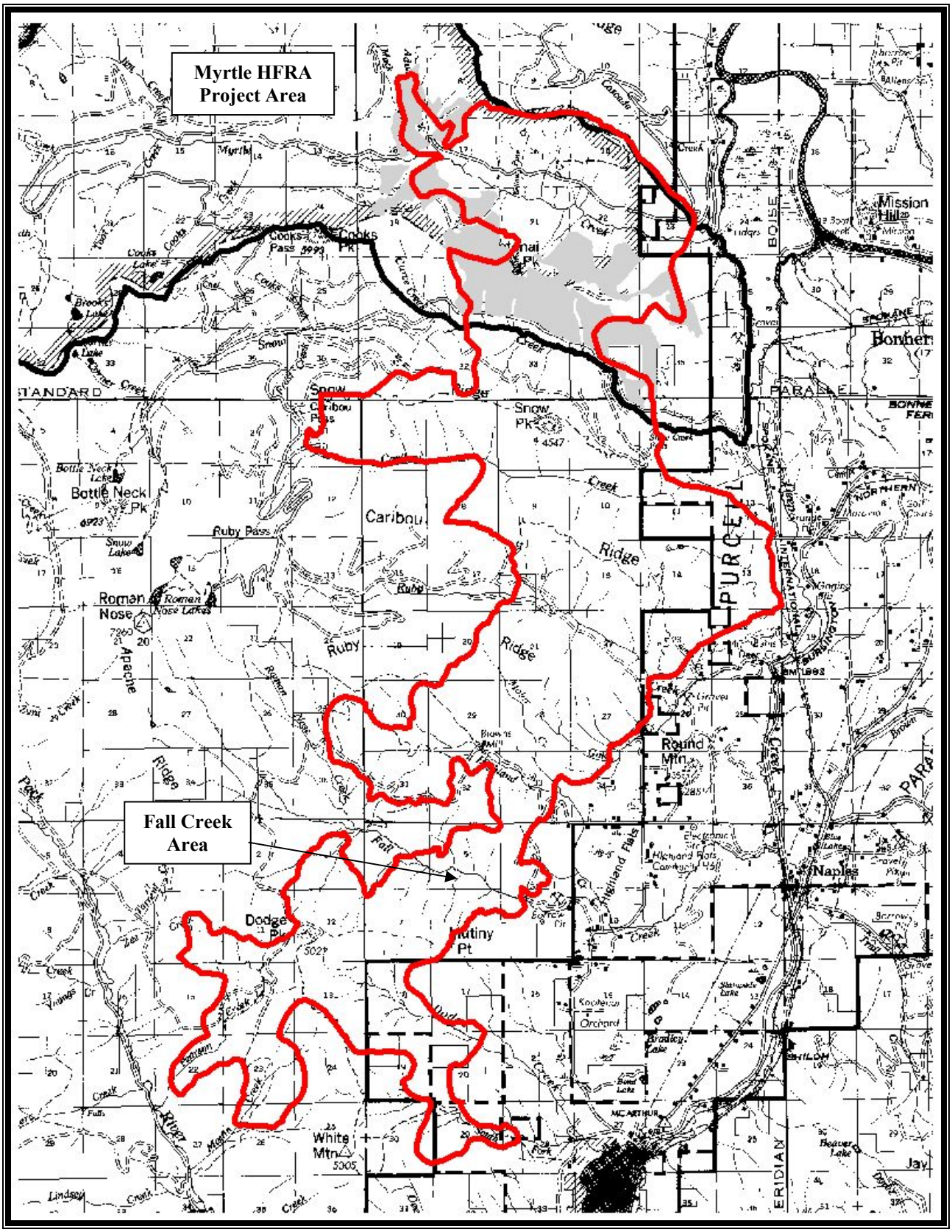

Figure 3.9 Approximate Perimeter of 1926 Fire

The project area is at the north and Fall Creek is in the lower 1/3 of the fire area.

Figure 3.10 Myrtle-Cascade Photo Series

Figure 3-10.a. Myrtle-Cascade stand with heavy fuels prior to harvest.

Figure 3-10.b. Myrtle-Cascade stand with heavy fuels after harvest.

Figure 3-10.c. Myrtle-Cascade stand with heavy fuels after fire.

Figure 3-10.d. Myrtle-Cascade stand with lighter fuels prior to harvest.

Figure 3-10.e. Myrtle-Cascade stand with lighter fuels after harvest.

Figure 3-10.f. Myrtle-Cascade stand with lighter fuels after fire.

b. Timber Management

The majority of regulated• timber harvest began in the late 1950s in the upper end of Myrtle Creek and continued into the 2000s with the Myrtle-Cascade timber sales. Figure 3-11 summarizes the harvest activities and timber management trends in the project area on National Forest lands.

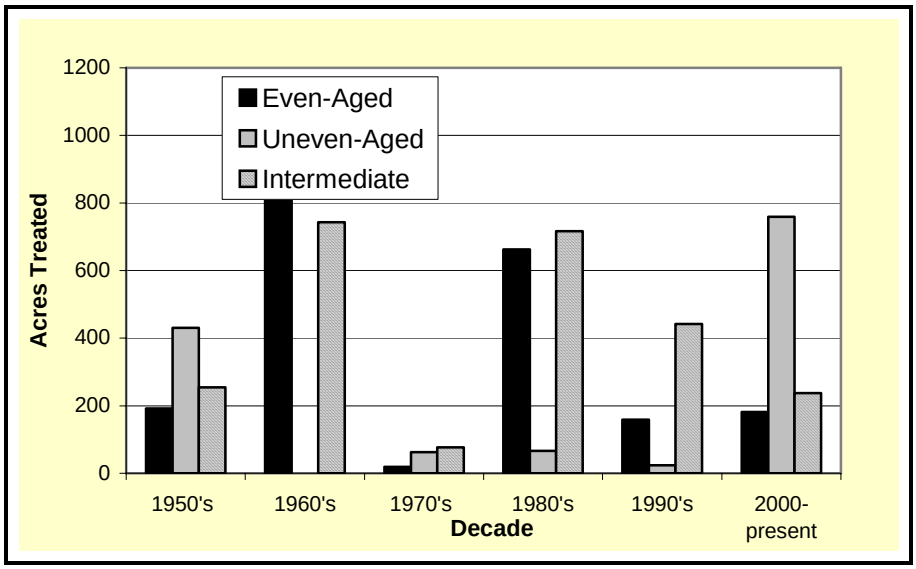

Figure 3.11 Myrtle HFRA Timber Management History (National Forest Lands)

An industrial private timber company owns approximately 6,000 acres of the project area and the acres of harvest on these lands since the 1950's are shown in Figure 3-12. Timber harvest activity prior to the 1950's was very limited in scale.

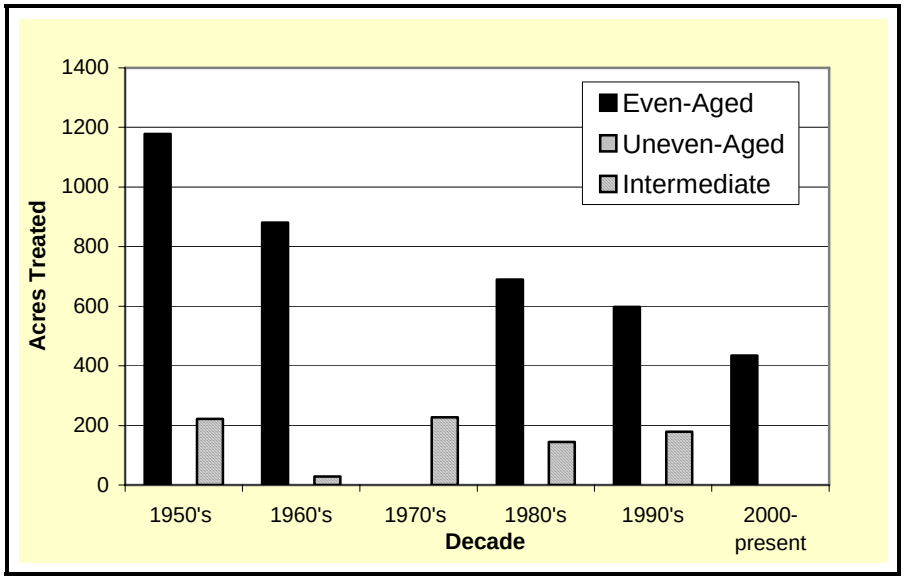

Figure 3.12 Myrtle HFRA Timber Management History (Private Lands)

• Regulated Timber Harvest refers to the forest management principle of organizing and planning activities within a forest ecosystem keeping the following objectives in mind, i.e., maintaining a forest that is growing, vigorous and well distributed in size, age, and condition over the forest area in order to reduce the risk of fire, insects and diseases, and other elements of unhealthy conditions.

The following table illustrates the National Forest timber sales that were sold and harvested from the 1950's to present. Information for some of the sales between 1950's and 1970's is incomplete. When the timber stand management information was converted from written records to computer-based data, some information was missing, such as name of sales and activity codes. These sales are represented with a sale name of "National Forest" in the table. In the absence of natural fire these harvest activities served as the major disturbance factor that produced vegetation changes in the project area.

Table 3.15 National Forest Timber Sales within the Myrtle HFRA Project Area

Sale Name	Year	Even-Aged	Intermediate	Uneven-Aged	TOTALS
Adverse Creek	1978-82	125	0	0	125
B Road	1983	7	140	66	213
Big Mack♦	2003-05	142	0	0	142
Chef Creek	1983	60	76	0	136
Curve Creek	1989-91	140	189	0	329
D Road Cedar	1982	0	20	0	20
Mama Cascade	2002-04	132	134	537	803
Salt Lick	2003-05	61	176	64	301
Snow Cedar	1981	9	0	0	9
Snow Creek	1995-98	40	348	0	388
Snow Myrtle	1985-88	204	140	0	344
Snow Ridge	1988	312	126	0	438
Snowplowski	1990	0	12	0	12
National Forest	1957-59	192	255	431	878
National Forest	1960-69	1005	743	0	1748
National Forest	1970-79	3	62	77	142
TOTALS		**2432**	**2421**	**1175**	**6028**

A map of the harvest history is included in the Map Appendix (Past Activities Map).

It is interesting to note that fire history data (Allen, 1999) shows that within the project area, approximately 1,500 acres burned every decade between 1750 and 1926. The 1926 fire, which originated in Falls Creek south of the area, burned about 6,000 acres in the Myrtle HFRA project area.

c. Insect and Disease Disturbance Factors

Most of the health concerns with these timbered stands can be tied to the overstocked or overcrowded condition of the stands. The densely stocked stands we see today are causing a general health decline in all tree species. There is too much competition for moisture, sunlight, and nutrients.

The following section discusses the major insects and disease agents that are causing, or have the potential to cause, major disturbances within forest stands in the analysis area:

Root Diseases

Root diseases are common in the moist Douglas-fir, grand fir, and high elevation cool subalpine forests in the Northern Rockies Province. Several pathogens are involved, even in the same stand, so it is usual to consider them as a group. The main hosts are Douglas-fir and true firs (USFS 1999). Root diseases have apparently increased significantly over the past several decades, with the several-fold increase in host abundance (USFS 1999). Of particular concern is the dominance of Douglas-fir on all forest types in the project area. One of the most effective management tools is to reestablish resistant species on these sites, i.e., long-lived seral species (Williams et al 1989 and USFS 1999).

♦ Big Mack is an ongoing timber sale – approximately 50% of 142 acres have been treated

Major root diseases include: *Armillaria mellea* root rot, *Schweinitzii* root and butt rot, *Phellinus weirii* laminated root rot, and *Annosus* root rot (*Fomes annosus* or *Heterobasidium annosus*).

Bark Beetles

Bark beetles are considered the most consequential insects in western coniferous forests, where they kill millions of trees annually (USFS 1999). Most of this mortality is scattered widely throughout mature forests (Furniss and Carolin 1977). Mountain pine beetle, Douglas-fir beetle, spruce beetle, and fir engraver beetle are among the most important mortality agents of mature Idaho forests (USFS 1999).

Of these species, mountain pine beetle and Douglas-fir beetle are the most likely species of concern in the project area, given the relatively high number of stands where mature lodgepole pine ponderosa pine, and Douglas-fir are a major components. Silvicultural control measures are the most efficient methods for managing the bark beetle populations. The most effective strategies for managing Douglas-fir beetle populations are preventive measures that involve reducing stand susceptibility to beetle infestations through maintenance of vigorous stands (Schmitz and Gibson 1996). Thinning stands of lodgepole and ponderosa pines will prevent or minimize beetle-caused mortality. Patch cutting in lodgepole pine stands creates a mosaic of age and size classes, which reduces the acreage of lodgepole pine that will be highly susceptible to beetles at one time (Amman et al 1989).

Bark beetles include: Douglas-fir beetle, fir engraver beetle, western pine beetle, mountain pine beetle, *Ips* beetle, and red turpentine beetle.

Stem and butt decays

Stem and butt decays include: cedar-laminated butt rot, cedar brown pocket rot, white pocket rot, pouch fungus, and Indian Paint fungus.

Foliage Diseases

The major foliage diseases include larch dwarf mistletoe and Douglas-fir dwarf mistletoe. Dwarf mistletoe plants cause the tree to form thick branching habits or witches brooms in the canopy. Over time, the width of the tree crown shrinks and the host tree dies. The parasitic plants reproduces by “shooting” sticky seeds out about 30 feet from the host tree every summer and any susceptible trees in the understory are then infected and the cycle is then is the restarted. These parasitic plants are native components to the forest ecosystems, but human influences such as fire exclusion and partial cutting have served to increase the intensification, spread and severity of dwarf mistletoes to unnatural levels in many forest stands (IPNF Insect and Disease Handbook).

Stem Disease - White Pine Blister Rust

The main stem disease is white pine blister rust. Latin name Cronartium ribicola, is a pest (fungus) introduced from Europe. It was first discovered in western North America at Point Grey near Vancouver, British Columbia in 1921 on eastern white pine that had come from France as seedlings in 1910. By 1928, the rust disease had spread eastward and southward into Idaho almost to the limits of the western white pine forest type, which includes the analysis area. Over the past 82 years, blister rust and bark beetles have caused significant mortality in western white pine stands, increasing levels of standing and dead woody materials in these stands. White pine blister rust, plus bark beetle attacks, have accounted for the loss of the white pine and the white bark pine cover type from the western United States.

Natural resistance to blister rust is about four percent, with only a few individual trees surviving the disease. Losses, however, have decreased and will continue to decrease since the numbers of five-needle pines (white pine, white bark pine and limber pine) are decreasing across the landscape; however, the surviving trees show a natural resistance. Forest geneticists and silviculturists are using seed from superior individuals to grow semi-resistant pines for reforestation projects.

Because of their relative intolerance of shade, seral species such as ponderosa pine, western larch and western white pine attain a dominant position in the stand only following wildfires, even-aged silvicultural systems, or through cultural treatments (thinning) favoring the species (USDA, 1990).

Larch, a component of dry forest types, is also a significant component of moist forests. Larch evolved with natural fire cycles. One can easily recognize burn patterns in the forest by looking for concentrations of larch. It depends on fire as an agent to expose mineral soil, reduce thick duff layers and create openings to germinate and grow in. Without fire, regeneration cuts, or pre-commercial thinning, larch would drop out of most stands and not maintain the role it had prior to European settlement and fire suppression (Zack, 1995).

Since European settlement in the area, the landscape has undergone substantial changes. Three main factors have contributed to these changes: fire suppression, past logging practices, and the white pine blister rust fungus (Zack, 1995).

Fire would have favored ponderosa pine, larch, and white pine because those species regenerate well in full sunlight, they have self-pruning lower branches and thick layers of bark to protect the tree from relatively frequent underburns and are long lived. Shade tolerant (trees that can grow under shaded conditions) such as subalpine fir and grand fir were thinned by root diseases, insects, and low intensity non-lethal fires. Large trees in patches would have dominated the landscape, with large patches of post-fire shrub/seedling/sapling stands (Zack, 1995).

d. Forest Habitat Type

The following forest types found in the assessment area are unique in some way. These forest types are based mostly on their similarities in forest character, climate and moisture regimes, and natural disturbance processes including fire, insect and disease outbreaks, and weather events such as blow down and ice storms. Figure 3-16 provides a comparison of forest habitat types in the project area to those at the Kootenai River sub-basin scale. The distribution of forest types at project scale is fairly similar to the larger sub-basin scale, although there are some small differences.

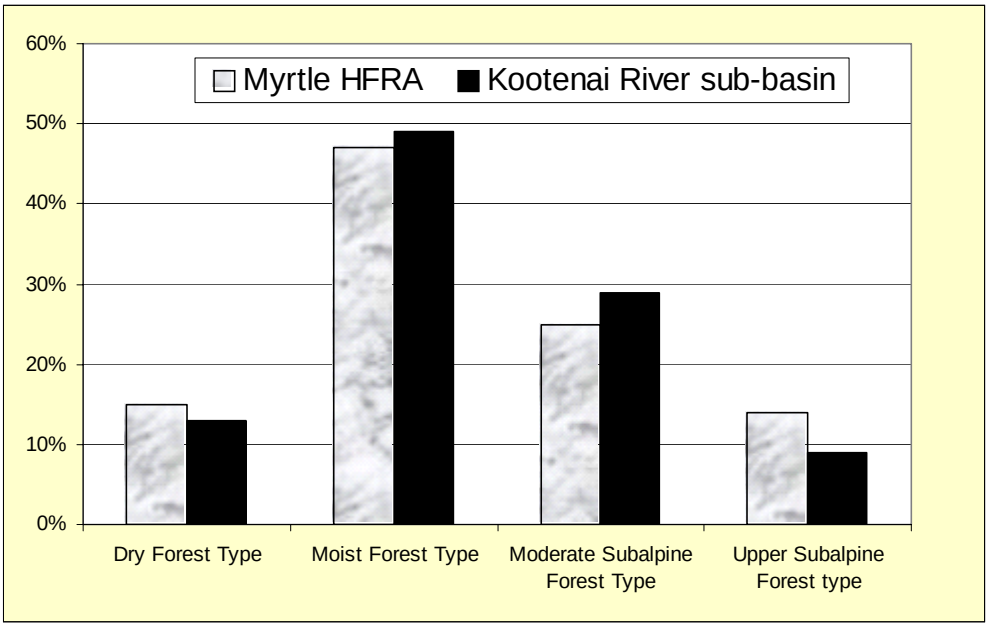

Figure 3.13 Distribution of Forest Types – Project Area compared to Kootenai River Sub-basin

Dry Forests

These forest types consist primarily of Douglas fir, ponderosa pine, western larch and grand fir and represent 12% of the project area. A century ago the ponderosa pine (*Pinus ponderosa*) type covered about 40 million acres in the Western United States (Van Hooser and Keegan 1988). Underburns have been excluded for 60 to 90 years in most of the seral ponderosa pine forests. As a result, accumulations of surface fuels and conifer thickets have developed that allow stand-replacing fires to become common (Arno and Brown 1991; Barrett 1988; Mutch and others 1993). Smith and Fischer (1997) state the dry forest habitat types similar to those found in the Myrtle Creek HFRA project area burned frequently, i.e., between 10 and 50 years. Arno et al (1995) found mean fire return intervals of 26 to 50 years in studies of old growth ponderosa pine and western larch in dry forest types on the Bitterroot and Lolo National Forests in Montana, also similar to the habitat types in the Myrtle Creek HFRA area. Similar patterns of fire exclusion in the dry forest types on the Bonners Ferry Ranger District and the Myrtle Creek HFRA project have occurred as well. Based on fire history data taken from the project area the estimated mean fire return interval is consistent with intervals reported by Arno et al for similar habitat types (Behrens 2005).

Moist Forests

These forests occupy about 52% of the acreage in the project area and are dominated by a mixture of conifer species such as western larch, Douglas-fir, grand fir, lodgepole pine, western red cedar, western hemlock. Historically, white pine was a long-lived major species in this forest type, but has dropped out due to blister rust. Moist forests are common at mid-elevations on the north and easterly aspects in the mountains of northern Idaho.

These forests are very productive and prior to European settlement tended to accumulate large amounts of biomass (the collection of all the living plant in a forest) in the relatively long intervals (average 200+ years) between stand replacing fires. Sometimes, low-severity fire occurred two to three times as often as either moderate- or high-severity fire (Smith and Fischer 1997). Because pre-settlement intervals between severe fires were generally long in these forest types, the effects of fire exclusion are subtle. However, exclusion of low and mixed severity fire events over the past 70 years has reduced ecological diversity and increased homogeneity (stands of similar size, age, species composition, structure, etc.) across the landscape (Smith and Fischer, 1997).

Cool Moist Forests

These forests are dominated primarily by subalpine fir and Engelmann spruce and represent 24% of the project area. These forests are characterized by cool and moist conditions. In pre-settlement times, the average interval between stand-replacing fires in these stands was 174 years. Very wet sites are found in forested riparian areas along streams and wetlands. These sites are very difficult to burn except during extremely dry conditions. Since the period of effective fire exclusion in these stands (100 years since the last significant event) is less than the historic fire return interval (174 years), fire exclusion has not measurably altered the structure and composition of these stands.

Cold Forests

Cold-dry forests occupy about 12% of the acres in the project area. They are located at higher elevations characterized by harsher and more restrictive growing environments. Consequently, the forest canopy is partially open in many of the mature stands of subalpine fir and Engelmann spruce. Younger stands are dominated by lodgepole pine or by a mixture of lodgepole pine, subalpine fir, Engelmann spruce, and some Douglas-fir.

Historically, stand-replacing fires occurred at average intervals ranging from 52 to 200 years or more. Stand-replacing fire occurred less frequently at high elevations than at the low elevations because of slower tree growth and less continuous fuels at high elevations (Barrett 1982; Green 1994). Low severity and mixed severity fires also occurred every 30 to 50 years on average (Smith and Fischer 1997).

e. Forest Structure

Forest vegetation was assessed for the Myrtle Creek HFRA based on three old growth management units (OGMUs). The assessment area intersects OGMU 14 (17,555 acres), OGMU 16 (9,395 acres), and about 12% of OGMU 18 (791 acres). OGMU 14 includes forested lands within the Myrtle Creek drainage, OGMU 16 includes the Snow Creek drainage, and the portion of OGMU 18 within the assessment area includes those forested lands on the face drainage between Myrtle Creek and Snow Creek.

Prior to European settlement, forest structure was determined mostly by fire. Since European settlement forest structure has been determined mostly by fire suppression and timber harvest. For this analysis the forested landscape has been broken into the following structural classifications: 1) openings, 2) pole timber, 3) immature forests, 4) mature forests and 5) old growth. The following figure displays current forest structure compared to the estimated historic ranges (North Zone GA) of each structural class.

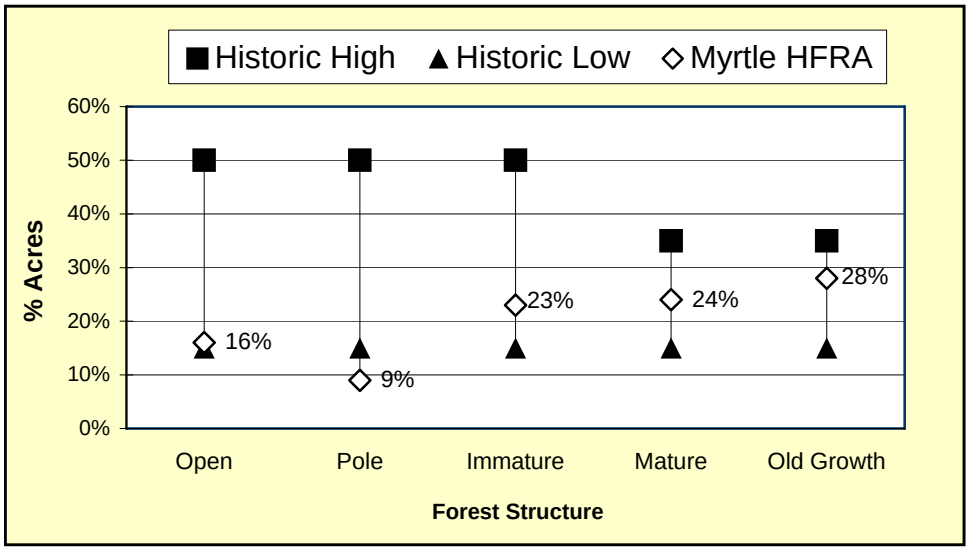

Figure 3.14 Myrtle HFRA Forest Structure: Historic vs. Existing

Current distribution of various forest structures compares to estimated historic levels in the following ways:

- Forested openings (16%) fall within the historic range (15-50%), on the lower end of the range
- Pole-sized timber stands (9%) fall below the historic range (15-50%)
- Immature timber stands (23%) fall within the historic range (15-50%), on the lower end of the range
- Mature timber stands (24%) fall within the historic range (15-35%),
- Old growth timber stands (28%) fall within the historic range (15-35), on the upper end of the range

Old Growth – The distribution of old growth forests varies across landscape scales. The historical range of variability (HRV) for old growth on the North Zone was estimated at 15 to 35%. Currently, 14% of the North Zone forests are composed of old growth, which is outside the estimated historic range, near the lower level. In the Kootenai River sub-basin, old growth forests total 17% of the forested landscape. At the project level Old Growth Management Unit 14 (OGMU 14) contains 40% old growth, OGMU 16 contains 8% old growth and the portion of OGMU 18 within the assessment area does not contain any acres of old growth. It should be pointed out that only about 12% of OGMU 18 is included in the assessment area and nearly 30% of the portion within the assessment area burned in the Sundance Fire (1967). In total, there are more than 27,500-forested acres in the vegetation assessment area and nearly 28% of the acres are included in the IPNF's old growth allocation, which is within the estimated HRV of 15-35% for the North Zone forests.

Forest Structures – The distribution of forest structures also varies across habitat type groups. Currently, the subalpine forests (*cool-moist* and *cold-dry* forest types) are dominated by mature and old growth forest structures. In the *cool-moist* forest types the combination of old growth (54%) and mature forests (28%) totals more than 80% of the forest structures. Similar to the *cool-moist* forests, the higher elevation *cold-dry* forests are also dominated by mature (38%) and old growth (23%) forest structures. In combination, over 75% of the subalpine forests are mature and old growth forests. These conditions indicate a relatively long fire-free interval throughout these forest types. Although the stand-replacing fire interval may not have been exceeded, the frequency of light and mixed-severity fires have likely been disrupted, leading to fairly limited structural diversity and continuous fuels across these forest types.

In the moist cedar-hemlock forests, mature and old growth forests account for 26% and 20% of the forest structures respectively.

In the dry forest types, old growth accounts for only 10% of the forest structure, while mature forests add another 21%. The majority of the dry forest type is comprised of immature forests (40%) and forest openings (34%). The dominance of these forest structures is a direct result of fire. The 1926 fire burned extensively on the south slopes of Myrtle Creek and Snow Creek, while the 2003 Myrtle Creek fire burned extensively on the south slopes of Myrtle Creek. An estimated 450 acres of dry forest old growth burned and were converted to forest openings as a result of the Myrtle Creek fire. It is not known how much old growth was burned in the 1926 fire.

Overall, forested openings and pole size stands (essentially the youngest forest structures) total 23% of the forests in the assessment area, which is less than the estimated combined historic levels for these two types of structures. Meanwhile, old growth and mature forests account for a combined total of 53% of the forest structures.

The existing condition in the Myrtle Creek HFRA area represents a similar trend on the District. Presently, the District has approximately 394,000-forested acres and roughly 291,000 acres (approximately 75%) are considered suitable for timber management, based on Forest Plan management allocations. This means about 25% of the District's forest acres are off limits to timber management. Since 1955, considering only the 291,000 suitable acres, the District has harvested over 53,000 acres using even-aged regeneration (i.e., clearcut, seed tree, and shelterwood – Figure 3-18). This equates to less than 1,100 acres of even-aged regeneration cutting annually.

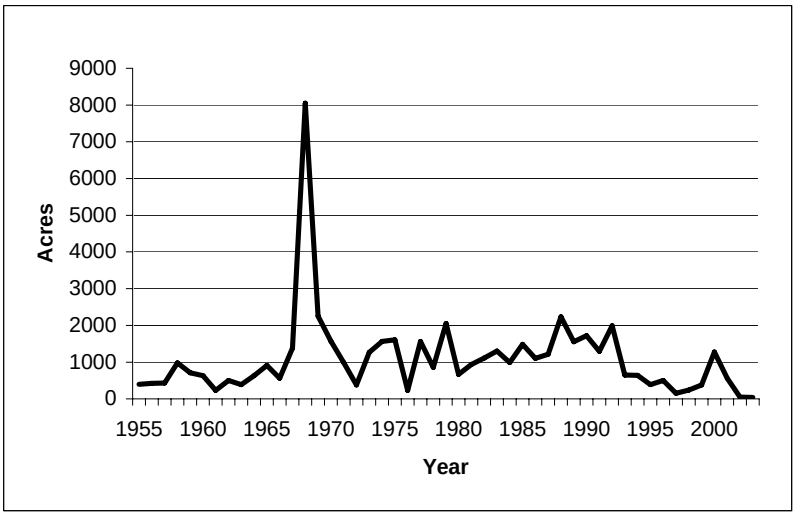

Figure 3.15 Bonners Ferry Ranger District Even-Aged Regeneration Harvest History

Using a forest regulation basis of 100-year rotations, which the 1987 Forest Plan assumed, the District would need to regenerate an average of about 2,900 acres (1%) annually to achieve regulation under these conditions. The average of less than 1,100 acres (about 0.4%) regenerated annually equates to an actual rotation length of more than 260 years. Furthermore, since the inception of the 1987 Forest Plan, the District has regenerated an average of about 850 acres using even-aged regeneration harvesting; since the early 1990s this rate has dropped to about 450 acres annually. The highest rate of regeneration was in 1988 at about 2,240 acres, but still a regeneration rate of less than 1% annually. The sharp spike in the table, which occurred in the late 1960s, reflects the Sundance and Trapper Peak Fires of 1967.

In the project area, over the past 50 years, the District has been regenerating forests at a rate of slightly less than 50 acres per year (2,432 acres as shown in the preceding table), which equates to an annual regeneration rate of about 0.2%. Consequently, the long-term trend at the District and project level is toward the development of more old growth, and larger patches, within the next 20-50 years.

f. Forest Composition

The composition of a forest changes over time. Historically, fire was the primary ecological process that determined forest composition. Prior to the 2003 Myrtle Creek fire, the last major fire in the project area was in 1926. Fire suppression tends to favor the development of shade tolerant species (Douglas-fir, grand, fir, western red cedar, western hemlock, subalpine fir, etc.) that flourish in closed canopy forest conditions. Since the 1960's, even-aged silvicultural systems (clearcut, seed-tree, and shelterwood) have been the primary mechanism for changing species composition. In these systems, shade intolerant species (i.e., western larch, ponderosa pine, western white pine, etc.) are typically favored, although the more shade tolerant species will regenerate as well. As a result, of changed disturbance patterns, significant changes in forest composition have occurred in the Myrtle Creek HFRA area as displayed in Figure 3-19. These changes in forest composition parallel changes that have occurred across the IPNF North Zone and the Kootenai River sub-basin.

Summarized, the following changes have occurred in forest composition in the project area, as compared the North Zone as a whole:

- The percentage of long-lived seral species has ***decreased*** significantly:
  - White pine has ***decreased*** from greater than 21% to 1%
  - Ponderosa pine has ***decreased*** from over 9% to 3%.
    (This includes the acres from the 2003 Myrtle Creek Fire that were regenerated with ponderosa pine, or stands where the primary overstory species was converted to ponderosa pine.)
  - Western larch has ***decreased*** from almost 19% to just over13%
    (Many of the stands now dominated by western larch originated as a result of the 1926 Fire.)

- The percentage of shade-tolerant and climax species has ***increased*** significantly:
  - Douglas-fir has ***increased*** from about 7% to more than 12%
  - Western red cedar has ***increased*** from about 3% to more than 10%.
  - The combination of grand fir and hemlock has ***increased*** from just over 1% to more than 6%
  - Subalpine fir has ***increased*** from about 29% to almost 47%

These changes in forest composition have significant implications.

- The shade tolerant species that now dominate the landscape tend to be much less resistant to fire, insects, and disease than long-live seral species they have replaced.
- These shade-tolerant species also tend to "hog" nutrients in their foliage, such as potassium, that trees need for disease resistance.

The following chart displays the project area species distribution (forest types) from a historical perspective, comparing the historical average in the Kootenai sub-basin with the current average in the Myrtle HFRA analysis area.

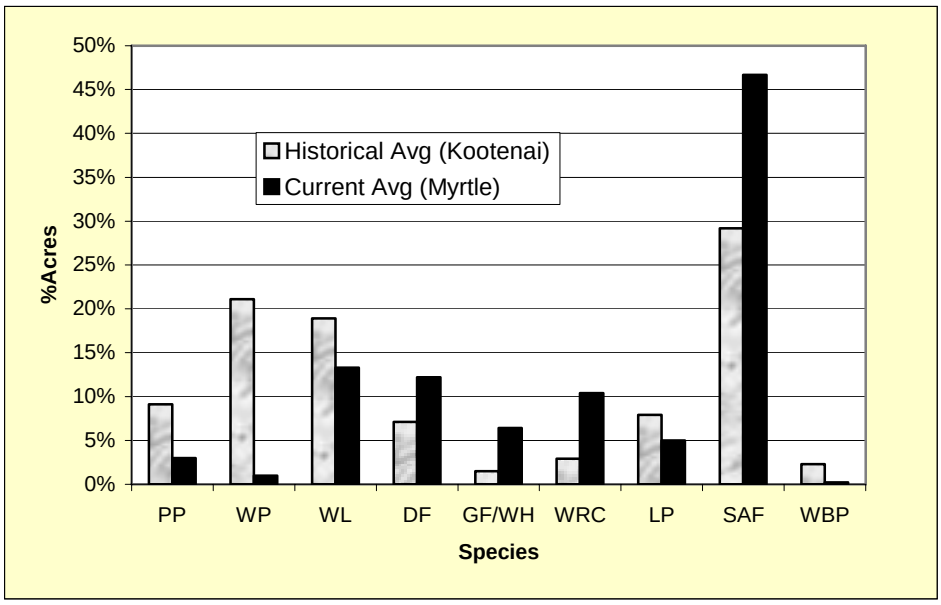

Figure 3.16 Historic vs. Current Forest Types - Myrtle HFRA Project Area

The chart below illustrates the different kinds of habitat groups and compares their proportions in the Myrtle HFRA project area versus the Kootenai sub-basin. A positive value (right of 0%) represents an increase in the species, a negative value (left of 0%) represents a decline in the species, compared to the Kootenai sub-basin. It also displays the changes in species composition at sub-basin scale. The consistent trend at each scale, when compared to historical conditions, is that shade intolerant, long-lived seral species (ponderosa pine, western larch and white pine) are decreasing, while shade tolerant climax species (Douglas-fir, grand, fir, western red cedar, western hemlock, subalpine fir, etc.) are increasing.

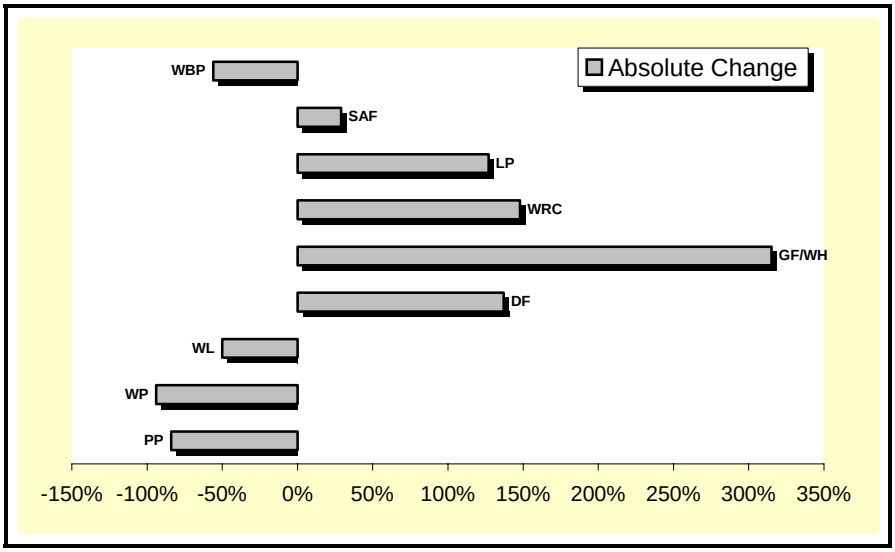

Figure 3.17 Absolute Change in Species Composition -- Kootenai River Sub-basin

(WBP = White Bark Pine, SAF = Subalpine Fir, LP = Lodgepole Pine, WRC = Western Red Cedar, GF/WH = Grand Fir/Western Hemlock, DF = Douglas-fir, WL = Western Larch, WP = White Pine, PP = Ponderosa Pine)

3.5-C Conclusions

Dry forests have experienced the greatest ecological change

Important ecological changes in the Myrtle HFRA area have occurred with fire suppression and widely scattered timber harvest over time. A historic study of some of these types in western Montana illustrates some of the changes that have occurred in our dry forests.

Prior to 1900, these western Montana sites may have supported an average of 27 trees per acre, with ponderosa pine and western larch dominating. Historically, these thick-barked pine and larch withstood frequent low intensity fires. Total density of trees greater than three inches diameter at breast height (DBH) averaged 43 trees per acre (TPA).

In 1984 these sites in western Montana supported 211 TPA larger than 3 inches and Douglas-fir dominated every size class except the largest (Habeck 1990).

The photo below, right depicts the typical dry forest conditions in the project area where treatments are proposed.

Stands on similar forest types in the Myrtle HFRA analysis area average about 280 TPA greater than 3 inches DBH. Given the estimated fire return interval of 25 to 50 years for these forests, portions of the project area could have burned one to three times over since the 1926 fire. Since the early 1940s, when the District started keeping records, within the project area there were more than 130 lightning caused fires that were suppressed. Therefore, it is reasonable to assume that fire suppression has altered the structure and composition of dry forest types in the project area.

3.5-C.1 Dry forest old growth

To meet Forest Plan *minimum* requirements, dry-site old growth stands must contain at least 8 TPA greater than 21 inches in diameter that are at least 150 years old and have an overall stand density of 40 ft^2 of **basal area**▪. These minimum standards are considered a starting point in determining whether a stand should be allocated as old growth. Other structural characteristics such as snags, downed woody debris, and number of canopy layers are also considered in the process (Green et al, 1992).

In their study of old growth ponderosa pine and Douglas-fir stands on three National Forests in Montana, Arno et al (1995) found that eight out of nine plots had pre-1900 basal areas of less than 145 ft^2 and that seven out of nine plots had pre-1900 basal areas of 100 ft^2, or less.

Figure 3.18 Typical dry forest conditions in the project area

The dry forest old growth stands in the assessment area are typically stocked with more than 250 trees per acre (TPA) larger than three inches DBH and overall stand densities average about 145 square feet (ft^2) of basal area. In their present condition the long-term sustainability of these stands is in question. As stated in Arno et al (1995) and (Biondi 1996), absent fire, understory trees out-compete the old trees for moisture and nutrients the old trees lose vigor and often succumb to insects and disease, or the stress imposed by even low- moderate intensity fires.

▪ **Basal area** equals the cross-sectional area of a single stem, including the bark, measured at 4.5 feet above the ground. Since larger trees occupy more space, fewer larger TPA are required to meet a given basal area. For example, a stand with about 17 TPA that are all 21" DBH would equal 40 ft^2 of basal area. On the other hand, it would take about 73 TPA that are 10" DBH to equal the same 40 ft^2 of basal area.

3.5-C.2 Overstocked Moist Forest Stands

The moist mixed conifer stands are the most productive forest types in north Idaho, which is a "good news", "bad news" scenario. The good news is that regeneration after fires can be prolific and forest stands can recover relatively quickly.

However, in the absence of thinning (either natural fire, or human) these stands can become excessively overstocked. Eventually, as trees begin to lose their health and vigor from too much competition for water, nutrients, and physical growing space, considerable build-up of natural fuels will occur.

As discussed earlier, the 1926 fire burned a good portion of the project area and many of the stands look similar to those in the photo to the right. These are typical moist forest conditions in the project area where treatments are proposed.

Figure 3.19 Typical Moist Forest Conditions

3.5-C.3 Desired Conditions

a. Dry Forest Types

In the absence of fire, native insects and pathogens regulate stocking by killing susceptible individuals and species. Formerly, frequent underburning fires prevented excess accumulation of carbon and storage of nutrients in woody biomass via consumption and release of nutrients. With the exclusion of fire, organic residues have accumulated as have standing live and dead fuels. The effectiveness of fire prevention and suppression in dry interior forests in recent years has permitted greatly increased ground fuel accumulations and stratified fuels (both living and dead) to the point where many fires can no longer be contained or confined (Harvey 1994).

The stand shown to the right, (located about 15 miles northeast of the Myrtle HFRA project area), is on the same habitat type as the stand in Figure 3-23. This stand was thinned in 1974 and underburned in 1978. A commercial thin and group selection harvest was conducted in 2000 and the stand was underburned again in the spring of 2002. Ponderosa pine is the dominant species in this stand with lesser amounts of western larch and Douglas-fir. This stand does not currently meet dry forest old growth standards, but with continued silvicultural treatments and prescribed burning it has the potential to meet these standards within the next 20-30 years.

Figure 3.20 Typical dry forest conditions

b. Moist Forest Types

The stand in the following photos displays a moist forest stand on the District where fuels were reduced using a combination of timber harvest and mechanical piling. In this stand, the majority of trees removed were less than eight inches DBH. These prescriptions also focused on retaining the biggest and best quality trees, primarily the more fire-resistant western larch. Figure 3-24 represents the conditions in many moist forest stands in the project area and Figure 3-25 provides an example of the target stand conditions the District would try to create in these types of stands.

c. Desired Conditions Summary

The following photos more closely represent the types of stands that would meet long-term management objectives across the Myrtle HFRA landscape. Both of these photos were taken at the same location (Dawson Lake area) on the Bonners Ferry Ranger District.

Figure 3.21 Moist forest stand prior to fuels reduction.

Figure 3.22 Moist forest stand following fuels reduction.

3.5-C.4 Vegetation Regulatory Framework

a. Forest Plan Direction

Site-Specific

The IPNF Forest Plan provides direction for all resource management programs and resource activities on the IPNF. Some of the directions that apply specifically to the vegetation resources within the Myrtle HFRA Project Area are listed below. (USDA 1987, pp. II-31-34, II-38-39)

- Provide for a diversity of plant and animal communities.
- Provide efficient fire protection and fire use to help accomplish land management objectives.
- Manage the forest resources to protect against insect and disease damage.

General Project Design Features

Many Forest Plan Standards are applicable to the general design of the proposed action and alternatives. Standards that apply to vegetation resources are listed below. (USDA 1987, pp. II-32-34, II-38-39)

- Reforestation will normally feature seral tree species, with a mixture of species usually present. Silvicultural practices will promote stand structure and species mix that reduce susceptibility to insect and disease damage.
- Project design will provide for site preparation and slash hazard reduction practices that meet reforestation needs of the area.
- Encourage utilization of forest products to reduce biomass, which must be disposed of otherwise.
- Activity fuels will be treated to reduce their potential rate of spread and fire intensity so the planned initial attack organization can meet initial attack objectives.
- Vegetation management [through fire] will favor the use of fire, hand treatment, natural control, or mechanical methods whenever feasible and cost effective. Direct control methods, such as chemical or mechanical, may be used when other methods are inadequate to achieve control.

b. Healthy Forests Restoration Act

The Healthy Forest Restoration Act [HFRA, Sec. 102 (e)(2)] requires that projects, "fully maintain, or contribute toward the restoration of, the structure and composition of old growth stands according to the pre-fire suppression old growth conditions characteristic of the forest type, taking into account the contribution of the stand to landscape fire adaptation and watershed health, and retaining the large trees contributing to old growth structure."

For projects with a Forest Plan established prior to December 15, 1993 a review of the management direction is required if the Forest has not completed a revised plan by January 1, 2007. Such is the case on the Idaho Panhandle National Forests.

HFRA says to review the management direction for the affected covered projects, taking into account any relevant scientific information made available since the adoption of the management direction; and amend the management direction for affected covered projects to be consistent with paragraph 2 (noted above), if necessary to reflect relevant scientific information the Secretary did not consider in formulating the management direction.

The Idaho Panhandle Forest Plan contains several standards related to old growth (see Chapter 4 - Vegetation discussion of old growth and compliance with the standards). The following standards are applicable to the proposal to treat dry forest old growth.

Standard 10(b) – This standard calls for maintaining "at least 10% of the forested portion of the Idaho Panhandle National Forests as old growth."

Standard 10 (c) – For distribution purposes, the Forest Plan directs Districts to select and maintain at least 5% of the forested portion of those old-growth management units (OGMUs) that *have* 5% or more old growth.

Standard 10 (d) – Existing old growth stands may be harvested when there is more than 5% old growth in an old-growth management unit, and the Forest total is more than 10%.

Compliance with HFRA

Based on two independent inventories and monitoring tools (FIA and IPNF stand level inventory) the IPNF is maintaining over 12% allocated old growth on its forested acres and is in compliance with Forest Plan standard 10 (b). As further explained below, this project is also in compliance with Forest Plan standards 10 (c) and 10 (d).

New scientific information (Arno et al. 1995 and Biondi 1996) indicates that absent fire, understory trees out-compete the old trees for moisture and nutrients and the old trees lose vigor and often succumb to insects and disease, or the stress imposed by

even low-moderate intensity fires. Treatments in an old growth larch and ponderosa pine stand on the Lolo NF in the late 1990s reduced basal area about 16% from 144 to 121 ft^2 per acre using the least intensive treatment, compared to the most intensive treatment that reduced basal area by about 48% from 145 to 76 ft^2. Prior to treatment, increment borings showed growth rates slowing in old growth trees and several old pines succumbed to beetle attacks (Arno and Fiedler 2005).

Results three years later showed old growth trees had increased sap flow, higher foliar nitrogen content, and higher foliage production (Sala and Calloway 2001), indicating improved tree vigor and increased resistance to insects and disease. Stone et al (1999) also found that restoration of pre-Euro-American stand structure by thinning, improved vigor of ancient pre-settlement ponderosa pines in northern Arizona. Increased canopy growth and increased uptake of water, nitrogen, and carbon indicated improved tree vigor. They concluded in their study that the negative influence of post-settlement trees on pre-settlement trees likely resulted from competition for soil resources. Their conclusion agreed with correlative studies conducted at their study site by Sutherland (1983) and Biondi (1996).

Finally, Pfister (2000) discussed the types of old growth where some of level management is appropriate. First, initial restoration cutting treatments appear necessary to restore old-growth stands historically sustained by relatively frequent low to mixed-intensity fire. The most extensive example would be old-growth ponderosa pine and ponderosa pine/Douglas-fir stands. Overstocked stands with sapling pole understories are at high risk to stand replacement fire, and may not have the capacity to regenerate themselves following such fires. The appropriate treatment is to *significantly* (emphasis added) reduce the density of understory *and* (emphasis added) overstory trees established since Euro-American settlement, and remove them from the site. Following cutting, restoration of fire, through prescribed burning, is necessary if such stands are to perpetuate themselves in place, consistent with historic disturbance processes, intervals, and intensities.

In addition, based on field exams and fire history data collected in Myrtle Creek (Zack 1994) there is very good evidence that the south faces of Myrtle and Snow Creek burned on average between every 35 to 40 years. Currently, the fire-free interval in these areas exceeds 80 years.

The Myrtle Creek HFRA proposes silvicultural prescriptions in OGMU 16, which currently contains 8% old growth. This proposal is in compliance with Forest Plan standards 10 (c) and 10 (d). Prescriptions are proposed in allocated dry forest old growth and would be designed to restore and maintain the structure and composition of these stands. This would be accomplished by retaining old growth ponderosa pine, western larch, and Douglas-fir. Additional trees from smaller size classes would be retained to provide additional structural diversity and replacement old growth for the future. In the long-term, these conditions would be more sustainable. The proposed action would result in no net loss of allocated old growth. In addition, the proposed action is consistent with the Idaho Panhandle Forest Plan because the project would maintain old growth habitat (12 percent at the forest scale and 5 percent at the OGMU).

Based on our review, we have determined the Forest Plan does not need to be amended to incorporate new information because the plan says to maintain certain amounts of old-growth. The plan does not prescribe how to maintain old growth. Nor does it preclude harvest to fully maintain, or contribute toward the restoration of, the structure and composition of old growth stands according to the pre-fire suppression old growth conditions characteristic of the forest type, taking into account the contribution of the stand to landscape fire adaptation and watershed health, and retaining the large trees contributing to old growth structure.

Harvest in old-growth stands meets the requirements of both the Forest Plan and the direction in HFRA, therefore no further adjustments are necessary.

3.6 - Soil Resources

3.6-A Introduction

Soil is the unconsolidated mineral or organic material on the immediate surface of the earth that serves as the natural medium for the growth of land plants. A productive soil can sustain biological productivity, maintain environmental quality, and promote plant and animal health. The Healthy Forest Restoration Act (HFRA) was enacted to restore healthy forests and reduce wildfire risk. While wildfire has the potential to severely damage forest resources including soils, activities pursued under the auspice of HFRA also have the potential to negatively affect soil productivity. The purpose of this report is to investigate and disclose the potential of effects of the proposed action and alternatives on the soil resource.

3.6-B Regulatory Framework

The regulatory framework providing direction for protecting a site's inherent capacity to grow vegetation comes from the following principal sources:

- Multiple Use-Sustained Yield Act of 1960
- National Forest Management Act of 1976 (NFMA)
- Forest Plan and Regional Soil Quality Standards (2554.03 – R1 Suppl. 2500-99-1)

The Multiple Use-Sustained Yield Act of 1960 directs the Forest Service to achieve and maintain outputs of various renewable resources in perpetuity without permanent impairment of the land's productivity. Section 6 of the NFMA charges the Secretary of Agriculture with ensuring research and continuous monitoring of each management system to safeguard the land's productivity. To comply with requirements, the Chief of the Forest Service charged each Forest Service Region to develop soil quality standards for detecting soil disturbances indicating a loss in long-term productive potential. In an effort to imply the most stringent standard, both Forest Plan and Regional Standards were incorporated into the analysis of the project. Management direction in the Forest Plan (p. II-17) is to manage the soil resource to maintain long-term productivity.

Forest Plan objectives and standards (Forest Plan, pp. II-32 and II-33) include:

- Management activities on Forest lands will not significantly impair the long-term productivity of the soil or produce unacceptable levels of sedimentation resulting from soil erosion. This will be accomplished using technical guidelines developed in conjunction with the soil survey and Best Management Practices necessary to protect soil productivity and minimize sedimentation.
- Soil-disturbing management practices will strive to maintain at least 80 percent of the activity area in a condition of acceptable productivity potential for trees and other managed vegetation. Unacceptable productivity potential exists when soil has been detrimentally compacted, displaced, puddled, or severely burned as determined in the project analysis.
- Projects should strive to maintain sufficient large woody debris to maintain site productivity.
- In the event of whole-tree yarding, provisions for maintenance of sufficient nutrient capital should be made in the project analysis.

The Regional Soil Quality Standards were revised in November 1999 (R-1 Supplement 2500-99-1 – PF SOIL-35). Manual direction recommends maintaining 85 percent of an activity area's soils at an acceptable productivity potential with respect to detrimental impacts, including the effects of compaction, displacement, rutting, severe burning, surface erosion, loss of surface organic matter, and soil mass movement. This recommendation is based on research indicating that a decline in productivity would have to be at least 15 percent to be detectable (Powers, 1990). In areas where more than 15 percent detrimental soil conditions exists from prior activities, the cumulative detrimental effects from project implementation and restoration should not exceed the conditions prior to the planned activity and should move toward a net improvement in soil quality. These standards do not apply to intensively developed sites such as permanent roads, mines, developed recreation and administrative sites.

3.6-C Methodology

3.6-C.1 Analysis Area

The analysis area for soil resources encompasses all land within an individual treatment unit or a compilation of all the individual harvest units (2086 total acres of activity area for Alternative 2 and 865 acres for Alternative 5) and one temporary road• in the Snow Creek drainage (FR 402C). The analysis area for soil resources was broken down into activity areas based on proposed vegetation treatments, logging systems, and fuel treatments (see the following tables) (PF SOIL-20). The effects of management of Road 402C (following table) were considered in the activity area in which it is proposed.

Soils outside the unit boundaries are not expected to be directly or indirectly affected by this proposal since no harvest or post-harvest equipment will operate off system roads outside the unit boundaries. Existing classified National Forest System roads are considered designated lands and, as such, the loss of soil productivity due to these roads was not considered in the cumulative effects analysis.

Table 3.16 Proposed action logging systems summary.

Description	Alt 2 (ac)	Alt 5 (ac)
Cable	417	203
Helicopter	1129	370
Ground-based	540	292
Total of Logging Systems	**2086**	**865**

Table 3.17 Proposed action silviculture and fuels treatments.

Description	Alt 2 (ac)	Alt 5 (ac)
Underburn (following harvest treatment)	1038	519
Grapple Piling	1022	346
Whole-tree Logging (Unit B3)	25	0
Total of Fuel Treatment	**2086**	**865**

To mitigate for unwanted fire starts, units adjacent to open roads or private land would be perimeter pile or whole tree yarded for approximately 150 feet into the unit. This would result in the creation of approximately 150 acres of fuel breaks in Alternative 2 and approximately 95 acres in Alternative 5. The fuel breaks are incorporated into the underburn and grapple pile acres shown in the above table and no further fuel reduction will be needed on the perimeters.

Table 3.18 Proposed action road management summary

Description	Alt 2 (mi)	Alt 5 (mi)
New System (permanent) Road Construction	0	0
Temporary Road Reconstruction - reopen Road 402C	0.6	0.6
Road Obliteration (402-C)	1.0	1.0
Road Obliteration (1309-UC)	1.0	1.0

(For additional management on roads not related to activity units refer to the Watershed Hydrology section at the beginning of each chapter and in Appendix D.)

• As described in Chapter 2, this refers to the re-opening of approximately 0.6 miles of Road 402-C which will be obliterated following use.

3.6-C.2 Analysis Methods

Soil resource existing conditions were determined using TSMRS records, aerial photography, and GIS data. Landtype descriptions and hazard ratings were gathered from the Idaho Panhandle National Forests Land Systems Inventory (PF SOIL-3 and 4) and were field verified in the project area during several visits by the Forest Soil Scientist. Shallow soil pits were dug and examined for texture, horizon thickness, and coarse fragment content. Other observations included existing vegetation, slopes, and evidence of mass movement. Detailed field reports are included in the project file (PF SOIL-22 to 32).

Existing conditions and impacts from past activities were quantified using a combination of on-the-ground soil transects (the "Onsite Assessment Method" outlined in Niehoff (2002)), depth of organic matter, and amount of coarse woody debris (PF-SOIL 1). The approximate confidence level (±5 percent) is 90 percent (Page-Dumroese et al. 2006; PF SOIL-36).Potential impacts to the soil resource by proposed harvest activity impacts were evaluated using the Soil Disturbance Spreadsheet (PF SOIL-9 and 10). For additional soil related modeling results using WEPP FuMe (Fuel Management Erosion Analysis) see Specialist's Report on Watershed Hydrology.

The disturbance spreadsheet (DS) evaluates the impacts of proposed activities on harvest units for each harvest method based on empirically derived coefficients that were obtained and averaged from numerous monitored sites throughout the Forest (Niehoff 2002). The DS is limited to the harvest and slash disposal methods for which coefficients have been determined, and its coefficients assume that the appropriate best management practices (BMPs) will be implemented. The DS does not account for changes in soil type, the recovery of soils over time, or existing conditions. The protocol for applying the DS is included in the "Soil NEPA Analysis Process and Source of Soil Disturbance Model Coefficients" (Niehoff 2002).

3.6-D Affected Environment

3.6-D.1 Geology and Landscape

The project area encompasses approximately 27,995 acres of Federal and private land. The area is between approximately 1800- to 6900-foot elevation on generally south- and north-facing slopes of previously glaciated terrain in the entire Myrtle Creek and northeast portions of Snow Creek watersheds. The parent geology (PF SOIL-12 and 13) in the project area is dominated by Cretaceous medium- to coarse-grained granitic rocks of the Priest River complex (73 percent), various glacial or alluvial deposits (21 percent), and a small amount of Prichard formation of the metasedimentary Belt Supergroup in the front range (three percent) (Miller et al. 1999). Quaternary glaciolacustrine deposits define the easternmost boundary of the project area above the Kootenai Valley (three percent).

The area was visited by at least two ice advances over the past 50,000 years that covered all but the tops of the highest mountains in North Idaho – reshaping the landscape through the rounding of ridges and widening of valleys. The valley bottoms are defined by abrupt stream breaklands surrounded by steep to moderately steep dissected mountain side slopes with occasional gently sloping benches typical of a glaciated mountainous landscape. Cirque lakes are found in the upper headwaters of Myrtle Creek at the highest elevation and feed some of the numerous small streams that delineate several widely-spaced, shallowly to deeply incised main drainages in Myrtle Creek and to a lesser degree some shallow drainages in Snow Creek.

The project area, especially in the North and at higher elevations, contains glacially scoured ridges and upper mountain slopes that contain alpine to subalpine forest vegetation. Glacial basins are partially enclosed by steep cirque headwalls which are mostly talus and outcrop. Soils are generally dark yellowish brown, often skeletal (rocky), and form in volcanic ash influenced loess overlying glacial till derived from granitic bedrock sources. Texture and rock fragment content is extremely variable.

Low-to mid-elevation glaciated mountain slopes, benches, and draws often contain deeper (8 to 25 inches deep) ash-influenced dark yellow to brown soils of silt loam to sandy silt loam texture and five to 80 percent rock fragments that support mixed coniferous forest. Gravel and rock fragment content varies and increases in amount and size depending on shallowness or depth to bedrock.

Soils in valley bottoms are usually subject to flooding and are poorly developed with little or no volcanic ash surface layers. They support a complex association of vegetation generally dominated by riparian and moist habitat types. Upland areas can contain volcanic ash-influenced soil of silt-loam texture overlying outwash, alluvium, and till and can be quite variable.

A restrictive layer of dense till often occurs at a depth of 12 to 60 inches and may inhibit infiltration and influence drainage patterns, especially on the north facing slopes above Myrtle Creek. When associated with roads, these compacted layers keep water flowing out of cut banks and down ditches, culverts, and road surfaces for extended periods of time. Bare rock outcrop is common along the ridges and breaklands of the project area and frequently occurs in conjunction with drier habitat types. For complete descriptions of activity area soils and their characteristics see Project File documents SOIL-3 and 4.

3.6-D.2 Soils and Productivity

The most productive part of the soil occurs near the surface at the contact between the forest litter and the mineral soil. Here, the litter has been highly decomposed into dark colored amorphous material, which is the richest part of the soil. This layer is frequently only a few inches thick, but its presence is much more important than its thickness would indicate. This organic-matter-rich layer contains most of the soil nitrogen, potassium, additional nutrients, and mycorrhizae that must be present for a site to be productive.

Underneath this organic horizon is volcanic ash that occurs as the surface layer of the mineral soil. The volcanic material accumulated from several Cascade volcano eruptions with most of the ash originating from Mt. Mazama (Crater Lake) in Oregon about 7,600 years ago. The top part of the ash is usually enriched with organic matter that is incorporated into this part of the soil. The ash has a high water- and nutrient-holding capacity, both of which are important for soil productivity, while the lower part of the volcanic ash contains less organic matter and is not as fertile.

Below the volcanic ash, the subsoils and substratum tend to be medium to coarse textured in the granitic glacial tills. These young glacial soils are very weakly weathered and generally have a high component of rock fragments, although this can be quite variable, particularly in the alluvial bottoms. Granites are rated as having good inherent nutrient status, but medium to low soil nutrient content because of their poor retention capacity.

Retaining coarse woody debris (CWD) and organic matter is important in maintaining the soil's most productive layer. CWD is defined as woody material derived from tree limbs, boles, and roots greater than three inches in diameter and in various stages of decay. It performs many physical, chemical, and biological functions in forested ecosystems and is also a key habitat component for many wildlife species and for stream ecology (Graham et al. 1994). Coarse woody debris in natural systems fluctuates with forest growth, mortality, fire, and decay.

Because CWD is such a valuable part of a functioning ecosystem, a portion of the material must be maintained to ensure that organic matter is recycled for long-term productivity. Harvest and slash burning should include precautions to maintain large wood to insure that soil function is maintained since both standing boles and down wood may be reduced.

The deep volcanic ash surface layer is very productive, but highly susceptible to compaction, displacement, and surface erosion, especially under wet conditions. Long-term damage to productivity from burning may occur if soil moisture is not sufficient to protect soil organisms (Borchers and Perry 1990; Hungerford et al. 1991; Niehoff 1985).

Bare or disturbed soils may increase the presence of noxious weeds that can alter vegetative cover and soil stability and effectively reduce native plant species without providing comparable effective soil cover. This can lead to an increase in potential soil erosion, decrease in organic matter input into to the soil, and reduction in potential soil productivity.

3.6-D.3 Loss of Nutrients

Harvesting results in the removal of nutrients that have been accumulated in the wood and foliage over time. Of concern is the possible loss of potassium in the soil and its effect on forest health, especially the increased susceptibility to insects and disease (Garrison-Johnston et al. 2003) and a possible link between potassium deficiency and the lack of tree resistance to root disease (Garrison-Johnston 2003). Research (Garrison-Johnston 2003; Garrison-Johnston et al. 2003; Moore et. al 2004a; Shen et al. 2001) suggests a complex balance between underlying geology and the natural deficiency of potassium in northern Idaho. In comparison, soil nitrogen can be replenished more rapidly through nitrogen fixation or atmospheric deposition than can potassium, which is derived primarily from underlying geologic formations and is a product of slow weathering processes.

Whole-tree yarding and removal of treetops can lead to the direct loss of potassium (Morris and Miller 1994). On some sites, 45 percent of the available potassium is retained in trees, with the remainder being held in subordinate vegetation, forest floor, and soil pools. Within the trees, about 85 percent of the potassium is held in the branches, twigs, and foliage (Garrison and Moore 1998). It is therefore vital to recycle as many nutrients as possible before removal, which can be done by overwintering small-scale debris to leach out potassium (Baker et al. 1989; Barber and Van Lear 1984; Edmonds 1987; Garrison and Moore, 1998; Laskowski et al. 1995 and Palviainen et al. 2003).

Some geological formations of the metasedimentary Precambrian Belt Supergroup have a natural deficiency of potassium; however, the predominantly granitic rocks of the project area are not expected to be as low in potassium as Belt rocks (Garrison-Johnston 2004) but exhibit moderate to low soil nutrient status because of their poor ability for nutrient retention. The majority of proposed activity areas are on granitic rocks (70 percent or approximately 1445 acres) and glacial alluvial material (27 percent or approximately 571 acres). Only portions of Unit F1 (3 percent or approximately 70 acres) are situated on Belt rocks (Prichard formation) (PF SOIL-13).

The Intermountain Forest Tree Nutrition Cooperative (IFTNC) continues to research potassium contents within tree species and different rock types in order to establish specific minimum thresholds for retention and effects of potassium on tree growth and resistance to root diseases (Mika 2005; Shaw 2005). Until these minimum thresholds are developed through research, the

Idaho Panhandle National Forests are using management recommendations from the IFTNC as a guideline for maintaining sufficient potassium on a site. These measures have been incorporated into the design and mitigation measures for soils (see Chapter 2).

3.6-E Existing Conditions

Four criteria were used to assess existing conditions for soil resources:

1. Landtypes and hazard ratings of the Idaho Panhandle National Forests;
2. Soils and productivity;
3. Wildfire and severely burned soils;
4. Existing site conditions in the units in which proposed activities would occur.

1. Land Types and Hazard Ratings

Forty land types have been identified and mapped in the project area (Map Appendix Soils Map 3 and PF SOIL-3 and 4). Proposed activity units in Alternative 2 occur on 13 land types (PF SOIL-5), and on 11 landtypes in Alternative 5 (PF SOIL-6). Detailed descriptions of each landtype are located in the soils section of the project file (PF SOIL-3). Hazard ratings have also been compiled and are broken into subcategories of mass failure, productivity, surface erosion, and sediment delivery potential (Map Appendix Soils Maps 1 and 2; PF SOIL-5 and 6); each is rated as low, moderate, or high for a particular land type as displayed in the following table.

Table 3.19 Sensitive landtypes associated with fuel treatment activity units and their potential for hazards.

	Mass Failure Potential (acres)			Surface Erosion Potential (acres)			Sediment Delivery Potential (acres)			Soil Productivity (acres)		
	L	M	H	L	M	H	L	M	H	L	LM	M
Alt. 2	2025	57	4	2025	61	0	1979	103	4	285	3	1798
Alt. 5	861	0	4	861	4	0	841	20	4	129	3	733

L – Low; LM – Low Moderate; M – Moderate; H – High.

In an effort to reduce potential problems, hazard prone landtypes were identified during the initial project analysis and excluded from proposed harvest activities. The intent was to delineate activity areas that avoid potential hazard areas; however, several "slivers" (areas of overlap) may still remain due to GIS mapping (i.e. the four pieces of approximately four acres in size that are included in the above table) and will be eliminated when layout of the units is finalized (Map Appendix - Soils Map 3).

a. Mass Failure Potential

> ***Mass Failure Potential*** *is the relative probability of downslope movement of masses of soil material. Besides natural failure, landslides or slumping can be triggered by a number of mechanisms, including harvest activities and related road building.*

In the activity units for Alternatives 2 and 5, all but two landtypes exhibit low or moderate mass failure potential (Table 3-19 and PF SOIL-5). Four acres of potentially high mass failures types (3 acres on MU106 and 1 acre on MU365) are located within a landtype crossing the boundaries of some activity units (the result of a GIS mapping error as discussed earlier). Though conditions are stable, no logging should occur on these acres.

Alternative 2 includes treatment units along Road 1309 and the main Myrtle Creek Road #633. The following items were considered during the development of the proposed action. (Due to the differences in treatment unit locations, this discussion applies only to Alternative 2)

- Within the project area, road related small scale slumping along Road 1309 is the most common form of soil movement, besides some landslides on the north facing slope that were identified in relation to the 1926 fire (Janicki 2003). Potentially unstable ground was observed along the Front Range above the Kootenai valley and was therefore removed from proposed harvest activities (PF SOIL-25).
- Several wooden retaining walls and gabion structures on the cut slopes of Road 633 were installed between 1979 and 1982 to keep material from eroding onto the road prism and to stabilize the cut slope, which otherwise would have a high

likelihood for failure. Seepage is present most of the year and trickles out of the retaining wall and/or gathers in ditches next to the in-sloped road.

- The hills above Road 633 were assessed to observe the extent of sensitive landtypes in the area (PF SOILS-29). Soils are very uncohesive and several indications of mass failures were observed, especially one rotational slide approximately 250 to 300 feet above a retaining wall. Over the years, portions of the retaining walls have been repaired, but the overall state of the structures is slowly deteriorating. Site specific recommendations have been made to reduce mass failure potential in these critical areas (see Chapter 2).

Slumping was also observed in a drainage of proposed Unit G7 (PF SOIL-14) in Snow Creek. The movement is fairly confined to the drainage itself and is protected from logging activities by the RHCA buffer.

Removal of forest canopy and cover from either clearcutting or wildland fire increases landslide occurrence (Megahan et al. 1978; Gray and Megahan 1981). This is primarily due to root decay, soil disturbance, increased snow accumulation and altered melting rates, and soil water increases from reduced interception and transpiration.

Megahan et al. (1978) found that landslide occurrence increased only slightly when overstory canopy was reduced from 100 percent to 11 percent, but increased dramatically when canopy closure went below 11 percent. They also found that crown cover from shrubs affected landslide occurrence after 80 percent crown removal and indicated that landslide occurrence is more sensitive to shrub removal than tree crown removal.

b. Surface Erosion Potential

Surface Erosion Potential *is a rating of the relative susceptibility of exposed soils to sheet and rill erosion.*

In the activity units, the majority of the landtypes exhibit low surface erosion potential, with the remaining approximately 61 and 4 acres for Alternatives 2 and 5, respectively, having a moderate rating (Table 3-19 and PF SOIL-5).

Roads are currently the primary source of erosion and sediment production in the project area. The dominant processes in roaded portions are surface erosion from bare soil areas of roads, including the cutslope, fillslope, and travel way. Revegetation of cutslopes and fillslopes is often difficult due to lack of soil moisture, organic material, low productivity potential, and desiccation of seeds and seedlings, especially on south-facing slopes. On moist slopes, revegetation efforts are more successful since erosion of road cutslopes and fillslopes is generally lower.

Road erosion and sediment yield usually decline after construction (Jones 2000; Switalski et al. 2004) but can provide a chronic, long-term source of sediment to streams within the project area. Periodic large pulses of erosion may occur during intense water yield and overland flow events in interaction with road drainage systems.

c. Sediment Delivery Potential

Sediment Delivery Potential *is a rating of the probability of eroded soil reaching a stream channel. By using slope gradient, slope shape, and distance to channel, a rating of low, moderate, or high potential is determined.*

In the activity units, all land types exhibit low and moderate sediment delivery potential (Table 3-19 and PF SOIL-5 and 6) with the exception of high ratings on 3 acres (MU106) and 1 acre (MU365) for Alternatives 2 and 5. These 4 acres of potentially high sediment delivery potential are located at the boundaries of some activity units (the result of a GIS mapping error as discussed earlier). These areas will be avoided when the units are laid out on the ground. Refer to the aquatics section for more details on sediment delivery potential.

d. Soil Productivity Potential

Productivity Potential *is a rating of the relative capacity or ability of a soil to produce and sustain biomass.*

In the activity units, about 85 percent of soils were rated as having a moderate and 14 percent as having a low to low-moderate productivity potential (Table 3-19 and PF SOIL-5 and 6) for Alternatives 2 and 5.

Soils susceptible to reduced productivity potential are generally those located on shallow, rocky steep slopes on southerly aspects. Removal of canopy can affect soil moisture content in several ways. Precipitation may enter previously intercepted areas and provide existing or establishing vegetation with additional needed moisture and increase decomposition rates. Conversely, rain events may increase erosion on exposed soil and reduce the availability of a growing medium. Furthermore, increased sunlight may also support plant growth or heat up soils to the extent that vegetation is inhibited by moisture stress.

2. Soils and Productivity

The soils found in the Myrtle Creek project area owe their productivity to excellent nutrient-holding capacities and other favorable characteristics provided by an ash-influenced layer that can extend to over two feet deep in certain locations. However, these generally young and poorly developed soils can experience long-term deficiencies when insufficient biologically essential elements, like organic matter and coarse woody debris, are not available.

Organic matter content varies throughout the project area and appears to range from optimum to low on the south-facing and high on the north-facing slopes (PF SOIL-1). Its variability and depth is natural and usually correlates to habitat type and aspect with excessive needle cast often decreasing the establishment of a more herbaceous cover. Exclusion of fire has also contributed to increased duff accumulations.

Coarse woody debris was found to be variable as well (PF SOIL-1). Some stands contain high amounts of downed wood, generally on moist north-facing slopes, that have never been harvested and have been excluded from wildfire for a long period of time. Drier south-facing slopes, especially in Snow Creek, have lower CWD levels that reflect past management and more recent wildfire activities. Decomposition may also be affected due to light and moisture variations under different canopy densities.

3. Wildfire and Severely Burned Soils

Natural disturbance events commonly reset watersheds and influence water quality and stream habitat. Wildfire is a natural component in forest watersheds and has influenced forest soils and watershed processes for thousands of years. However, as a result of fire suppression during the last century, natural fire regimes do not exist anywhere in northern Idaho today (Smith and Fisher 1997).

Depending on the intensity of the fire and the severity of its effects, wildfire can alter watershed soils by consuming the erosion-limiting litter layer at the top of soils and the binding organics within the soil (Ice 2003). Condensation of volatized organics on soil surfaces often result in water-repellant (hydrophobic) soil conditions (DeBano 1981; Doerr et al. 2000; Dyrness 1976) that can contribute to overland flow and increased in-channel failures (Ice 2003).

The 1926 fire represents the last major natural fire event that occurred in the project area prior to the Myrtle Creek fire of 2003, which burned 3450 acres of primarily south facing slopes and some pockets of the middle- to lower lying north-facing mountain side. Distribution of burn soil severity was equally distributed with 31 percent having a high, 34 percent having a moderate, and 35 percent having a low rating (PF SOIL-15). Hydrophobic soils were initially estimated to total 7 percent of the total burn area and were limited to south-facing, dry site Ponderosa pine/brush areas (Janicki 2003).

Post-fire effects to the water supply were relatively short-term. BAER (Burned Area Emergency Response) efforts, a mild winter and spring, and overall low intensity precipitation events assisted in the rapid growth and establishment of vegetation, which helped to stabilize the burned soils in the Myrtle Creek drainage. However, a high intensity summer storm in July of 2004 created a debris torrent that blew out the main road (#633) crossing at the, previously untreated, Yellow Pine drainage. Accumulation of runoff and overland flow from the still hydrophobic upper portions of that drainage was the likely cause of this response (PF SOIL-27). No harvest is proposed within the boundary of the area burned by the 2003 fire.

4. Existing Site Conditions

Detrimental Soil Impacts *are defined as the proportion of an activity area that may be subjected to compaction, displacement, rutting, surface erosion, soil mass movement, or severe burning. These impacts may be due to a particular management activity (such as timber harvest, fuels treatment, or prescribed burning), exclusive of committed resources such as system roads.*

The soils in an activity area are considered detrimentally disturbed when the following conditions are present as a result of Forest practices:

- Detrimental compaction results in a 15 percent or more increase in bulk density. Soil compaction reduces the supply of air, water, and nutrients to plants. Roading, ground-based yarding, and dozer piling are the major contributors to compaction in a managed area.
- Detrimental displacement is the removal of one or more inches (in depth) of any surface soil horizon, usually the A horizon, from a continuous area greater than 100 square feet.
- Rutting consists of wheel ruts at least 2 inches deep in wet soils.
- Surface erosion is indicated by rills, gullies, pedestals, and soil deposition and should be kept within tolerable limits by retaining the enough ground cover, depending on site characteristics.
- Severe fire consumes most woody debris and the entire duff and litter layer, exposing mineral soil and creating very high temperatures at the soil surface when surface soil moisture content is low. Many of the nutrients stored in these

organics can also be volatilized and removed from the site in fly-ash (Amaranthus 1989; DeBano 1991; Garrison and Moore 1998).

Initial evaluation of proposed harvest activities showed that of 24 proposed units, 12 had past harvest activities (D1, D2, and, entire units or portions of individual, G units). During the summer of 2005, the "Onsite Assessment Method" (see Niehoff 2002 for procedures) was conducted to evaluate all previously harvested units with proposed activity. Results of existing conditions are outlined in Table 3-20 below and PF SOIL-1.

Eleven units proposed for initial entry were assessed by the forester and District Fuels Planner (PF SOIL-2) or soil scientist on other occasions (PF SOIL-23 and 29), which included walkthroughs and visual observations of potential hazards such as slumping, especially associated with roads and past existing disturbance. Site specific recommendations were made where considered necessary (project file and Chapter 2 "Features designed to protect soils and site productivity"). Twenty-six shallow soil pits were dug in the general project area to aid in the initial evaluation (Map Appendix – Soils Map 3 and PF-SOIL-11, 23, 25, 26, and 27).

Field verification found that past harvest activities on two (G3 and G10) of the 13 visited units exceed or are at detrimental disturbance limits of 15 percent with all measured disturbances being directly related to existing roads or skid trails (Table 3-20 and PF SOIL-1). Three units (D1, G2, and G7S) have localized elevated levels of detrimental disturbance in portions of the activity area due to previous harvest activities (mitigation measures and considerations are discussed in Chapter 4). Over the extent of the entire activity area, all three units meet standards (Table 3-20 and PF SOIL-7).

The following table summarizes existing conditions and potential impacts from proposed harvest and temporary road construction for Alternative 2. A table for Alternative 5 is available in the project file (PF-SOIL-8). The potential detrimental disturbance predictions are based on coefficients established from monitoring of past harvest activities on the IPNF (Chapter 4; Niehoff 2002). It is presumed that activity units that have had little or no prior disturbance will show a greater incremental increase in potential detrimental disturbance than those units that already contain a network of existing skid trails. Little to no increase in disturbance is therefore expected because equipment would re-use already existing skid trails.

For this project, all tractor harvest will occur during the winter, providing additional protection of the ground due to snow cover or frozen ground conditions. The impacts are projected to range around 8 percent for the winter logging. Grapple piling usually occurs during the summer so that the expected disturbance potentially increases to approximately11 percent. Since enough debris should provide for a slash mat and if legacy skid trails are present and re-used, the potential new impacts would be minimal.

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The following table displays the existing conditions and potential effects of fuels treatments and the re-opening of Road 402-C under Alternative 2.

Table 3.20 Existing conditions and potential impacts for Alternative 2.

					Existing Detrimental Disturbance	Predicted Impact from Temp Rd		Potential Detrimental Disturbance		
Unit	**Activity Area Acres**	**Treatment**	**Logging System**	**Slash Treatment**	**In Unit Total %**	**Temp Rd. Const. ** miles**	**Est. Road Disturbance acres**	**In Unit Total %**	**Est. Acres**	**In Unit Total* %**
B1	118	ISW	H	GP	0				9	8
B3	25	ISW	H	none	0				0	0
B4	47	ISW	T	GP	0				5	11
B5	97	ISW	T	GP	0				11	11
B6	137	ISW	H	GP	0				11	8
D1	36	ISW	S	GP	3				4	11
D2	23	ISW	T	GP	14				3	14
D6	114	ISW	S	GP	0				9	8
D9	32	ISW	T	GP	0				4	11
E3	124	ISW	T/S[x]	GP	0				11	9
E8	35	CT	S	GP	0				3	8
F1	112	GS	H	UB	0				2	2
G1	113	ISW	T	GP	1				12	11
G2	309	GS	H	UB	4				18	6
G3	20	CT	T	UB	21				4	21[#]
G4	45	CT	S	UB	14**	0.6	2.4[+]	5**	6	14
G5	10	CT	T	GP	0				1	11
G6	68	GS	T	GP	11				7	11
G7H	144	GS	H	UB	0				3	2
G7S	113	GS	S	UB	8				11	10
G8	11	CT	T	UB	3				1	11
G9	283	GS	H	UB	1				7	3
G10	49	CT	T	GP	15				7	15[#]
G11	19	CT	T	GP	11				2	11
Total Alt 2 = 2086						**0.6**	**2.4[+]**	**5**	**151**	**7**
Total Alt 5[++]= 865						**0.6**	**2.4[+]**	**5**	**87**	**10**

++ A complete table for Alternative 5 is available in the project file (PF SOIL-8).

* Refer to Chapter 4 and PF SOIL-9 and 10 for coefficients used to predict potential detrimental disturbance for proposed logging and slash treatment scenarios including burning and piling. The level of disturbance increase also depends on the amount or lack of existing skid trails. Activity units that have had little prior disturbance will show a greater incremental increase in potential detrimental disturbance than those units that already contain a network of existing skid trails. Little to no increase in disturbance is expected there because equipment would re-use existing skid trails. Additionally, all ground-based units will be winter logged for further resource protection.

[x] Unit E3 is estimated at 60/40 for Skyline and Tractor.

** Existing detrimental disturbance already includes impacts from the old non-system roadbed. (see Unit G4)

+ Assuming an avg. width of 35 ft. Temp road will be reconstructed on an already existing old roadbed and will be fully obliterated post-harvest, therefore providing an additional net-improvement.

Units exceed or are right at allowable SQS's – if possible, Unit G3 may be primarily skyline logged in conjunction with neighboring Unit G4. Post-harvest decompaction of Units G3 and G10 will provide for a net improvement (SOIL-18)

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Treatments: ISW – Irregular Shelterwood
CT – Commercial Thin GS – Group Select
H – Helicopter
S – Skyline T – Tractor
GP – Grapple Pile UB – Underburn

3.7 - Roadless Areas Existing Condition

The roadless area discussion for the Myrtle Creek HFRA project was broken into two sub-topics:

1) the potential effects on roadless areas, and
2) the internal Forest Service requirements that would have to be met for timber harvest or the construction of temporary roads within inventoried roadless areas.

Analysis and disclosures of the anticipated effects on Roadless Areas utilized direction provided by the 2001 Roadless Rule and the 2007 Forest Service Handbook (FSH 1909.12, Chapter 70). The following attributes were analyzed:

Natural
Undeveloped
Outstanding Opportunities for Solitude or Primitive and Unconfined Recreation
Special Features
Manageability

3.7-A Regulatory Framework

Current guidance is provided by the Forest Plan, the 2001 Roadless Area Conservation Rule and Forest Service Manual Interim Directive: 1920-2006-1.

3.7-A.1 Roadless Area Conservation Rule (RACR), "The Roadless Rule"

This project is guided by the January 2001Roadless Rule (incorporated at 36 CFR 294) that generally prohibits road construction and timber removal in inventoried roadless areas on NF lands, with certain exceptions:

§ 294.13 Prohibition on timber cutting, sale, or removal in inventoried roadless areas.

(a) Timber may not be cut, sold, or removed in inventoried roadless areas of the National Forest System, except as provided in paragraph (b) of this section.

(b) Notwithstanding the prohibition in paragraph (a) of this section, timber may be cut, sold, or removed in inventoried roadless areas if the Responsible Official determines that one of the following circumstances exists. The cutting, sale, or removal of timber in these areas is expected to be infrequent.

(1) The cutting, sale, or removal of generally small diameter timber is needed for one of the following purposes and will maintain or improve one or more of the roadless area characteristics as defined in § 294.11.
(i) To improve threatened, endangered, proposed, or sensitive species habitat; or
(ii) To maintain or restore the characteristics of ecosystem composition and structure, such as to reduce the risk of uncharacteristic wildfire effects, within the range of variability that would be expected to occur under natural disturbance regimes of the current climatic period;

(2) The cutting, sale, or removal of timber is incidental to the implementation of a management activity not otherwise prohibited by this subpart;

(3) The cutting, sale, or removal of timber is needed and appropriate for personal or administrative use, as provided for in 36 CFR part 223; or

(4) Roadless characteristics have been substantially altered in a portion of an inventoried roadless area due to the construction of a classified road and subsequent timber harvest. Both the road construction and subsequent timber harvest must have occurred after the area was designated an inventoried roadless area and prior to January 12, 2001. Timber may be cut, sold, or removed only in the substantially altered portion of the inventoried roadless area.

3.7-A.2 Forest Service Handbook Direction for Wilderness Attributes and Roadless Characteristics for RACR

Evaluation of these attributes provided a thorough analysis of the effects of proposed activities on the roadless areas and recreation use, and addressed public concerns. The following table describes the attributes.

Table 3.21 Wilderness Attributes and Roadless Characteristics

Wilderness Attributes (FSH 1909.12)	Roadless Characteristics (RACR)
Natural	- High quality or undisturbed soil, water, and air. - Sources of public drinking water. - Diversity of plant and animal communities - Habitat for threatened, endangered, candidate, proposed, or sensitive species dependent on large areas.
Undeveloped	Natural appearing landscapes with high scenic quality. Reference landscapes
Outstanding Opportunities for Solitude or Primitive and Unconfined Recreation	The following three classes of dispersed recreation: Primitive, Semi-Primitive Non-Motorized, and Semi-Primitive Motorized.
Special Features and Values	Other locally identified unique characteristics. Traditional cultural properties and sacred sites.
Manageability	No criteria

Roadless Area Conservation Rule = RACR

3.7-A.3 Forest Service Manual Interim Direction

In addition to the rulemaking described above, the Forest Service Manual incorporated interim direction (FSM 1920-2006-1) regarding the authority to approve activities in inventoried roadless areas. The interim direction delegates to the Regional Forester the authority and responsibility to serve as the Responsible Official for certain decisions on road construction, reconstruction, or timber harvest projects in Inventoried Roadless Areas (IRAs), and reserves the right of approval to the Chief in other situations. The Chief, for good cause, may grant exceptions to the reservation of authority outlined in the interim directive, upon written request of a Regional Forester or Forest Supervisor (FSM 1925.03).

Circumstances where timber harvest may be authorized at the local level include:

a. The timber is generally small-diameter material and the removal of timber is needed for one of the following:
   1. To improve habitat for listed or proposed threatened and endangered, or sensitive species (FSM 2670), or
   2. To maintain or restore the desirable characteristics of ecosystem composition and structure -- for example, to reduce the risk of uncharacteristic wildfire effects.

In keeping with the FSM interim direction requiring the Regional Forester to review and agree to the purpose and need for any notice of intent to prepare an EIS that will consider timber harvest in an IRA, the Bonners Ferry District presented the proposal to Regional Forester, Gail Kimbell in June, 2005 and again in November, 2006. The letter authorizing fuel reduction treatments (timber harvesting) in the roadless areas was received in February, 2007 (project file). The discussions with, and the letter from, the Regional Forester were necessary to fulfill the Regional Forester's responsibilities as laid out in Interim Directive 1920-2006-1 1925.04b.

3.7-A.4 Forest Plan Direction

The analysis of roadless lands in the 1987 Forest Plan EIS led to some areas being proposed for inclusion in the National Wilderness Preservation System and others being assigned non wilderness prescriptions (Forest Plan FEIS; USDA Forest Service 1987a, Appendix C). The Forest Plan direction for management of roadless areas states, "Roadless areas will be managed based on the direction and goals established for the respective management area (MA) within which they are located" (Forest Plan, p. II-4). It is important to note that MAs that allow activities in roadless areas do not mandate that future development will occur.

The Myrtle Creek HFRA project area includes portions of two Inventoried Roadless Areas (IRAs) – the Selkirk and Kootenai Peak IRAs. The Record of Decision for the Forest Plan recommended portions of four roadless areas for wilderness classification, including 26,658 acres of the Selkirk Crest (Forest Plan ROD, pg 16). Portions of the Selkirk Roadless Area not recommended for wilderness are outside the scenic Selkirk Crest and have lower wilderness attributes, and did not receive

significant public support, with the exception of Long Canyon, which will be managed as roadless with no development for this planning period (Forest Plan ROD, pg 17). None of the proposed treatments for this project are located within Long Canyon.

The Selkirk Crest and contiguous roadless lands have been supported for Wilderness designation by the public for the last 20 years or more. Area boundaries included for designation have varied with each proposal. Roadless lands in this project area are generally south and east of the lands most consistently supported for Wilderness designation.

Note: The Forest Plan is currently in the process of being revised; however, proposed activities must remain compliant with the 1987 Forest Plan until a new plan is issued.

a. Current Forest Plan Management Area Direction

Management Area direction (Forest Plan Chapter III; and Record of Decision, Table 1, pg 19) for these areas include the following:

- MA1 Timber Production – manage lands suitable for timber production for the long-term growth and production of commercially valuable wood products. Includes dispersed recreation management primarily for roaded modified and roaded natural ROS classes with a diversity of recreation opportunities; road construction is allowed.
- MA 2 Timber Production within identified grizzly bear habitat – manage identified grizzly bear habitat to support a recovered grizzly bear population while providing for the long-term growth and production of commercially valuable wood products. Includes dispersed recreation management primarily for roaded modified and roaded natural ROS classes with a diversity of recreation opportunities; road construction is allowed. Manage trails to avoid areas of critical grizzly bear habitat. Use restrictions may be necessary to reduce bear/human conflicts.
- MA 3 Timber Production within identified grizzly bear habitat and big game winter range – manage identified grizzly bear habitat to support the IPNFs' share of a recovered grizzly bear population (25 animals) while providing sufficient winter forage to support projected big game populations through scheduled timber harvest. Includes dispersed recreation management primarily for roaded modified and roaded natural ROS classes with a diversity of recreation opportunities; road construction is allowed. Manage trails to avoid areas of critical grizzly bear habitat. Use restrictions may be necessary to reduce bear/human conflicts.
- MA 4 Timber Production with big game winter range – manage big game winter range to provide sufficient forage to support projected big game needs, through scheduled timber harvest and permanent forage areas. Includes dispersed recreation management primarily for roaded modified and roaded natural ROS classes. Motorized use is generally restricted to designated routes and may be restricted to provided needed wildlife security. Road construction is allowed.
- MA 7 Caribou Habitat – manage caribou habitat to provide a proper mix of seasonal habitats needed to support the IPNFs' share of a recovered Selkirk woodland caribou population. Includes dispersed recreation management for roaded natural and, where possible, toward semi-primitive motorized and non-motorized recreation. Motorized use may be restricted when needed to protect caribou. Road construction is allowed, but should be limited through old-growth cedar/hemlock stands to those instances in which no other reasonable access is available. Snow roads are encouraged where possible.
- MA 9 Includes non-forest lands or lands physically unsuited for timber production – manage such areas to maintain and protect existing improvements and resource potential. Dispersed recreation management will be for roaded natural or semi-primitive ROS experience. Trail construction will be only to provide access to adjacent areas. No local road construction is planned, but construction of arterials and collectors is permitted as needed to provide access to adjacent areas.
- MA10 Roadless – provide opportunities for a semi-primitive recreation experience including motorized (with the exception of Long Canyon); manage the area in its present condition with no new roads; provide grizzly bear and caribou habitat; manage big game winter range, provide low public access fisheries, and meet visual quality objectives (Forest Plan, III-42, III-43)
- MA11 Wilderness – manage existing and proposed wilderness to maintain wilderness characteristics and provide opportunities for public use, enjoyment and understanding of the wilderness resource; provide opportunities for a primitive and semi-primitive recreation experience; use prescribed fire for habitat improvement or other benefits in achieving objectives of the management area; timber harvest not permitted (Forest Plan, III-48 thru III-50)
- MA12 – Wild and Scenic River Corridors (Forest Plan, III-52),
- MA13 – Areas and sites with special attributes or features (scenic or botanical areas, natural history areas, cultural resource sites) (Forest Plan, III-56),
- MA14 – Research Natural Areas, and Experimental Forests.

MAs 12, 13, and 14 do not occur within the Myrtle Creek HFRA project area.

Kootenai Peak IRA – The Forest Plan designated the Kootenai Peak IRA as available for development. The Management Areas, by percent, for the portion of the Kootenai Peak IRA that is within the project area are as follows:

Management Area	MA 1	MA 2	MA 3	MA 4	MA 7	MA 9	MA 10	MA 11
Percent (approx)	10	58	01	01	12	18	0	0

Management Area 2 covers the center and northern part of the roadless area; MA1 lands are in the eastern part, while MA7 is in the southwestern finger of the area. MA9 areas are scattered along the steep reaches on the north side of Myrtle Creek (the northern edge of the roadless area) and Snow Ridge, as well as along the step east-facing end of Snow Ridge. (See Map Appendix – Roadless Maps 1 and 2.)

Selkirk IRA – For the entire Selkirk IRA, Management Area designations were approximately 32% as MA10 Roadless, approximately 26% as MA11 proposed wilderness, a minor portion in MAs 12, 13, 14, and approximately 40% in MAs available for development.

The Management Areas, by percent, for the **portion of the Selkirk IRA that is within the project area** are as follows:

Management Area	MA 1	MA 2	MA 3	MA 4	MA 7	MA 9	MA 10	MA 11
Percent (approx)	0	16	0	0	35	16	11	22

The portion of the roadless area where management activities are proposed for this project is designated as MA2, with scattered areas of MA9. Management Area 7 covers practically one-half of the Cascade stringer (described below under the section *Existing Condition of the IRAs).* The Roadless (MA10) and Wilderness/Proposed Wilderness (MA11) areas wrap around the western and southwestern part of the project area, separated from the MA7 on the northern corner by a large area of MA9 lands.

b. Forest Plan Revision -- Proposed Land Management Plan Allocations

The Comprehensive Evaluation Report (CER) for the Proposed Idaho Panhandle Land Management Plan (Appendix K of the Proposed Plan) provides information on the evaluation of inventoried roadless areas in the Forest and provides the basis for the proposed Plan (USDA Forest Service 2006). Appendix K contains the following information for the Selkirk and Kootenai Peak IRAs:

Inventoried Roadless Area	**Capability**	**Availability**	**Need**	**Proposed Plan Allocations**
Selkirk #125	High	High	High	36,700 acres Proposed Wilderness MA1b * Rest is Backcountry MA5 or General Forest MA6
Kootenai Peak #126	Moderate	Moderate	High	Backcountry MA5 or General Forest MA6 Not recommended as Proposed Wilderness.

** Areas recommended as additions to the National Wilderness Preservation System. Managed to protect their wilderness characteristics until Congressional action is taken. The designations of MA1b, MA5 and MA6 are defined in the Proposed Management Plan. They differ from the definitions currently in use under the 1987 Forest Plan.*

The portion of the Selkirk IRA that is included as MA1b in the Proposed Land Management Plan covers the Selkirk Crest, Long Canyon and Parker Creek – areas that are not included in the Myrtle Creek HFRA project (USDA Forest Service 2006 map of proposed management areas).

Note: It is important to keep in mind that until a decision revises the Forest Plan, all management activities must comply with the current Forest Plan Management Area direction.

See the following map of the Inventoried Roadless Areas and **current** Management Areas.

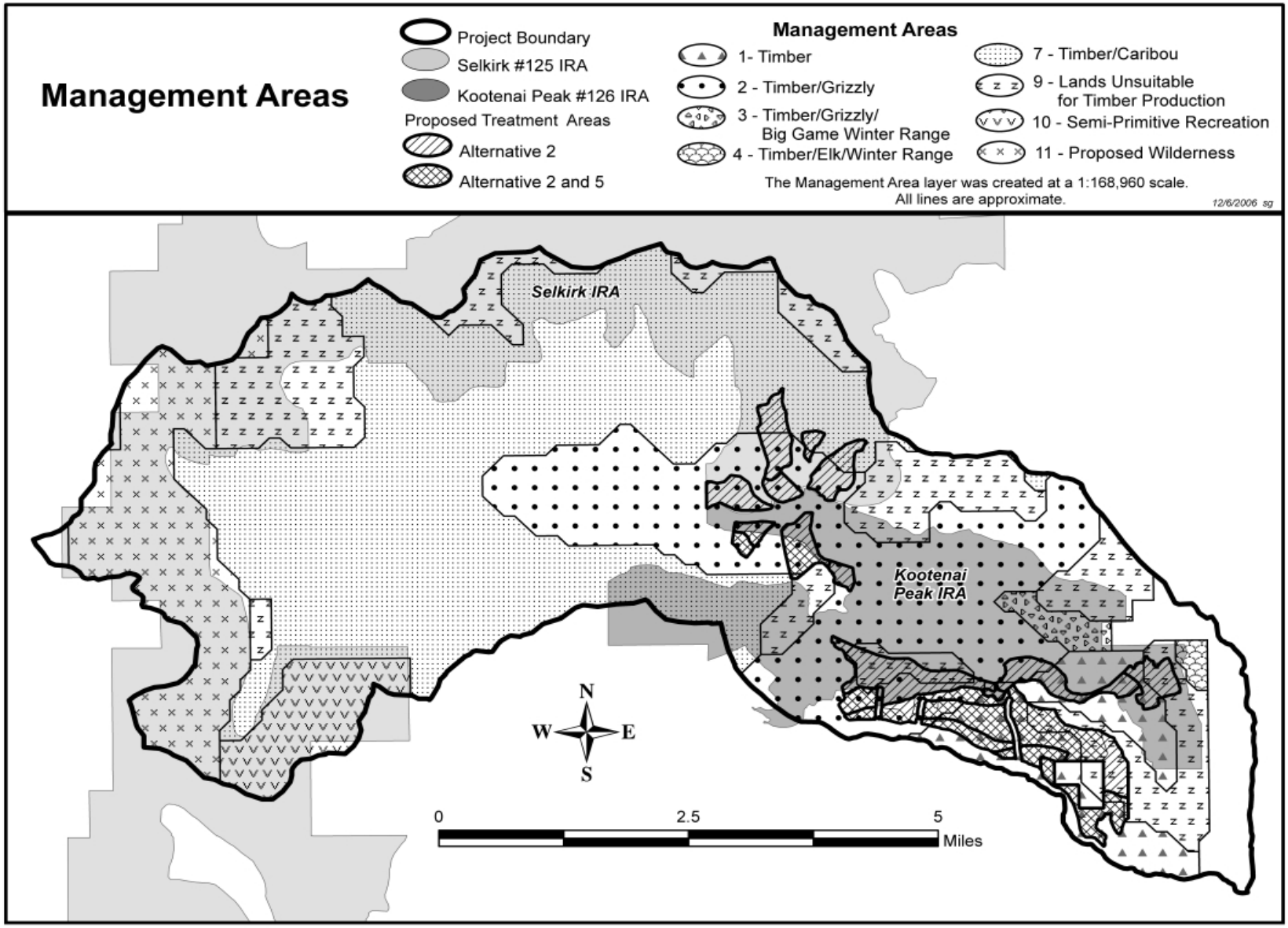

Figure 3.23 Project Area, Forest Plan Management Areas and Inventoried Roadless Areas

3.7-B Current Conditions Related to Crown Fire Hazard

The current condition of the project area is moderately removed from historic fire regimes, depending on the potential natural vegetation type or the biophysical setting. About 50 percent of the proposed treatment units are in locations that are most removed from their fire condition class natural range (Fire/Fuels Chapter 3, Fire Regime Condition Class and Conclusions discussions).

The drainages in the project area are oriented with the prevailing wind direction – typical winds are light to moderate from the southwest. Late afternoon winds tend to funnel down the drainages. This orientation may aid in fire spread. Steep slopes on the sides of the drainages can contribute to rapid, upslope runs. District fire records show that it is not uncommon for wildfires in the Selkirks to move down drainage and northward from one drainage to the next. (See map of the 1926 fire in Chapter 3.)

Selection of potential treatment areas was based on the following fundamental factors:

- The need to reduce the risk of hydrophobic soils adjacent to Myrtle Creek and its tributaries, as they are the transporting mechanism for post-fire sediments.
- The need to reduce fuels in the path of historic burn patterns (see Figure 3.9 map of the 1926 fire that burned from the south to the north across several watersheds.)
- The need to treat areas at a high risk of crown fire hazard, and areas with poor ecological integrity (described in the Vegetation discussion, also see Figure 3.3 map of the terrestrial integrity in the project area.)

3.7-B Roadless Area Analysis Methods and Resource Indicators

The project area contains portions of two Inventoried Roadless Areas – Selkirk #125 and Kootenai Peak #126.

> A roadless area is defined as an area of 5,000 acres or greater in size, or any acreage contiguous to existing wilderness.

The Selkirk IRA #125 is about 97,957 acres total .

The Kootenai Peak IRA #126 is about 4844 acres, less than the 5000 acre required; however, it is being managed as an IRA until further notice.

Public Comments

Comments related to roadless areas in the Myrtle Creek HFRA project area expressed concern about the following items:

- the need to treat vegetation in selected portions of the roadless areas in order to restore the desired stand characteristics, composition and structure to reduce the risk of catastrophic fire;
- potential effects on the roadless areas;
- the possibility of setting a precedent for management in IRAs;
- the benefits of constructing temporary roads in the IRAs for access, weighed against the length of time needed to gain approval from the Chief of the Forest Service;
- effects from construction of temporary roads are temporary and of short term risk to the watershed; risk from fire is a long term condition;
- the biological importance of roadless areas;
- long term benefits of roads weighed against benefits of roadless areas;
- methods that could treat priority areas in the watershed without constructing roads.

3.7-B.1 Roadless Characteristics (Resource Indicators)

To thoroughly analyze the effects of proposed activities on the roadless areas and recreation use, and to address the public concerns, six roadless area characteristics were evaluated. These characteristics are the same that were used by the RARE I and II roadless evaluations, which led to roadless and proposed wilderness designations in the Forest Plan. The public concerns above are addressed by analyzing these six roadless characteristics: See Table 3-23 (above) for descriptions of Wilderness Attributes and Roadless Characteristics.

Natural is the extent to which long-term ecological processes are intact and operating. It is also measured by the presence and magnitude of human-induced change to an area (e.g., mining, recreation developments, vegetation manipulation, and fire suppression).

Undeveloped means the environment looks natural to most people, that it generally appears to be affected by the forces of nature. If the landscape has been modified by human activity, the evidence is not obvious or is disappearing due to natural processes.

Outstanding Opportunities for Solitude or Primitive and Unconfined Recreation is a perceived condition of being secluded, inaccessible and out of the way. Physical factors often influence a sense of remoteness include topography, vegetative screening, distance from human impacts, and difficult access.

Solitude is a personal value that can be defined as the isolation from the sights sounds, and presence of others and the developments of man. **Opportunities for Primitive Recreation** refers to opportunities to experience solitude, remoteness and a spirit of adventure that offers a high degree of challenge and risk.

Special Features and Values are the unique geological, biological, ecological, cultural, or scenic features that may be located in roadless areas.

The Manageability element relates to the ability to manage an area to meet size criteria (minimum of 5,000 acres) for roadless areas, and the five elements summarized above. This is a particularly important element to address if there are any roads proposed for the roadless area.

3.7-C Existing Condition of the IRAs

a. Kootenai Peak #126: 4844 acres

The Kootenai Peak Roadless Area, located five miles from Bonners Ferry, is a narrow area (two miles across at the widest point) encircled by the Myrtle Creek / Snow Creek driving loop. It is located across the Myrtle Creek Road from the Selkirk IRA, and more than 100 miles from any designated Wilderness (Cabinet Wilderness in western Montana).

The roadless area encompasses both sides of a long ridge extending from Cooks Pass to the Kootenai River Valley. Most of the ridge is timbered. The terrain is typical of the surrounding forest. There are no lakes or outstanding topographical features in this area. Wildlife is varied and abundant. Mule deer, moose, elk, black bear and many small mammals and birds are typical. A portion of the area is visible from the city of Bonners Ferry, as well as numerous points throughout the Kootenai River valley and along US Highway 95.

Since the late 1980s, some development has occurred within this roadless area. The Curve Creek Timber Sale treated approximately 270 acres and extended the road system (Curve Creek EA and DN, 1986). Then, the roadless area was entered by the Snow Creek Timber Sale which treated approximately 60 acres and built about 0.5 mile of road. These changes as well as previous changes in the size were documented by the Snow Creek project (Snow Creek EA and DN, 1993). Approximately 130 acres of timber harvest analyzed and approved in the Myrtle-Cascade EIS occurred within the roadless area, along the Myrtle Creek road. Also, with the advent of better mapping capabilities and GIS technology, the acreage is now calculated as approximately 4,844 acres as reported in the Draft Comprehensive Evaluation Report prepared by the IPNF in May 2006 (USDA, 2006).

Natural: Lands within this area are generally undisturbed by human activity. However, over time the natural integrity has been diminished by fire suppression, which has caused the advance of shade tolerant trees, insect & disease, and accumulation of forest fuels; which adds up to reduced resilience to disturbance. The 1926 wildfire burned across a large portion of the area (see Vegetation and Fire/Fuels sections, and Figure 3-9 1926 wildfire perimeter; and Figures 3-23 through 3-26 photos with IRA boundaries and Units). The 2003 Myrtle Creek Fire burned more than 1300 acres of the roadless area, within the Myrtle Creek drainage (Figure 1-1 Vicinity Map with fire perimeter). Over time, changes in forest structure and composition have also affected wildlife and their habitat (see wildlife section).

Undeveloped: This item is a subjective term based on an individual's perception of what appears to be normal/natural. People who live close to the project area or who have spent time there are familiar with how the area looks from day to day. They may perceive that the current forest conditions appear to be "natural" where there has been little to no management. Access to and around the Kootenai Peak Roadless Area includes the Myrtle Creek Road #633 and Snow Creek Road #402 which traverse heavily managed areas which are likely to be perceived as not very natural because of the obvious development along portions

of the roads and the amount of use of these roads. The entire length of the northern border of the Kootenai Peak roadless area (approximately 4.75 miles) and follows Myrtle Creek Road #633.

Outstanding Opportunities for Solitude or Primitive and Unconfined Recreation: The level of remoteness (perceived seclusion and inaccessibility) varies across the Kootenai Peak roadless area. Access to the area from the heavily traveled Myrtle and Snow Creek Roads does not support a feeling of remoteness. Trail #89 along Snow Ridge would give visitors a greater feeling of seclusion. It is rare that a visitor to the area would meet another party once they are away from the road system. Sights and sounds of human activities are screened merely by timber.

Solitude and Opportunities for Primitive Recreation: The area provides solitude, once visitors are away from the sights and sounds of Myrtle Creek Road and views of developed areas. There are opportunities for hiking, berry picking, (hunting in Snow Creek only) and other forms of primitive recreation.

Special Features and Values: An old Forest Service cabin, remnants of a lookout tower, and habitat for grizzly bear and sensitive wildlife species (see Wildlife discussions). There are no special prominent mountain peaks, scenic vistas or other unique physical features in the area.

Manageability: The 1987 Forest Plan established the boundaries and management area designations for the roadless area. Area boundaries are difficult to identify on the ground. Often boundaries follow survey lines between private and public land. Management activities (described above) have resulted in the area now covering approximately 4,974 acres; which is below the 5000 acres required for Congressional designation as a Wilderness Area.

b. Selkirk #125: 97,957# acres total

(#Approximate acres reported in the 2006 Draft Comprehensive Evaluation Report prepared during Forest Plan Revision)

The Selkirk Roadless Area is the largest inventoried roadless area on the Idaho Panhandle National Forests. Its northernmost point is located approximately four miles south of the Canadian border and continues southerly for about 30 miles. The northern portion of the area is a relatively large block including the Long Canyon and Parker Creek drainages. The center is divided almost full-width across the roadless area by roads and management activities in the lower elevations of the Trout Creek and Ball Creek drainages. Continuing south, roads and management on the east-facing slopes of the Selkirks in the Burton, Clark, Lost and Cascade Creek drainages, as well as roads, forest management and private timber company lands in the Myrtle Creek drainage result in this portion of the roadless area being composed of smaller areas and fingers or stringers. The southern most portion of the area is considerably narrow as it follows the Selkirk Crest in a north-south direction.

The analysis for this project evaluated the portion of the roadless area within the Myrtle Creek HFRA project area; identified as the Cascade stringer, for the following discussion.

Cascade stringer portion of the Selkirk IRA: 8,772 acres approximately

The portion of the Selkirk Roadless Area affected by the project proposal is the eastern most tip of a "stringer" of land running out Cascade Ridge between Myrtle Peak and Burton Peak. The stringer is about 8 miles from east to west, at its narrowest point about 1 mile wide and measures about 4 miles at the widest point. The Selkirk Roadless Area - Cascade stringer is located across the Myrtle Creek Road #633 from the Kootenai Peak Roadless Area, and more than 100 miles from any designated Wilderness (Cabinet Wilderness in western Montana) http://roadless.fs.fed.us/states/id/idah.pdf. Photos in Chapter 4 show the proposed treatment units within this stringer and the southern edge of three of the five units that are within a few hundred yards of the road.

Although the project area analysis boundaries encompass more of the Selkirk IRA than this Cascade stringer, the proposed project will not be seen from nor will it affect the integrity of other Selkirk roadless lands.

<u>The following discussion describes lands in the Cascade stringer east of Myrtle Peak and Myrtle Lake.</u>

Natural: The ridgeline is rugged with very steep slopes. It is a dramatic ridge with exceptional views. It also serves as the headwaters for many creeks flowing both into the Ball Creek drainage and the Myrtle Creek drainage. One small pond exists without benefit of trail or other easy access. Mid-slopes and bottom-lands are generally forested. The area provides habitat for elk, moose, deer, black and grizzly bears and mountain caribou. However, over time the natural integrity has been diminished by fire suppression, which has caused the advance of shade-tolerant trees, insect & disease, and accumulation of forest fuels; all of which add up to reduced resilience to disturbance. The 1926 wildfire did burn into the Adverse Creek part of the area (see Vegetation and Fire/Fuels sections and Figure 3-9 1926 wildfire perimeter Chapter 4 photos with IRA boundaries and Units). The 2003 Myrtle Creek Fire burned into the roadless area between Yellow Pine and Adverse Creeks (Figure 1-1

Vicinity Map with fire perimeter). Over time, changes in forest structure and composition have also affected wildlife and their (see wildlife section).

Undeveloped: As explained earlier, this item is a subjective term based on an individual's perception of what appears to be normal/natural. People who live close to the project area or who have spent time there are familiar with how the area looks from day to day. They may perceive that current forest conditions appear to be "natural" where there has been little to no management. Access to the southern edge of this Cascade stringer includes the Myrtle Creek Road #633, which is likely to be perceived as not very natural, due to the obvious development along portions of the road and the amount of use the road receives. The impact from human activity within the stringer is minor and scattered. Trail #9 to Burton Peak roughly follows the project boundary on the northeast. Trail # 286 to Myrtle Peak and Myrtle Lake touches the westernmost edge of the stringer, about 6 miles from the nearest proposed treatment area.

Outstanding Opportunities for Solitude or Primitive and Unconfined Recreation: To the north and west, the landscape appears rugged and remote. Because of the area's variable north-south width, depending upon the vantage point, there are many places where it is easy to look down on roads and timber harvest areas. A portion of this stringer actually uses about 1.75 miles of Myrtle Creek Road #633 as a boundary. Lands to the south of the Cascade stringer have mixed ownership and display very diverse management practices. Lands to the east of the Selkirk stringer overlook the Kootenai Valley, which is a highly developed agricultural area.

Solitude and Opportunities for Primitive Recreation**:** It is rare that within the Cascade stringer, a visitor would meet another party. Along the perimeter trails, use is more typical but not heavy. The Cascade stringer offers variety in recreational opportunities. Trails offer moderately difficult access while open ridges and steep slopes encourage technical climbing, ski mountaineering and rugged cross-country travel.

Special Features and Values: An old Forest Service cabin sits on Burton Peak (just on the project boundary.) Historic ridge trail #209 followed the entire length of Cascade Ridge but is no longer maintained.

Manageability: The boundary and management area designations of the entire Selkirk Inventoried Roadless Area were established by the 1987 Forest Plan. The boundary of the Cascade stringer follows section lines or mid-slope boundaries that are often difficult to identify on the ground.

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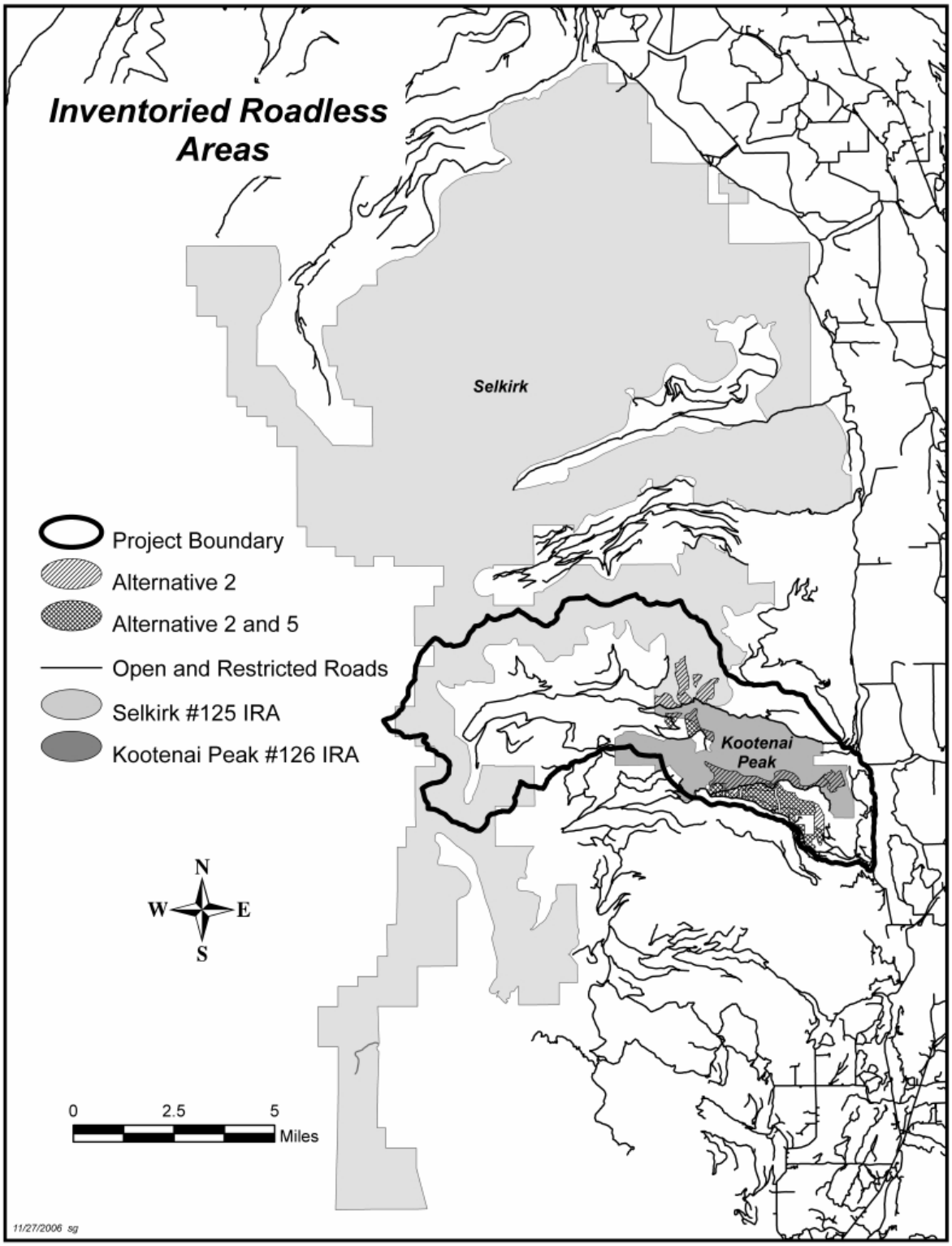

Figure 3.24 Inventoried Roadless Area and Alternative 2 Vicinity Map

**Note: the roadless characteristics (or lack thereof) may be viewed using a virtual over flight on the World Wide Web using freeware such as Google Earth ™. The photos on display at the time of this writing are from 2004, one year after the Myrtle Creek fire. http://earth.google.com/*

3.8 - Recreation

The lands within the analysis area represent the "introduction" to the eastern side of the Selkirk Mountains, which have a long history of recreation use. They are distinctive in that they offer exceptionally high scenic quality and a variety of settings within an hour of a full service community and two major interstate highways (U.S. 95 and U.S. 2).

3.8-A Methodology

3.8-A.1 ROS (Recreational Opportunity Spectrum)

The Recreation Opportunity Spectrum is a system for defining the types of outdoor recreation opportunities the public might desire, as well as identifying the portion of the spectrum a given area might be able to provide. It is used for planning and managing the recreation resource and recognizes recreation activity, setting and experience opportunities. The characteristics of the landscape change seasonally, with the ROS classes generally reflecting more Semi- Primitive attributes during the winter. General definitions of each class are as follow:

Rural: Natural setting is culturally modified to the point that it is dominant to the sensitive travel route observer. May include pastoral, agricultural, intensively managed wildland resource landscapes or utility corridors. Pedestrian or other slow moving observers are constantly in view of culturally changed landscapes.

Roaded Natural: Characterized by predominantly natural-appearing settings, with moderate sights and sounds of human activity. Roads, trails and campgrounds are common in this setting. Density of use is moderate.

Roaded Modified: A subclass of the Roaded Natural classification**.** Natural setting may have modifications that range from being easily noticed to strongly dominant to observers in the area. Large clearcuts, skid roads, and landings may dominate to the view. Recreation facilities are rare.

Roaded Modified Non-Motorized: A subclass of Roaded Natural similar to the Roaded Modified setting, but access to the area is via non-motorized trail or roads closed to motorized use. These areas may shift to the roaded modified setting dependent upon gate closures and openings.

Semi-Primitive: Both Semi-primitive Motorized and Semi-primitive Non-Motorized classes are characterized by predominantly natural or natural appearing landscapes. The size of the area gives strong feelings of remoteness. There are ample opportunities to practice wildland skills and achieve feelings of self-reliance.

Semi-Primitive Motorized: Motorized travelways are primitive and generally most difficult. Structures are rare. Isolation is the norm.

Semi-Primitive Non-Motorized: The presence of primitive roads is tolerated provided they are closed to public motorized travel. Structures are rare. Isolation is the norm.

Primitive: Setting is generally an unmodified natural environment. Evidence of humans would be unnoticed by an observer wandering through the area. Motorized vehicles are not permitted. There may be evidence of trails but the trail standard should not exceed a standard needed to carry the expected use.

Developed Sites

A place containing a concentration of facilities and services intended to enhance and to provide recreation opportunities to the public. Examples of such sites are campgrounds, picnic areas, boat ramps, trailheads, etc.

Dispersed Sites

Sites with or without amenities that access or provide recreational opportunities to the public. Examples of these sites include "user-developed" camping spots, most trailheads, viewpoints, favorite fishing holes, etc. Facilities and services provided in these areas are intended primarily to protect natural resources.

3.8-B Recreation Affected Environment / Existing Conditions

3.8-B.1 Characteristics and Features of the Area

Recreational use has significantly increased in the last 20 years. The Selkirk Crest has been touted as a special "undiscovered" wildland area. Locally and nationally distributed guidebooks and newspaper coverage have promoted the area. Guidebooks have been written for back packing, fishing, day hiking, photography, mountain bike riding and more.

Myrtle Creek Road (#633) and Snow Creek Road (#402) create the only driving loop in the Selkirks. The natural scenery, as well as the proximity to Bonners Ferry, provides generous opportunity for photography, wildlife viewing and driving for pleasure. In addition, the loop is the primary access to multiple trails in the Selkirks. Myrtle Creek Road accesses trailheads for Myrtle Lake (Trail # 286), Two Mouth Lakes (Trail # 268), Harrison Lake (Trail # 6), and Cooks Peak (Trail #236). It also provides access to Burton Peak (Trail #9) via the Burton Creek road (# 2411), located just outside the project area. Snow Creek road provides access to Snow Falls (Trail #189), Bottleneck Lake (Trail # 187), Snow Lake (Trail #185) and roads leading to the Roman Nose Recreation area. These trails are some of the most popular trails on the District for both day-use and over night camping. They represent more than 30% of the trail miles in the Selkirks. They receive consistent use throughout the snow-free seasons.

Cooks Lake (located on private land) and several other popular small lakes are accessed from the Myrtle-Snow road loop via road or cross-country passage.

In addition to trail and lake access, recreational day use along the road loop is high. Berry picking, mushroom gathering and firewood cutting are seasonally popular. Large game hunting is also substantial in areas outside the Myrtle Creek Game Preserve.

Summer and fall seasons represent the highest use seasons, although the Snow Creek road is one of the three major winter play access points on the District. Hundreds of snowmobile users travel the Snow Creek road during a typical winter season. Cross-country ski use is common but varies with the snow pack.

Physically, landforms vary from dramatic scoured granite faces and forested hillsides to fire scarred openings and heavily harvested areas. A mixture of long range, mid range and foreground views is typical from roads and trails within the area.

3.8-B.2 Recreation Opportunity Spectrum

The analysis area supports almost a full range of Recreation Opportunity Spectrum, (ROS), classifications.

Out of approximately 26,500 acres in the analysis area, the acres of each ROS class are as follows:

Summer Season (acres are approximate):
- Roaded Modified -- 5,528 acres
- Roaded Modified Non-Motorized -- 2,637 acres
- Roaded Natural -- 4,448 acres
- Semi-Primitive Non-Motorized -- 11,264 acres
- Primitive -- 2,625 acres

Winter Season (acres are approximate):
- Roaded Natural -- 1447 acres
- Semi-Primitive Non-Motorized -- 21,183 acres
- Primitive -- 3870 acres

3.8-B.3 Management Areas and Associated Recreation Goals

The project area includes Management Areas 1, 2, 3, 7, 9, and 11 as defined by the 1987 Forest Plan (see Chapter 1 for more information about Management Areas and the Map Appendix for a map of Management Areas).

Recreation goals for those areas are as follows:

MA1, MA 2, MA3: Provide a diversity of recreational opportunities. Manage trails to avoid critical grizzly bear habitat. Maintain a Roaded Natural or Roaded Modified ROS class experience.

MA7: Manage for primarily dispersed recreation opportunities. Retain a more semi-primitive ROS class experience. Restrict motorized use when needed to protect caribou.

MA9: Provide dispersed recreation opportunities. Maintain trails and trailheads. Area will be managed for Roaded Natural or Semi-Primitive ROS recreation experience.

MA11: Existing and proposed wilderness areas. Provide opportunities consistent with a wilderness experience. Motorized use is restricted. Trail construction will be accomplished with minimal disturbance to the natural environment. Maintain a Semi-Primitive or Primitive ROS recreation experience.

No management activities are proposed in MA11.

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Chapter 4 -- Environmental Consequences

4.1 - Introduction

This chapter discloses the results of the analysis and describes the probable direct, indirect and cumulative effects to specific resources in the project area. It outlines the probable environmental consequences of implementing any one of the alternatives described in Chapter 2. Chapter 4 forms the scientific and analytical basis for the comparison of alternatives. Impacts to resources described in this chapter are linked to the alternative driving issues discussed in Chapter 2 and the existing condition of the affected environment described in Chapter 3. Both positive and negative effects are considered. Environmental consequences that relate to resources and issues discussed in Appendix A are not described in this chapter.

Resources topics are discussed in the following order:

- Hydrology
- Fire and fuels
- Old growth
- Soils
- Inventoried Roadless Areas

Changes Between the Draft and Final EIS

To aid the reader's understanding of the Myrtle Creek HFRA project, the format for this Final EIS was improved in the following ways:

- **Watershed Hydrology** – A Summary of Existing Conditions has been included immediately following the description of the Scope of Analysis and Cumulative Effects Area. Various portions of this discussion have been reorganized and much of the supporting data has been moved from Chapter 3 to Appendix D (for example, Channel Morphology definitions are now in Appendix D). Information about the assumptions and limitations of computer models used in the analysis is located in Appendix D. Maps are now located in the Map Appendix. Please refer to these appendices as noted in the Watershed Hydrology discussions.
- **Fire and Fuels** – Further discussion of fire regimes and an overall summary have been added, some of the maps have been moved to the Map Appendix.
- **Vegetation and Old Growth** – There have been only small changes, in particular the addition of greater discussion on the regulatory framework, including compliance with the Healthy Forests Restoration Act, and moving the map of past harvest activities to the Map Appendix.
- **Soil Resources** – This documentation was moved from Appendix A to Chapters 3 and 4, and maps are located in the Map Appendix..
- **Roadless Areas** – Discussion of roadless areas was expanded and moved from Appendix A to Chapters 3 and 4, and maps are located in the Map Appendix.

4.2 - Watershed Hydrology

4.2-A Introduction

This section provides information regarding the potential consequences on the hydrology characteristics (identified in the Chapter 3) that may be affected by the No Action (Alternative 1) and action alternatives (Alternatives 2 and 5). Existing conditions are described in Chapter 3, but future effects of implementing Alternatives 1, 2 or 5 are analyzed and discussed in this chapter. Direct, indirect, and cumulative effects are disclosed. Effects are quantified where possible, and qualitative discussions are also included. Long term trends in aquatic conditions are discussed in Section 4.2.K, with supporting information in Appendix D.11.

Ultimately, the effects of the project on stream channels and watershed functionality are the main concern for watershed and fisheries resources. Hillslope conditions are often reflected in stream channels, which in turn are the formative features of

aquatic habitat. The analysis of direct and indirect effects is based on how the various components of the project (e.g., location, size of cutting units, methods of logging systems, road construction and road work, and reasonably foreseeable actions) are expected to affect Myrtle Creek, Snow Creek, Deep Creek and their tributaries.

4.2-B Summary of Predicted Effects

This summary is provided here to assist the public and the decision-maker in understanding the features of Alternative 1 (No Action), Alternative 2 (Proposed Action), and Alternative 5; and the predicted effects of each alternative to the watershed and hydrology characteristics. Additional supporting information is found in the discussions that follow this Summary section.

a. Cumulative Effects Analysis Area, Indicators and Types of Effects

The cumulative effects area is the Myrtle Creek and Snow Creek watershed and the western portion of the Deep Creek watershed, as displayed on Aquatics Map 1 in the Map Appendix. The direct, indirect and cumulative effects of past, present and reasonably foreseeable activities were analyzed and are disclosed in this chapter. They are organized into five Indicators:

- Watershed Condition,
- Water Yield,
- Sediment Yield,
- Channel Morphology, and
- Water Quality.

The discussion of each Indicator concludes with tables showing the short-term effects for each alternative Long-term effects are discussed in the cumulative effects section, the trend analysis portion of the watershed summary, and the trend analysis section of Appendix D.11.

b. Past Activity Analysis

Past management of both National Forest System lands and private lands were considered along with the natural processes in determining the existing conditions as well as determining a natural range of variability in the project area. Activities of particular importance to this analysis are past timber harvest and road construction, and wildfires. See Chapter 3 Affected Environment for more information.

c. Present Activity Analysis

Management of the project area includes some activities that are outside the scope of this project and will continue regardless of the decision(s) made regarding the Myrtle Creek HFRA project. This includes the following activities that were included in the hydrology analysis: suppression of wildfires, and implementation of projects for which analysis was conducted and decisions were made prior to the proposal and development of this project (Myrtle-Cascade FEIS, 2001).

d. Reasonably Foreseeable Activity Analysis

Analysis of potential effects requires land managers to also consider the activities that are likely to occur, but are not part of the Myrtle Creek HFRA Proposed Action or alternatives, and which could have an effect on the natural resources. For this hydrology analysis, that includes the following:

- Noxious weed measures carried out under the Bonners Ferry Ranger District Noxious Weed Control FEIS/ROD,
- Completion of harvest and fuels treatments authorized by existing timber sale contracts,
- Road decommissioning and culvert improvements analyzed and authorized by the Myrtle-Cascade FEIS/ROD, portions of which have received Resource Advisory Committee (RAC) funding for 2007,
- Grandmother Mountain Land Exchange, which is scheduled for completion in 2007
- Personal Use firewood gathering
- Private Land activities

e. Effects Common to Alternative 1 (No Action), Alternative 2 (Proposed Action), and Alternative 5

Some of the predicted effects of the alternatives would be essentially the same for each alternative. Common effects for this analysis involve reasonably foreseeable timber management on private lands, and road decommissioning approved for RAC funding. The activities and expected effects are as follows:

- Private land timber management on approximately 120 acres in lower Snow Creek drainage. Best Management Practices would be applied and the amount of ground disturbance would be limited, thus minimal potential for sediment production and delivery is anticipated even though there could be short-term site-specific sediment increases and short-term peak flow increases. There may also be a reduction in the overall fuels-related risks to the watershed.

- Road decommissioning and associated soil restoration in the Myrtle Creek drainage would contribute to reduced compaction, improved water infiltration, and reduced surface runoff. Culvert work and road decommissioning, although there would be short-term negative impacts, would have positive long-term impacts on sediment yield.

f. Effects of Alternative 1 (No Action)

The No Action alternative does not mean that there would be no management on National Forest System lands in the project area. As described above, certain activities would continue. The natural ecosystem processes would also continue. Both aspects of No Action have been considered.

In terms of the watershed and hydrology in the project area this means:

- There would be no direct effects to the watershed/hydrology because no roads would be constructed and no roads would be decommissioned.
- None of the proposed road improvements would be implemented and the risk of sediment delivery would increase over time.
- Watershed Condition – would not improve.
- Water Yield – In the absence of a future stand-replacing wildfire, the current levels of water yield and peak flows would be expected to continue. If a stand-replacing fire were to occur, water yield and peak flows would increase.
- Sediment Yield – No Action would result in the greatest long-term negative effects to the values at risk because the road improvements would not occur and timber stand conditions would continue toward conditions that are favorable to stand-replacing wildfire. These effects include increased sediment yield and increased road and culvert failures.
- Channel Morphology – would not be directly affected since this alternative would not conduct silvicultural treatments or road work; however, neither would any of the proposed improvements occur. Current trends (negative or positive) would continue
- Water Quality – None of the proposed road improvements or fuels reduction treatments would occur. Currently, the beneficial use of providing municipal water for the City of Bonners Ferry is fully supported. However, in the event of a wildfire, there would be increases in water temperature, sediment and peak flows, thus negatively affecting water quality.

g. Effects of Alternative 2 (Proposed Action)

Features of Alternative 2: approximately 2086 acres of silvicultural/fuels reduction treatments, decommissioning approximately 1 mile of road in the Myrtle Creek watershed (1309-UA), and re-opening approximately 0.6 mile of Road 402-C in the Snow Creek watershed and then decommissioning this road segment along with an additional 0.4 mile of Road 402-C, which will result in decommissioning, by full obliteration, the full length of Road 402-C. Approximately 29 miles of road would be used as haul routes for the silvicultural/fuels reduction treatments. A map of Alternative 2 is provided in Chapter 2 (Figure 2-1).

In terms of the watershed and hydrology in the project area this means:

- Watershed Condition – Overall, the greatest amount of road conditions would be improved under this alternative because it would improve more miles of road (29 miles) than Alternative 1 (0 miles) or Alternative 5 (22 miles). The road reconditioning would reduce the potential for stream crossing failure and road related sediment production and delivery even if a severe wildfire (stand-replacing) does occur. Beneficial uses, should such an event happen, would be impacted to a lesser extent and they would recover more quickly compared to the scenarios for Alternatives 1 or 5.

- Water Yield – Proposed activities are expected to result in immediate short-term increases in peak flows that would be within the capabilities of Myrtle Creek and Snow Creek watersheds. Culvert work would reduce the risk of road failure and the associated risk of sediment delivery.

- Sediment Yield – There would be an immediate short-term increase in sediment, but an overall reduction in sediment risk and a net decrease in sediment yield in the long-term. The short-term increase is small compared to the long-term reduction in sediment yield and risk of sediment delivery. Beneficial uses would not be impaired by this project.

  Proposed treatment units are located on landtypes with low sediment delivery potential and have been specifically designed to avoid or reduce the potential for sediment production and delivery. Analysis shows that sediment delivery would be negligible. See Chapter 2 for information about design features (Chapter 2, section 2.9). Road reconditioning (29 miles) would also result in reduced potential for sediment and delivery. Prescribed burning activities would not have detrimental impacts to sediment production and delivery. While some localized sediment production is anticipated from the mechanical slash disposal treatments and site preparation for planting, the untreated vegetation and Riparian Habitat Conservation Areas (RHCAs) between

the treatment areas and the streams would buffer sediment delivery to stream channels. Anticipated effects of the work on Road 402-C are predicted to be within the capabilities of the Snow Creek watershed.

- Channel Morphology – There would be short-term changes to channel morphology; however, overall morphology would be maintained and somewhat improved since many of the known sediment delivery sources would be rehabilitated.

- Water Quality – In both Myrtle Creek and Snow Creek watersheds, risks to beneficial uses would be reduced, water quality issues associated with TMDLs would be addressed with improvements striving to benefit the TMDL process and reduce pollutants of concern. The proposed road improvements and decommissioning would have a net beneficial effect and work toward the TMDL Desired Future Condition. In Deep Creek, the proposed activities (approximately 36 acres of silvicultural treatment – a portion of Unit F1) would have a low risk of delivery of sediment off the immediate site. The proposed treatment would not contribute to the factors listed for Deep Creek in the 2002 TMDL Integrated Report – see the Fisheries Report for additional information regarding Deep Creek.

- Compliance with the Forest Plan – Alternative 2 meets Forest Plan requirements for water resources (Appendix B). The Proposed Action also meets other regulations pertaining to water quality and beneficial uses, as described at the end of the watershed/hydrology discussions (see page 4-42).

h. Effects of Alternative 5

Features of Alternative 5: approximately 865 acres of silvicultural/fuels reduction treatments, decommissioning approximately 1 mile of road in the Myrtle Creek watershed (1309-UA), and re-opening approximately 0.6 mile of Road 402-C in the Snow Creek watershed and then decommissioning this road segment along with an additional 0.4 mile of Road 402-C, which will result in decommissioning, by full obliteration, the full length of Road 402-C. Approximately 22 miles of road would be used as haul routes for the silvicultural/fuels reduction treatments. A map of Alternative 5 is provided in Chapter 2 (Figure 2-2).

- Watershed Condition – Overall, the watershed condition, as measured by road density, would minimally improve or stay the same. This alternative would improve road conditions to less extent than Alternative 2 (22 miles compared to 29 miles) but more than under Alternative 1 (0 miles). The road reconditioning would reduce the potential for stream crossing failure and road related sediment production and delivery even if a severe wildfire (stand-replacing) does occur. Beneficial uses, should such an event happen, would be impacted to a lesser extent and would recover more quickly than Alternative 1; however, the impact would be greater and recovery slower than under the scenario for Alternative 2. Risk to beneficial uses would be greater than under Alternative 2. The beneficial uses would likely be fully supported in years that did not experience extreme events, such as a 100-year flood event, or a stand-replacing wildfire. However, the amount of resource damages experienced during the extreme events would be less severe than in Alternative 1. Accordingly, beneficial uses may be impacted to a lesser extent than Alternative 1. There would be no detectable effects in Deep Creek.

- Water Yield – Activities are expected to result in immediate short-term increases in peak flows that would be within the capabilities of Myrtle Creek and Snow Creek watersheds. Culvert work would reduce the risk of road failure and the associated risk of sediment delivery. If a stand-replacing fire were to occur, there would be an increase in peak flows and water yield. By improving or removing the high-risk culverts, the risk of a road failure is reduced and the net associated risk of sediment delivery would drop. There would be no detectable effects in Deep Creek.

- Sediment Yield – The treatment units are located on landtypes with low sediment delivery potential, and sediment production and delivery would not be adversely affected by the proposed timber harvesting; thus, sediment delivery from these units is considered minimal. Reducing the potential for roads to cause mass erosion translates into an immediate reduction in sediment risk. As a result, when "Required Design Criteria for All Action Alternatives" are followed, obliteration between crossings is expected to reduce the short and long term production and delivery of sediment to streams. Overall, the short-term increase in sediment yield associated with Alternative 5 is small compared to the long-term reduction in sediment yield and risk of sediment delivery. The greatest sediment reduction activities within the watersheds are from the proposed removal of the at-risk culverts and decommissioning (obliteration) of existing roads. There would be a net decrease in sediment delivery. Therefore, this project would not impair beneficial uses within Myrtle or Snow Creeks.

- Channel Morphology – Overall, stream channel morphology in Myrtle and Snow Creeks would be maintained and somewhat improved upon since known sediment delivery sources would be rehabilitated. This would be achieved through the removal and upgrades of at-risk culverts, road decommissioning, and road maintenance work. However,

since Alternative 5 includes fewer miles of road work than Alternative 2 (22 miles of maintenance compared to 29 miles), there would be less improvements than under Alternative 2, but more than under Alternative 1 (0 miles). There would be no cumulative effects to Deep Creek

- Water Quality – Water Quality in Myrtle Creek would not be directly affected, as minimal fuels reduction treatments and road reconditioning would occur. An indirect effect would be in the event of a wildfire, which would reduce shade, increase sediment and increase peak flows, thus negatively affecting the water quality of the Myrtle Creek Watershed. If a stand-replacing wildfire were to occur in Myrtle Creek, beneficial uses would be affected. In Snow Creek, there would be little change in most water quality parameters. Beneficial uses would be protected. The road decommissioning, culvert replacement, and road obliteration or improvements would, in fact, have a net beneficial effect and work towards the TMDL Desired Future Condition. There would be no cumulative effects to Deep Creek Watershed.
- Compliance with the Forest Plan – Alternative 5 meets Forest Plan requirements for water resources (Appendix B). and also meets other regulations pertaining to water quality and beneficial uses, as described at the end of the watershed/hydrology discussions (see section 4.2-L).

4.2-C Scope of the Analysis

Cumulative Effects Area

A cumulative effects area is the logical culmination point of water flow where the effects of the distributed project activities could possibly integrate or synchronize over time and space and be addressed cumulatively in a larger watershed. Cumulative watershed effects are greatest and easiest to detect at the highest point in the watershed where the individual effects overlap in time and space (MacDonald 1989). The analysis includes effects from past, present, and reasonably foreseeable activities in the cumulative effects area.

The appropriate scale or geographic bounds for cumulative effects analysis relates to an area that would be affected by the proposed action or reasonable alternative. This area is referred to as the cumulative effects analysis area and may vary between resources. The task of selecting the geographical boundaries involved several factors, including the scope of the project considered, the features of the land, and point of diminishing effects.

The cumulative effects area of this project, for hydrology resources, is Myrtle Creek watershed, Snow Creek watershed, and the western portion of Deep Creek watershed; and covers all or part of 26 subwatersheds (see Map Appendix – Aquatics Map 1). These areas were chosen based on the degree and types of proposed activities planned within these basins and because they are logical cumulative affects areas. The boundaries of the cumulative effects analysis area are drawn along natural topographic features and are largely comprised of watershed delineations. Approximately 26% of the cumulative effects area is on private lands or other governmental agency lands outside of the IPNF Administrative boundary. All streams within the project area flow onto private land or are tributaries of streams that flow onto private land.

Typically, the physical effects of runoff modifications, sediment loading, and water temperature, if they occur in projects of this scale, are immeasurable and/or not observable at large watershed and sub-basin scales. This results from desynchronization (individual tributaries respond at different times of the year or may be slower to respond than others to disturbance events), the inherently large range of variability that watershed processes operate at, and under which they have evolved and adjusted; and the fact that watershed systems are dynamic in nature. At the point where Myrtle Creek joins the Kootenai River, Myrtle Creek accounts for less than 0.28 percent of the drainage area of the Kootenai Basin. The Kootenai River is controlled by the Libby and Cora Linn Dams, in Montana and British Columbia, respectively, and has a drainage area and flow several orders of magnitude larger than Myrtle Creek. In addition, the proposed activities have been designed to reduce existing risks to water quality, salmonid spawning, and aquatic organisms while minimizing new effects. Thus, no physical response from the Myrtle HFRA project would extend to or be measurable in the Kootenai River.

4.2-D Analyzing Direct, Indirect and Cumulative Effects

Project activities that have the potential to impact stream habitat include;

- fuels reduction activities (e.g. helicopter, skyline, and tractor logging),
- road maintenance and construction activities (e.g. road reconditioning and temporary road building), and
- site preparation (e.g. prescribed burning and grapple piling).

Important parameters that are potentially directly or indirectly affected by these management activities include: watershed condition, water yield, sediment yield, channel morphology, and water quality.

Short-term effects are summarized in tabular form at the end of each alternative for each indicator. Long-term effects are discussed in the cumulative effects section, in the aquatic trend analysis of the watershed summary section, and in the trend analysis section of Appendix D.11.

Direct Effects: Direct effects are those occurring at the same time and place as the triggered action.
Indirect Effects: Indirect effects are those that occur later in time or are spatially removed from the activity.
Cumulative Effects: Cumulative effects are effects that result from incremental effects of actions, when added to other past, present, and reasonably foreseeable future actions, regardless of the source. Cumulative Effects can result from individually minor, but collectively significant actions taking place over a period of time.
Immediate Effects: Effects that can be measured immediately during or after activities have taken place. They are usually only present for minutes, hours, or days. Thus, they are effects that are substantially shorter than Short-Term Effects.
Short-Term Effects: Effects that can be measured up to 5-10 years after activity is complete.
Long-Term Effects: Effects that can be measured longer than 10+ years after activity is complete.

4.2-D.1 Condition Indicators

Watershed condition indicators for direct and indirect effects are a series of metrics that can be used to index the level of disturbance in a watershed. They are usually expressed as densities or discrete amounts of various disturbances within a watershed. For example, road density expressed in miles of road per square mile (mi/mi^2) of watershed area is a common watershed condition indicator. Extensions of that include road density within riparian habitat conservation areas (RHCAs) or landslide prone terrain (LSP). Other indicators include various forms of timber harvest density, expressed as percent ECA of the watershed harvested, percent of RHCAs harvested and percent of LSP terrain harvested. Changes in watershed condition are compared to the existing watershed conditions discussed in the affected environment section.

Water Yield indicators for direct and indirect effects are estimated peak flows or change in runoff. It is usually expressed as the percent change from the estimated "baseline" peak month discharge. The models described in Appendix D.3 were used for this analysis to estimate the effects of the proposed fuels reduction, construction, reconstruction and decommissioning of temporary and classified roads, and site preparation treatments. Changes in peak flows are compared to the existing peak flows discussed in the affected environment section. The water yield analysis was conducted using the WATSED model.

Sediment Yield indicators for direct and indirect effects are expressed in terms of tons of sediment. The models described in Appendix D.3 were used for this analysis to estimate the effects of the proposed fuels reduction, construction, reconstruction and decommissioning of temporary and classified roads, and site preparation treatments. Changes in sediment production are compared to the existing sediment production discussed in the affected environment section.

Channel morphology indicators for direct and indirect effects are expressed in terms of stream classification parameter changes that lead to morphological changes. Water yield and sediment yield can interact to change channel morphology conditions through erosion of stream channels or deposition of sediment. Channel morphology can also be affected directly through activities such as road encroachment, stream crossings, and in-channel improvements. Changes in channel morphology are compared to the existing channel morphology parameters in the affected environment section.

Water quality indicators for direct and indirect effects are expressed in terms of physical and chemical characteristics of water. Parameters commonly measured include pH, alkalinity, hardness, specific conductance, nutrients, metals, sediment and water temperature. Many of these parameters are affected only to a slight degree, or not at all, by forest practices. Changes in water quality are compared to the existing water quality parameters in the affected environment section.

4.2-D.2 Past Activities

Past actions contribute to the baseline conditions that provide a foundation for the analysis (e.g. previous timber harvesting, road building, and fire suppression actions since the early 1900s). Past activities (such as timber harvest and road building) and natural processes (such as succession and floods) are described in the Affected Environment section (Chapter 3) and provide baseline conditions for streams.

a. Past Timber Harvest

The project area has been influenced by past timber harvest activities since the 1950s. Records indicate that timber harvest started on National Forest System lands in the project area in the 1950s and continued into the 2000s with some of the earlier records being incomplete. Incomplete information includes data such as the name of a particular sale, or activity codes used in the TSMRS database. Often the missing data can be inferred through use of old photos. Information such as the name of a sale is not pertinent to analysis of the effects that may have been generated by that sale.

Approximately 6,000 acres of industrial private timber land are located in the upper portion of the Myrtle Creek and parts of the Snow Creek drainages. Though timber harvest prior to the 1950s was very limited in scale, logging activities on private land have been ongoing and would continue into 2007 and likely beyond. As of November 2006, Forest Capital's only plans are to conduct approximately 120 acres of irregular shelterwood/commercial thinning in lower Snow Creek – Section 35, R1W, T62N. (Project File - personal communication with Kennon McClintock of Forest Capital Partners) See the table of National Forest Timber Sales within the Myrtle HFRA Project Area, in the Vegetation Section of Chapter 3.

b. Past Road Building

Activities on private or National Forest System land that yield sediment delivery to streams or remove recruitable large woody debris, would contribute to cumulative conditions. The effects of past activities, including timber harvest and road building, were considered in the establishment of the existing condition in proposed activity areas (see Chapter 3). Past activities (such as road building, timber harvest, and wildfire) were used in the WATSED, WEPP, and FuME models to determine the current baseline condition and to look at historic ranges of variability. Roads are and have been the main contributor to sediment erosion in these watersheds. (Hydrology Project Files)

The two following tables list the existing roads in the Myrtle Creek and Snow Creek Watersheds and display the level of erosion risk (Erosion Risk Rating) and the current ownership of the lands where the roads are located. Analysis of these roads resulted in the existing Erosion Risk Rating, which provides information for comparing the effects of the alternatives.

Table 4.1 Existing Condition for Road Risks in Myrtle Creek Watershed

Road Number	Erosion Risk Rating	Ownership
633	Moderate	Mix
633A	Moderate	Mix
633C	High	USFS
633D	High	USFS
633E	Moderate	USFS
633UB	High	Private
658	Moderate	Mix
661	Moderate	Mix
661A	Moderate	Mix
661UA	High	Mix
1309	Low	Mix
2400 & 1309C	High	Mix
1309UA	High	Mix
1309UB	High	Private
1309UC	Moderate	Private
1309UD	Moderate	Private
1309UF & UE	Moderate	Mix
1309UG	Moderate	Private
2190	Low	USFS
2405	High	Mix
2405A	High	Mix
2405AUA	High	USFS
2405AUD	High	USFS
2405B	High	USFS
2405C	High	USFS
2405D	High	USFS
2405DUB	High	USFS
2405UA	High	USFS
2405UN	High	USFS
2406	Moderate	Mix
2406A	Low	Mix
2409	High	USFS
2409UA top	High	USFS
2409UA	High	Mix
2409UB	High	Private
2409UE	High	Private
2409UG	High	USFS
2405UC	Moderate	USFS
2405CUB	Moderate	USFS

Erosion Risk Ratings are classified as High, Moderate, and Low. The definitions of these ratings are located in Appendix D. A multitude of information (i.e. Model outputs, road surveys, historical reports) was used, in combination with Appendix D to assign risk ratings.

Table 4.2 Existing Condition for Road Risks in Snow Creek Watershed

Road Number	Erosion Risk Rating	Ownership
402	High	Mix
402UF	Low	Mix
402A	Moderate	Mix
402AUX	Low	Mix

Roads and landings that remain on the landscape for future use (system roads) are considered irretrievable effects on productivity as these lands become "dedicated" to the permanent transportation system. Temporary roads (i.e. only needed for the project and planned for obliteration such as 402C in Snow Creek) have detrimental effects initially, but rehabilitation efforts (subsoiling and/or recontouring) initiate a long-term recovery process. More information about effects on soil productivity is included in the Chapter 3 and 4 Soils discussions and the Soil Scientist's report and project files.

See Appendix D for more detailed information for roads in the Myrtle Creek and Snow Creek Watersheds.

c. Past Wildfires

In 2003, a fire in the Myrtle Creek watershed burned about 3450 acres (approximately 15% of the watershed) on primarily south facing slopes and some pockets of the middle to lower lying north-facing mountain side. The fire burned in the lower portion of the watershed immediately above the mouth and where the city maintains its domestic water intake diversion. Distribution of soil burn severity was equally distributed with 31% having a high, 34% having a moderate, and 35% having a low rating. Hydrophobic soils were initially estimated as 7% of the total burn area and were limited to south-facing, dry site ponderosa pine/brush area (Janicki, 2003, Myrtle BAER Reports, Hydrology Project Files).

Post-fire effects to the water supply were relatively short-term. The intake facility had to be shut down for approximately one week due to effects from the fire (Myrtle BAER Report Hydrology Project Files). Burned Area Emergency Response (BAER) efforts, a mild winter and spring, and overall low intensity precipitation events assisted in the rapid growth and establishment of vegetation, which helped to stabilize the burned soils.

Following the 2003 fire, the BAER Team used computer models to calculate post-fire effects on erosion rates and sediment delivery (see Myrtle BAER reports in the Hydrology Project Files). The results of those calculations were as follow:

- Erosion rates were estimated at about 5 tons per acre on the high severity/non-hydrophobic steep slopes;
- Lower rates of 1.5 tons per acre were predicted on the moderate severity areas; and
- First year soil loss averaged over the burned area was modeled at 2 tons per acre.
- Calculations showed that steep, south-facing, first order drainages with high and moderate severity burn, would produce the most sediment.
- Predicted sediment delivery to the mouth of these drainages varied from 1.3 tons/acre/year to 3.9 tons/acre/year. Yellow Pine subwatershed was 2.4 tons/acre, and the average was 2.8 tons/acre for the south-facing slopes.
- North-facing slopes would deliver less sediment, at an average of 1 ton/acre.
- Not all of the sediment delivered to the mouth of the first order drainages, such as Yellow Pine Creek, would make it to the intake facility on Myrtle Creek. A delivery coefficient of 0.6 was used to route sediment from the mouth of first order drainages to the intake. Using this factor, final sediment delivery to the intake was predicted to be about 1 ton/acre.

In July of 2004, a high intensity summer storm created a debris torrent in the Yellow Pine drainage that caused the road crossing to fail. Accumulation of runoff and overland flow from the still hydrophobic upper portions of that drainage was the likely cause in this response (see Soils Project File and Hydrology Project Files).

The 2003 Myrtle Creek Fire and the 2004 summer storm and its consequences in Yellow Pine are considered a past and current activity along with the BAER treatments because the watershed is still recovering from the fire and post-fire actions. They were also factored into the existing condition (see Chapter 3). Erosion mitigation studies were conducted by Dr. Peter Robichaud, as to the effects of different erosion treatments after a fire. This research is still ongoing (Robichaud, unpublished research report).

Other historic wildfires (i.e. the 1926 fire), and their effects, are discussed in detail in the Fire and Fuels and Vegetation Sections of this document.

4.2-D.3 Present Activities

a. Suppression of Wildfires

There has been a history of fire suppression within the analysis area over the past 90 years, as described in the Fire and Fuels, and Vegetation sections of Chapters 3 and 4. This has increased the risk of a catastrophic wildfire, which has the potential to negatively impact stream habitat. Since changes in water yield are associated with vegetation conditions, the existing and future vegetative trends (including effects from disturbances such as fire) would have an effect on water yield.

b. Timber Harvest Activities

Activities occurring within the Mama Cascade, Big Mack and Salt Lick Timber Sales were analyzed in the Myrtle-Cascade FEIS, 2001. As of December 2006, one unit of shelterwood harvesting on approximately 60 acres and the underburning of approximately 162 acres on the Big Mack Timber Sale is the only remaining work located within the Myrtle HFRA project area. Completion of the underburning is open-ended, based on available burn windows and soil moisture conditions. Completion of the approximately 60 acres of harvest must be by December 31, 2008. No additional effects to watershed resources beyond what was analyzed for and disclosed in the Myrtle-Cascade FEIS are expected to occur. Within the Myrtle Creek HFRA project area, all harvest and fuels treatment activities of the Mama Cascade and Salt Lick Timber Sales have been completed.

4.2-D.4 Reasonably Foreseeable Activities

a. Noxious Weeds Monitoring and Treatment

Noxious weed monitoring and treatment would continue and would follow guidelines established in the Bonners Ferry Noxious Weeds Control Project EIS (USDA, 1998). Effects to aquatic resources were analyzed in that document and its adaptive strategy. No additional effects to watershed or fisheries beyond want was analyzed for and disclosed in the Bonners Ferry Noxious Weeds Control Project EIS are expected to occur.

a. Prescribed Burning Activities

Prescribed burning activities would follow applicable Inland Native Fish Strategy (INFS) standards and guidelines, as well as established BMPs, which would substantially reduce or eliminate the impact of these activities on watersheds. As explained above, approximately 162 acres of underburning is yet to be completed on the Big Mack timber sales. Completion of these tasks is open ended based on available burn windows and soil moisture conditions.

b. Timber Harvest Activities

Timber harvest activities are expected to occur on private land within the next five years. Forest Capital is planning a shelterwood cut in 2007 in Section 34 in Lower Snow Creek (Hydrology Project Files). Timber harvest on private land must follow the rules and Best Management Practices set by the Idaho Forest Practices Act (Title 38, Chapter 13, Idaho Code). These rules and BMPs are designed to prevent sediment delivery to stream channels and to prevent cumulative watershed effects. However, past activities on private land that yield sediment delivery to streams or remove recruitable large woody debris, may contribute to the cumulative condition. Due to stream habitat degradation associated with past activities on private land within the cumulative effects area, the portions of the streams located on National Forest lands are vital for the continued existence of beneficial uses.

c. Road Decommissioning and Culvert Improvement Activities

Future road decommissioning and culvert improvement activities are expected in the Myrtle Creek and Snow Creek watersheds, beginning in 2007. In 2006, Resource Advisory Committee (RAC) funds were designated for road decommissioning activities (Hydrology Project Files) analyzed and approved in the Myrtle-Cascade FEIS/ROD. Road decommissioning and soil restoration (see soils report) would contribute to a reduction in compaction, thus improving infiltration and reducing surface runoff. Removing or replacing culverts is expected to have short term impacts on sediment yield below the crossing sites; but long-term benefits would be a reduction in risk of erosion and sediment production and delivery. In the case of culvert replacements, the improvements often result from less backwatering upstream of the site and less scour downstream. Similar improvements occur where culverts are removed, with the additional benefit of enhanced floodplain function through the crossing site. Several stream crossing improvements should improve site-specific channel morphology conditions in their immediate vicinity. Some of the road decommissioning involves crossings and riparian areas and site-specific channel morphology would also be improved in those areas.

d. Land Exchange Activities

The Grandmother Mountain Land Exchange is a land exchange between Forest Capital (a privately owned timber management company) and the Forest Service. The exchange is scheduled to be completed in 2006 or early 2007. The majority of the land involved in the exchange is located on the St. Joe Ranger District outside of the cumulative effects area of this project. However, under this land exchange the Forest Service would obtain approximately 280 acres located in the lower Myrtle Creek drainage, including approximately 0.75 mile of Myrtle Creek, which includes Myrtle Creek Falls. The acquisition of this parcel would benefit water quality, bull trout and other aquatic species within the cumulative effects area through the long-term improvements of lands adjacent to Myrtle Creek and Myrtle Creek Falls.

e. Personal Use Firewood Permits

Personal use firewood permits within the project area would continue. This activity removes standing dead and down trees that contain little if any fine fuels, usually within 100 feet of open roads. With the minor amount of wood removed and small area impacted, this activity has very little effect on the water resources.

4.2-E Direct and Indirect Effects Common to All Alternatives

There are activities on private industrial forestland within the Myrtle Creek HFRA Project Area. The activities most likely to occur on these lands are pre-commercial thinning and limited timber harvesting. Most of the merchantable timber on all of the private sections in Myrtle Creek was removed during the 1950s to the 1970s, but there has also been harvest in the late 1990s to present in Toot, Jim, and Mack Creeks (Myrtle/Cascade FEIS, 2001). With the exception of a few small steep isolated portions, the remaining timber can be accessed from existing roads and skid trails. Activities on private land have been integrated into the existing condition. The potential for sediment production and delivery is not anticipated given the limited amount of ground disturbance that is expected in order to harvest the remaining trees, and given that State of Idaho Best Management Practices would be applied by the private forester and inspected by the State Forest Practices Advisor. The thinning and harvesting may add to short-term site specific-sediment increases, and short-term peak flow increases. It may also reduce overall fuels risks to the watershed.

Road decommissioning activities on National Forest System lands within the Myrtle Creek watershed would also occur in the near future. As previously stated, RAC funds were allocated for road decommissioning activities in the Myrtle Creek watershed. Road decommissioning and soil restoration (see soils report) would contribute to a reduction in compaction, thus improving infiltration and reducing surface runoff. Removing or replacing culverts, as well as other road decommissioning activities (e.g. full obliteration) are expected to have short-term negative impacts on sediment yield and positive long-term impacts on sediment yield.

4.2-F Indicator 1 – Watershed Condition

a. Alternative 1 – No Action Alternative

Direct and Indirect Effects

Myrtle Creek, Snow Creek, and Deep Creek Watersheds

Watershed condition would not be directly affected, as no new system roads would be constructed, nor would existing roads be decommissioned in any of the watersheds. But, the density and distribution of roads (see Map Appendix – Aquatic Maps 4 and 5) within most of the watersheds indicate there is a high probability that the hydrologic regime (i.e., timing, magnitude, duration, and spatial distribution of runoff) is altered, thus producing a lingering indirect effect from the No Action alternative. Road surfaces limit infiltration, which causes surface runoff during storm events and snowmelt. Insloped roads with ditches have the greatest negative effect. Native surface roads with traffic often develop ruts, which cause runoff to be concentrated on the road surface. Road are also subject to surface and mass erosion. Surface erosion is the dominant erosion process on roads in the Myrtle HFRA project area (Hydrology Project Files).

Under this alternative, none of the at-risk road drainage crossings or road issues, analyzed in this document, would be improved in either Myrtle or Snow Creek (see Chapter 2 maps). Without the proposed improvements, (see Alternatives 2 and 5), the risk of sediment delivery increases. The failure of crossings would likely happen under three scenarios.

- If a rain-on-snow event were to occur, as discussed in the affected environment section;

- If a large stand replacing fire occurs and is then followed by a high intensity rain or a rain-on-snow event;
- If a larger than normal snowmelt were to occur.

Under each scenario, if a flash flood or debris torrent, or both, is triggered by any of these events, culvert failures could occur. When debris plugs culverts and the capacity of the culvert is exceeded, water then is either concentrated over the top of road fills or is diverted down the road or ditch and onto hillslopes unaccustomed to concentrated overland flow. With either of these scenarios, the additional sediment pulse could result in adverse effects to the channel. This is an indirect effect related to past management activities.

Cumulative Effects

Myrtle Creek, Snow Creek, and Deep Creek Watersheds
Watershed condition, as it relates to road density, would degrade or stay the same. Conditions would not be improved. Although road density would not increase, it would not decrease either, and the current effects to the system would continue as no improvements would be implemented. Under the No Action Alternative, risk to beneficial uses would increase. The beneficial uses would likely be fully supported in years that did not experience extreme events. However, the amount of resource damages experienced during the future extreme events (e.g. 100-year flood, stand-replacing wildfires) would be more severe than natural conditions. Accordingly, beneficial uses may be impacted to a greater extent and the recovery would be slower under the No Action Alternative than either Alternative 2 or Alternative 5.

Table 4.3 Short-Term Effects to Watershed Condition (Road Density) for Alternative 1

	Entire Myrtle Creek Watershed	Lower Myrtle Creek subwatershed	Mack Creek subwatershed	Entire Snow Creek Watershed	Lower Snow Creek subwatershed	Deep Creek in the CE* Area
Existing Condition Road Density = mi/mi^2	2.5	1.25	1.85	2.96	3.20	3.03
% Change	0%	0%	0%	0%	0%	0%

***CE = Cumulative Effects Area**

Under this alternative, none of the proposed management activities would be implemented on National Forest System lands. Water yield or peak flows would not be affected, as no fuels reduction, roads reconditioning, or temporary road reconstruction, would occur. Associated restoration activities, such as road decommissioning, soil restoration (see soils report), and stream crossing improvements would not occur. But, the density and distribution of roads within most of the watersheds, in combination with field observations, indicate there is a high probability that the hydrologic regime (i.e., timing, magnitude, duration, and spatial distribution of runoff) is altered, thus the potential for the three scenarios described in 4.2-E.1.

There would be no change in flow timing or peak flows associated with roads because no road decommissioning would occur. Soil compaction would continue to reduce water infiltration, so effects to water yield, peak flows and ECAs would remain the same, based on No Action (see soils report). The ECA information used was derived from WATSED.

In the absence of a stand-replacing wildfire, ECA would decrease, as no fuels treatments would occur. The watersheds would continue to support current water yields and peak flows. If a stand-replacing fire were to occur, then the ECA would increase, which would in turn increase peak flows and increase water yield. The increase in ECA would be dependent upon the size and severity of the fire.

Table 4.4 Short-Term Effects to ECA for Alternative 1.

	Entire Myrtle Creek Watershed	Lower Myrtle Creek subwatershed	Mack Creek subwatershed	Entire Snow Creek Watershed	Lower Snow Creek subwatershed	Deep Creek in the CE* Area
****Existing Condition	**14%**	**33%**	**7%**	**6%**	**8%**	**3%**
% Change	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**

****Existing Condition is displayed as % above natural condition** ***CE = Cumulative Effects Area**

b. Alternative 2 – Proposed Action

Direct and Indirect Effects

Myrtle Creek Watershed

Temporary road construction would not be proposed in the Myrtle Creek Watershed; and 1 mile of road would be decommissioned, NFSR 1309UA. This road was deemed a higher priority for decommissioning because it is located in a riparian area. Thus, there would be positive effects on the riparian area and minimal effects to watershed condition in Myrtle Creek, as measured by road density. Most effects would be a result of existing road prisms and culvert~~s~~ failures. Watershed condition, as measured by road density, would minimally improve or stay the same. Road density would not increase; it would decrease by a minor amount.

Under the Proposed Action, the greatest amount of road conditions would be improved because the most miles of road (haul routes) would be improved (see Chapter 2 description of alternatives). These improvements would be in the form of improved road drainage by replacing culverts, removing culverts, blading road surfaces, and creating water bars and cross drains.

Snow Creek Watershed

This alternative would conduct temporary road reconstruction in Snow Creek to reopen approximately 0.6 mile of Road 402-C, to move personnel, logs, and equipment to conduct the silvicultural and fuels treatments. This was analyzed using the models described in Appendix D - section D.3, and would have affects to watershed condition. The road is currently categorized as decommissioned and would be reopened. The effects would temporarily increase open road density in the Snow Creek Watershed. This would be a short-term effect, as this road would be decommissioned by full obliteration upon completion of use, and road density would decrease. This road would be decommissioned because of its current categorization and its vicinity to other roads (causing a stacked road condition). The length of decommissioning is the 0.6 mile of re-opened road, plus approximately 0.4 mile of currently open section of Road 402-C; thus one mile total.

Other effects from decommissioning would be immediate-affect increases in sediment yield, peak flows, and an immediate-affect decrease in water quality. Total obliteration of the temporary road would restore slope stability, eliminate surface erosion, and all crossings and associated fills would be removed from the channel and floodplain and then stabilized. With total obliteration, these sites should need no future maintenance after decommissioning. Upon treatment completion (road obliteration (full-recontour) back to the junction of the main Road 402), would most likely withstand the immediate-effect pulses of the sediment and peak flows mentioned above. In the long term, decommissioning Road 402-C would result in improvement in sediment yield, peak flows, and water quality due to the restoration of slope stability, elimination of surface erosion, removal of all crossings and associated fills from the channel and floodplain and stabilization of those areas, and no need for future road maintenance.

Deep Creek Watershed

Due to the location, size, method, and prescription proposed for the fuels reduction treatments (see Chapter 2 description of alternatives), the direct or indirect effects to the Deep Creek watershed would be undetectable.

Cumulative Effects

Myrtle Creek Watershed

Under Alternative 2, more miles of road would be reconditioned and improved, as more haul routes would be used (see Table 2-11 in Chapter 2 for a comparison between alternatives). The "storm protection" associated with the road reconditioning would reduce the potential for stream crossing failure and road related sediment production and delivery, even if a stand-replacing wildfire (stand-replacing) does occur. Accordingly, beneficial uses would be impacted to a lesser extent and the recovery would be quicker than if the existing unnatural risks were not reduced or eliminated.

Under the Proposed Action, funding of road reconstruction and road decommissioning on roads that are not used as haul routes (identified as future opportunities) is not guaranteed to occur. If funding does become available, it can be assumed that some of the inventoried stream crossing risks would be reduced. All attempts will be made to garner funding to address these concerns.

Snow Creek Watershed

Because road obliteration would occur on Road 402C, the crossing risks would be further reduced. The road related potential for triggering landslides would be reduced by decreasing the amount of water concentrated by ditchlines and rerouted to unstable slopes. Landslide potential would be further reduced by stabilizing unstable cut and fill slopes and decreasing the interception and re-routing of groundwater. Therefore, the amount of sediment available to the stream networks would be reduced below existing condition. Much of the reduction in sediment risk, especially from road obliteration, would be permanent. In the long-term, total obliteration would decrease the amount of sediment and be more stable. The WATSED, FuME, and WEPP model runs assisted in the prediction of no irreversible increases or delays in recovery of Road 402-C being reopened and obliterated.

The "storm protection' associated with the road reconstruction would reduce the potential for stream crossing failure and road related sediment production and delivery even if a severe wildfire (stand-replacing) does occur. Accordingly, beneficial uses would be impacted to a lesser extent and the recovery would be quicker than if the existing unnatural risks were not reduced or eliminated.

Deep Creek Watershed

Due to the location, size, method, and prescription proposed, the cumulative effects to the Deep Creek Watershed would be undetectable.

Table 4.5 Short-Term Effects to Watershed Condition (Road Density) for Alternative 2.

	Entire Myrtle Creek Watershed	**Lower Myrtle Creek subwatershed**	**Mack Creek subwatershed**	**Entire Snow Creek Watershed**	**Lower Snow Creek subwatershed**	**Deep Creek in the CE* Area**
Existing Condition Road Density = mi/mi^2	2.51	1.25	1.85	2.96	3.20	3.03
% Change (reduction)	- less than 1%	- less than 1%	0%	- less than 1%	-1%	0%

***CE = Cumulative Effects Area**

Table 4.6 Short-Term Effects to ECA for Alternative 2.

	Entire Myrtle Creek Watershed	Lower Myrtle Creek subwatershed	Mack Creek subwatershed	Entire Snow Creek Watershed	Lower Snow Creek subwatershed	Deep Creek in the CE* Area
****Existing Condition	**14%**	**33%**	**7%**	**6%**	**8%**	**3%**
% Change	**+4%**	**+6%**	**+6%**	**+6%**	**+13%**	**+1%**

****Existing Condition is displayed as % above baseline** ***CE = Cumulative Effects Area**

Changes in the ECA are predicted to have the following effects. Although ECA would increase and push the Lower Myrtle Creek and Lower Snow Creek watersheds into a moderate category, the effects would not be permanent. Thus, the effects to flow timing and yield would be short term. Because there would be minimal increase in ECA for the Deep Creek watershed, effects would be negligible.

c. Alternative 5

Direct and Indirect Effects

Myrtle Creek Watershed

There would be minimal effects to the watershed condition in Myrtle Creek, as measured by road density, as no new roads would be constructed and approximately 1 mile of Road 1309UA would be decommissioned. This road was deemed a higher priority for decommissioning because it is located in a riparian area. Thus, there would be positive effects to the roads effect on the riparian area and minimal effects to watershed condition in Myrtle Creek, as measured by road density.

Most effects would be a result of existing road prisms and culverts failures. Watershed condition, as measured by road density, would minimally improve or stay the same. Road density would not increase; it would decrease by a minor amount. Under Alternative 5, fewer amounts of road conditions would be improved because fewer miles of road (haul routes) would be improved compared to Alternative 2; 22 miles compared to 29 miles, respectively.

Snow Creek Watershed

Watershed condition in Snow Creek would be affected by Alternative 5. Temporary road reconstruction in Snow Creek to re-open NFSR 402C approximately 0.6 miles to move personnel, logs, and equipment to complete the silviculture and fuels treatments. This was analyzed using the models described in Appendix D.3 and may have direct effects to watershed condition. The road is currently categorized as decommissioned and would be reopened. Effects would be temporarily increasing open road density in the Snow Creek Watershed. This would be a short-term effect, as this road would be decommissioned by full obliteration upon completion of use. The length of decommissioning is the 0.6 mile of re-opened road, plus approximately 0.4 mile of currently open section of Road 402-C; thus 1 mile total decommissioning.

Other effects would be immediate-effect increases in sediment yield, peak flows, and a immediate-effect decrease in water quality. Total obliteration of the temporary road would restore slope stability, eliminate surface erosion, and all crossings and associated fills would be removed from the channel and floodplain and then stabilized. With total obliteration these sites would need no future maintenance after decommissioning. Upon treatment completion, road obliteration (full-recontour) back to the junction of the main road would most likely withstand the immediate-effect pulses of the sediment and peak flows mentioned above. In the long term, decommissioning Road 402-C would result in improvement in sediment yield, peak flows, and water quality due to the restoration of slope stability, elimination of surface erosion, removal of all crossings and associated fills from the channel and floodplain and stabilization of those areas, and no need for future road maintenance.

Deep Creek Watershed

There would be no silvicultural or fuels reduction treatments in the Deep Creek drainage, therefore there would be no direct or indirect effects to the Deep Creek Watershed.

Cumulative Effects (Alternative 5)

Myrtle Creek Watershed

Under Alternative 5 funding of most of the road reconstruction and road decommissioning would not occur. Road reconstruction and stream crossing risks would be minimally reduced to a lesser degree (than under Alternative 2) in Myrtle Creek. For Myrtle Creek the watershed condition, as measured by road density, would minimally improve or stay the same. Although road density would not increase, it would not decrease by much either, and the existing effects would continue, as less improvements would be implemented. Under Alternative 5, risk to beneficial uses would be greater than under Alternative 2. The beneficial uses would likely be fully supported in years that did not experience extreme events, such as a 100-year flood event, or a stand-replacing wildfire. However, the amount of resource damages experienced during the extreme events would be less severe than in Alternative 1. Accordingly, beneficial uses may be impacted to a lesser extent than Alternative 1. Recovery would occur at a faster rate than it would under Alternative 1, but slower than under Alternative 2 because there would be fewer miles of road improvements (Alternative 5 includes 22 miles, Alternative 2 includes 29 miles, Alternative 1 includes 0 miles).

Snow Creek Watershed

Because road obliteration would occur on Road 402C, the crossing risks would be further reduced. The road related potential for triggering landslides would be reduced by decreasing the amount of water concentrated and rerouted to unstable slopes by ditchlines. Landslide potential would be further reduced by stabilizing unstable cut and fill slopes and decreasing the interception and re-routing of groundwater. Therefore, the amount of sediment available to the stream networks would be reduced below existing condition. Much of the reduction in sediment risk, especially from road obliteration, would be permanent. The “storm protection” associated with the road reconstruction would reduce the potential for stream crossing failure and road related sediment production and delivery even if a severe wildfire (stand-replacing) does occur. Accordingly, beneficial uses would be impacted to a lesser extent and the recovery would be quicker than under Alternative 1 (No Action).

In the long-term, total obliteration of Road 402C would decrease the amount of sediment and be more stable. WATSED, FuME, and WEPP model runs helped predict no irreversible increases or delays in recovery of Road 402C in Snow Creek being reopened and obliterated.

The "storm protection' associated with the road reconstruction would reduce the potential for stream crossing failure and road related sediment production and delivery even if a severe wildfire (stand-replacing) does occur. Accordingly, beneficial uses would be impacted to a lesser extent and the recovery would be quicker than under Alternative 1 (No Action).

Deep Creek Watershed

Due to the location, size, method, and prescription proposed, the cumulative effects to the Deep Creek Watershed would be undetectable.

Table 4.7 Short-Term Effects to Watershed Condition (Road Density) for Alternative 5.

	Entire Myrtle Creek Watershed	Lower Myrtle Creek subwatershed	Mack Creek subwatershed	Entire Snow Creek Watershed	Lower Snow Creek subwatershed	Deep Creek in the CE* Area
Existing Condition Road Density = mi/mi^2	2.51	1.25	1.85	2.96	3.20	3.03
% Change (reduction)	0%	0%	0%	- less than 1%	-1%	0%

***CE = Cumulative Effects Area**

Table 4.8 Short-Term Effects to ECA for Alternative 5.

	Entire Myrtle Creek Watershed	Lower Myrtle Creek subwatershed	Mack Creek subwatershed	Entire Snow Creek Watershed	Lower Snow Creek subwatershed	Deep Creek in the CE* Area
****Existing Condition	**14%**	**33%**	**7%**	**6%**	**8%**	**3%**
% Change	**0%**	**+1%**	**0%**	**+4%**	**+10%**	**0%**

****Existing Condition is displayed as % above natural condition *CE = Cumulative Effects Area**
ECA = Equivalent Clearcut Area

Changes in ECAs are predicted to have the following effects. In the Myrtle Creek watershed, ECAs would be minimally affected as a small amount of fuels reduction treatments would occur. The effects on flow timing and quantity would also be minimal. There would be a greater increase in ECA in Snow Creek watershed than in Myrtle Creek due to the greater amounts of silvicultural treatments. The percentage of increase is not significant enough to cause irretrievable detrimental effects. The effects of flow timing and quantity would be minimal, and short-term. There would be no effects to the Deep Creek watershed as there would be no silvicultural treatments in this drainage.

4.2-G Indicator 2 – Water Yield

a. Alternative 1 – No Action Alternative

Direct and Indirect Effects

Myrtle Creek, Snow Creek, and Deep Creek Watersheds

Under this alternative, none of the proposed management activities would be implemented on National Forest System lands. Water yield or peak flows would not be affected, as no fuels reduction, roads reconditioning, or temporary road reconstruction, would occur. Associated restoration activities, such as road decommissioning, soil restoration (see soils report), and stream crossing improvements would not occur. But, the density and distribution of roads within most of the watersheds, in combination with field observations, indicate there is a high probability that the hydrologic regime (i.e., timing, magnitude, duration, and spatial distribution of runoff) is altered, thus the potential for the three scenarios described in 4.2-E.1.

There would be no change in flow timing or peak flows associated with roads because no road decommissioning would occur. Soil compaction would continue to reduce water infiltration, so effects to water yield, peak flows and ECAs would remain the same, based on No Action (see soils report).

Cumulative Effects

Myrtle Creek, Snow Creek, and Deep Creek Watersheds

Watershed recovery would continue at the current rate, in the absence of a large disturbance such as wildfire or flood. Effects to water yield, peak flows, and ECAs from a potential fire are highly variable depending on timing, location, size, weather, and suppression activities. Runoff timing and quantity would reflect the magnitude of the disturbances. The risk of peak flows would depend on the extent of the vegetation change, conditions of the soil, floodplain and channel conditions, and weather following natural events. In the absence of a stand-replacing wildfire, ECA would decrease, as no fuels treatments would occur. The watersheds would continue to support current water yields and peak flows. If a stand-replacing fire were to occur, then the ECA would increase, which would in turn increase peak flows and increase water yield. The increase in ECA would be dependent upon the size and severity of the fire.

Table 4.9 Short-Term Effects to Water Yield for Alternative 1.

	Entire Myrtle Creek Watershed	Lower Myrtle Creek subwatershed	Mack Creek subwatershed	Entire Snow Creek Watershed	Lower Snow Creek subwatershed	Deep Creek in the CE* Area
**Existing Condition	**6%**	**17%**	**4%**	**3%**	**5%**	**1%**
% Change	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**

****Existing Condition is displayed as % above natural condition *CE = Cumulative Effects Area**

Table 4.10 Short-Term Effects to Peak Flow for Alternative 1.

	Entire Myrtle Creek Watershed	Lower Myrtle Creek subwatershed	Mack Creek subwatershed	Entire Snow Creek Watershed	Lower Snow Creek subwatershed	Deep Creek in the CE* Area
**Existing Condition	**6%**	**16%**	**5%**	**4%**	**5%**	**1%**
% Change	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**

****Existing Condition is displayed as % above natural condition *CE = Cumulative Effects Area**

b. Alternative 2

Direct and Indirect Effects

Myrtle Creek Watershed

Approximately 864 acres (approximately 41 percent) of the acres to be treated (Units B1, B3, B4, B5, B6, D1, D2, D6, D9, E3, E8 and 76 acres of F1) would be in the Myrtle Creek drainage.

All tractor units in Myrtle Creek are proposed to be treated during the winter season, which would reduce some effects of management activities (see soils report), such as water yield. Treatments on this landscape recommend minimal soil disturbance and timing restrictions (see Chapter 2 – Features Designed to Protect Soil, Water, and Fish Habitat).

Installation of additional relief culverts would reduce the amount of water carried by and eroded from ditchlines. This would allow the ditchwater to re-infiltrate the forest floor and deposit sediment before reaching stream networks, and would help prevent culvert failure. The dispersion of surface runoff would help “normalize” the flow regime of a basin by recharging the

groundwater that would slowly release into the live streams. There would be less opportunity for water to concentrate and be delivered to the naturally unstable stream breaklands. The volume of water and sediment delivered to stream channels (especially during peak flow conditions) would be reduced, as more water and sediment would be cross drained before reaching the channel. Therefore, adding relief drainage would reduce the probability of roads increasing stream crossing risk and sediment production and delivery.

Planting would be done by hand crews and would be accessed from existing system roads. This activity would reduce the amount of time needed for vegetative and hydrologic recovery following regeneration harvesting, which would reduce potential for sediment production and delivery. Risk at stream crossings and wildfire risk would not be affected by this activity.

Snow Creek Watershed

Approximately 1,184 acres (approximately 57 percent) of the fuels reduction treatments (Units G1 through G11), would be in the Snow Creek drainage. The majority of activities would occur during summer months in Snow Creek. Installation of additional relief culverts would reduce the amount of water carried by and eroded from ditchlines. This would allow the ditchwater to re-infiltrate the forest floor and deposit sediment before reaching stream networks, and would help prevent culvert failure. The dispersion of surface runoff would help "normalize" the flow regime of a basin by recharging the groundwater that would slowly release into the live streams. There would be less opportunity for water to concentrate and be delivered to the naturally unstable stream breaklands. The volume of water and sediment delivered to stream channels (especially during peak flow conditions) would be reduced, as more water and sediment would be cross drained before reaching the channel. Therefore, adding relief drainage would reduce the probability of roads increasing stream crossing risk and sediment production and delivery.

Planting would be done by hand crews and would be accessed from existing system roads. This activity would reduce the amount of time needed for vegetative and hydrologic recovery following regeneration harvesting, which would reduce potential for sediment production and delivery. Risk at stream crossings and wildfire risk would not be affected by this activity.

Deep Creek Watershed

Approximately 36 acres (approximately 2 percent) of the silvicultural and fuels reduction treatment (a portion of Unit F1) would be in the Deep Creek drainage. The activities would occur during summer months in Deep Creek. Due to the location, size, method, and prescription proposed, the direct or indirect effects to the Deep Creek Watershed would be undetectable.

Cumulative Effects(Alternative 2)

Myrtle Creek Watershed

The proposed activities and the direct and indirect effects of increased peak flows combined with the effects from past, present, and reasonably foreseeable activities, would not result in significantly adverse cumulative effects to Myrtle Creek. The proposed activities would increase peak flows to Myrtle Creek, but with a short-term effect and within the capabilities of the watersheds. The long-term effects are discussed in the Trend Analysis Section of Chapter 4 (4.2.F) and in Appendix D See Table 4.4 in the Watershed Summary Section below.

In the event of a rain-on-snow event, cumulative effects would cause peak flow increases to Myrtle Creek. These events are natural processes that occur episodically in time and space. Silvicultural prescriptions would trend vegetation towards conditions and patterns, that would be similar to those formed by past disturbance events. As discussed in the affected environment section, the greatest impacts observed from rain-on-snow events occur when culverts become plugged from resulting floods and debris flows. By improving or removing the high-risk culverts, the risk to a road failure is significantly reduced and net associated risk of sediment delivery would drop. There is some channel resilience, thus Myrtle Creek would be able to handle most rain-on-snow events, unless substantial road failures and culvert failures were to occur; however, as stated, risk of this happening would be reduced under this alternative.

Snow Creek Watershed

The proposed activities and the direct and indirect effects of increased peak flows combined with the effects from past, present, and reasonably foreseeable activities, would not result in significantly adverse cumulative effects to Snow Creek. The

proposed activities would increase peak flows to Snow Creek, but with a short-term effect and within the capabilities of the watersheds. The long-term effects are discussed in the Trend Analysis Section of Chapter 4 (4.2.F) and in Appendix D. See Table 4.4 in the Watershed Summary Section below. See Table 4.4 in the Watershed Summary Section below.

In the event of a rain-on-snow event, cumulative effects would cause peak flow increases to Snow Creek. These events are natural processes that occur episodically in time and space. Silvicultural prescriptions would trend vegetation towards conditions and patterns, that would be similar to those formed by past disturbance events. As discussed in the affected environment section, the greatest impacts observed from rain-on-snow events occur when culverts become plugged from resulting floods and debris flows. By improving or removing the high-risk culverts, the risk to a road failure is significantly reduced and net associated risk of sediment delivery would drop. There is some channel resilience, thus Snow Creek would be able to handle most rain-on-snow events, unless substantial road failures and culvert failures were to occur; however, as stated, risk of this happening would be reduced under this alternative.

Deep Creek Watershed

Due to the location, size, method, and prescription proposed, the cumulative effects to the Deep Creek Watershed would be undetectable.

Table 4.11 Short-Term Effects to Water Yield for Alternative 2.

	Entire Myrtle Creek Watershed	Lower Myrtle Creek subwatershed	Mack Creek subwatershed	Entire Snow Creek Watershed	Lower Snow Creek subwatershed	Deep Creek in the CE* Area
**Existing Condition	**6%**	**17%**	**4%**	**3%**	**5%**	**3%**
% Change	**+2%**	**+2%**	**+3%**	**+4%**	**+6%**	**0%**

****Existing Condition is displayed as % above natural condition *CE = Cumulative Effects Area**

Table 4.12 Short-Term Effects to Peak Flow for Alternative 2.

	Entire Myrtle Creek Watershed	Lower Myrtle Creek subwatershed	Mack Creek subwatershed	Entire Snow Creek Watershed	Lower Snow Creek subwatershed	Deep Creek in the CE* Area
**Existing Condition	**6%**	**16%**	**5%**	**4%**	**5%**	**1%**
% Change ##	**+2%**	**+4%**	**+3%**	**+4%**	**8%**	**0%**

****Existing Condition is displayed as % above natural condition *CE = Cumulative Effects Area**

As explained in Appendix D, models do not generate exact numbers, and the resultant data should be kept in perspective. For example, when WATSED predicts a 4% increase in sediment or peak flow, it is similar to saying that the effects are negligible. Such small increases are not normally perceivable in the field and are well within a normal range of values.

c. Alternative 5

This alternative would harvest approximately 865 acres within the Myrtle Creek and Snow Creek Watersheds. Of the acres to be treated, approximately 370 acres would be harvested by helicopter logging, approximately 292 acres would be harvested by ground-based logging and approximately 203 acres would be harvested by skyline logging. Approximately 522 acres of the proposed treatment area would receive a group selection treatment, approximately 181 acres would be treated with an irregular shelterwood harvest, approximately 139 acres would be treated with a commercial thin and approximately 23 acres would be treated with a seed tree harvest. Treatment of activity fuels (slash) would include approximately 519 acres being underburned and approximately 346 acres being grapple piled.

Direct and Indirect Effects

Myrtle Creek Watershed

Approximately 97 acres (approximately 11 percent) of the acres to be treated (Units D1, D2, and D6) would be in the Myrtle Creek drainage.

This alternative would have limited impacts in the Myrtle Creek Watershed. Water yield would not be negatively directly affected, as a small amount of vegetation treatments and road reconditioning would occur. Thus, fewer associated restoration activities, such as road decommissioning and soil restoration (see soils report), would occur. A minimal amount of stream crossing improvements would occur. As previously stated, the density and distribution of roads within most of the watersheds, in combination with field observations, indicate there is a high probability that the hydrologic regime (i.e., timing, magnitude, duration, and spatial distribution of runoff) is altered, thus the potential for the scenarios described in the paragraphs above.

There would be no change in flow timing and quantity associated with roads, within Myrtle Creek Watershed, because minimal road decommissioning would occur. For the most part, soil compaction would continue to impact water infiltration, so effects to water yield would remain the same.

Snow Creek Watershed

Approximately 769 acres (approximately 89 percent) of the acres to be treated (Units G1 through G7S, G7H, G10 and G11) would be in the Snow Creek drainage. This alternative proposes temporary road construction, in Snow Creek, to re-open approximately 0.6 mile of Road 402-C to move personnel, logs, and equipment to complete the silviculture and fuels treatments. This was analyzed using the models described in Appendix D.3 and may have direct effects to watershed condition. The road is currently categorized as decommissioned. The direct effects would be temporarily increasing open road density in the Snow Creek Watershed. This would be a short-term effect on peak flow, as this road would be decommissioned by full obliteration upon completion of use.

A moderate amount of road reconditioning would occur in Snow Creek. Installation of additional relief culverts would reduce the amount of water carried by and eroded from ditchlines. This would allow the ditchwater to reinfiltrate the forest floor and deposit sediment before reaching stream networks, and would help prevent culvert failure. The dispersion of surface runoff would help "normalize" the flow regime of a basin by recharging the groundwater that would slowly release into the live streams. There would be less opportunity for water to concentrate and be delivered to the naturally unstable stream breaklands. The volume of water and sediment delivered to stream channels (especially during peak flow conditions) would be reduced, as more water and sediment would be cross drained before reaching the channel. Therefore, adding relief drainage would reduce the probability of roads increasing stream crossing risk and sediment production and delivery.

Deep Creek Watershed

There would be no acres treated in the Deep Creek drainage, therefore there would be no direct or indirect effects to the Deep Creek Watershed.

Cumulative Effects (Alternative 5)

Myrtle Creek Watershed

The proposed activities and the direct and indirect effects of increased peak flows combined with the effects from past, present, and reasonably foreseeable activities, would not result in significantly adverse cumulative effects to Myrtle Creek. Effects would be direct short-term effects. The proposed activities would increase peak flows to Myrtle Creek, but with a short-term effect and within the capabilities of the watersheds. The long-term effects are discussed in the Trend Analysis Section and in Appendix D. See Table 4.4 in the Watershed Summary Section below.

In the event of a rain-on-snow event, cumulative effects would cause peak flow increases to Myrtle Creek. These events are natural processes that occur episodically in time and space. Fuels reduction prescriptions would trend vegetation towards conditions and patterns that would be similar to those formed by past disturbance events. As discussed in the affected environment section (Chapter 3), the greatest impacts observed from rain-on-snow events occur when culverts become plugged from resulting floods and debris flows. By improving or removing the high-risk culverts, the risk of a road failure is significantly reduced and net associated risk of sediment delivery would drop.

For the most part, watershed recovery would continue at the current rate, in the absence of a large disturbance such as wildfire or flood. Effects to water yield, peak flows, and ECAs from a potential fire are highly variable depending on timing, location, size, weather, and suppression activities. Runoff timing and quantity would reflect the magnitude of the disturbances. The risk of peak flows would depend on the extent of the vegetation change, conditions of the soil, floodplain and channel conditions, and weather following natural events. ECA would decrease, in the absence of a stand-replacing wildfire, as minimal

vegetation treatments would occur. The watersheds would continue to support current water yields and peak flows. If a stand-replacing fire were to occur, then the ECA would increase, which would in turn, increase peak flows and increase water yield. See the Fire and Fuels discussion concerning the risk of a stand-replacing fire under this alternative.

Snow Creek Watershed

The proposed activities and the direct and indirect effects of increased peak flows, combined with the effects from past, present, and reasonably foreseeable activities, would not result in significantly adverse cumulative effects to Snow Creek. The proposed activities would increase peak flows to Snow Creek, but with a short-term effect and within the capabilities of the watersheds. The long-term effects are discussed in the Trend Analysis Section of Chapter 4 (4.2.K) and in Appendix D. See Table 4.24 in the Watershed Summary Section below.

In the event of a rain-on-snow event, cumulative effects would cause peak flow increases to Snow Creek. These events are natural processes that occur episodically in time and space. Silvicultural and fuels reduction treatments would trend vegetation towards conditions and patterns, which would be similar to those formed by past disturbance events. As discussed in the affected environment section, the greatest impacts observed from rain-on-snow events occur when culverts become plugged from resulting floods and debris flows. By improving or removing the high-risk culverts, the risk of a road failure is significantly reduced and net associated risk of sediment delivery would drop.

Deep Creek Watershed

No acres would be treated in the Deep Creek drainage, therefore there would be no cumulative effects to the Deep Creek Watershed.

Table 4.13 Short-Term Effects to Water Yield for Alternative 5.

	Entire Myrtle Creek Watershed	Lower Myrtle Creek subwatershed	Mack Creek subwatershed	Entire Snow Creek Watershed	Lower Snow Creek subwatershed	Deep Creek in the CE* Area
**Existing Condition	**6%**	**17%**	**4%**	**3%**	**5%**	**3%**
% Change	**0%**	**0%**	**0%**	**+2%**	**+4%**	**0%**

****Existing Condition is displayed as % above natural condition *CE = Cumulative Effects Area**

Table 4.14 Short-Term Effects to Peak Flow for Alternative 5.

	Entire Myrtle Creek Watershed	Lower Myrtle Creek subwatershed	Mack Creek subwatershed	Entire Snow Creek Watershed	Lower Snow Creek subwatershed	Deep Creek in the CE* Area
**Existing Condition	**6%**	**16%**	**5%**	**4%**	**5%**	**1%**
% Change ##	**0%**	**0%**	**0%**	**+2%**	**+6%**	**0%**

****Existing Condition is displayed as % above natural condition *CE = Cumulative Effects Area**

As explained in Appendix D.3, models do not generate exact numbers, and the resultant data should be kept in perspective. For example, when WATSED predicts a 4% increase in sediment or peak flow, it is similar to saying that the effects are negligible. Such small increase are not normally perceivable in the field and are well within a normal range of values.

4.2-H Indicator 3 – Sediment Yield

a. Alternative 1 – No Action Alternative

Direct and Indirect Effects

Myrtle Creek, Snow Creek, and Deep Creek Watersheds

Sediment yield would not be affected, as no vegetation treatments, roads reconditioning, or temporary road reconstruction, would occur. Associated restoration activities, such as road decommissioning, soil restoration, and stream crossing improvements would not occur. But, the density and distribution of roads within most of the watersheds, in combination with

field observations, indicate there is a high probability that the hydrologic regime (i.e., timing, magnitude, duration, and spatial distribution of runoff) is altered. See Hydrology Project Files.

Existing sediment yields in 2005 are over base line conditions (due to historical practices); and under this alternative, none of the at-risk road drainage crossings or road issues, would be improved. Thus, under this alternative the risk of sediment delivery increases over time. Sediment erosion would continue at the current rate until a road or pipe failure occurs which would then cause an increase in sediment erosion.

With the three scenarios described below, the additional sediment pulse could result in adverse effects to the channels, thus a lingering affect associated with past management activities.

If a rain-on-snow event were to occur as discussed in the affected environment section (Chapter 3);
If a large stand replacing fire occurs and is then followed by a high intensity rain or a rain-on-snow event;
If a larger than normal snowmelt were to occur.

Cumulative Effects (Alternative 1)

Myrtle Creek, Snow Creek, and Deep Creek Watersheds

Under Alternative 1 (No Action), stream crossing and wildfire risk, and sediment production and delivery would be maintained at existing levels in the short-term. No Action results in the greatest long-term effects to the values-at-risk (relative to the action alternatives) for several reasons, including the fact that many of the road structures, such as culverts, are currently at or near the end of their expected design life. Stand development in untreated dry site stands would continue towards conditions that favor severe stand replacing fires, which would have negative effects on the watersheds.

Over time the risk of structural or functional failure at stream crossings would increase as culverts age beyond the normally expected design life. The size of flood events that a crossing could safely pass would remain the same as existing conditions, as would the number of road segments at crossings that could intercept streamflow. Road related potential for triggering landslides would not change given that the miles of road on sensitive landtypes would not change and that the amount of water intercepted, concentrated, and re-routed to unstable slopes by ditchlines would not be reduced. Therefore, the amount of sediment available to the stream network would remain the same as existing conditions but the probability of delivery would increase with time.

Sediment yield associated with fire is assumed to recover relatively quickly, whereas roads tend to produce a level of long term, chronic sediment yield.

Watershed recovery would continue at the current rate, in the absence of a large disturbance such as wildfire or flood. Effects to sediment erosion from a potential fire are highly variable depending on timing, location, size, weather, and suppression activities. Runoff timing and quantity would reflect the magnitude of the disturbances. The risk of sediment erosion would depend on the extent of the vegetation change, conditions of the soil, floodplain and channel conditions, and weather following natural events. ECA would decrease, in the absence of a stand-replacing wildfire, as no vegetation treatments would occur. The watersheds would continue to support current sediment yields. If a stand-replacing fire were to occur, then the ECA would increase, which would in turn, increase peak flows and negatively effect sediment yield. FuME models predict that sediment erosion could be as high as 100 times greater in magnitude than that produced by timber harvesting, if a stand-replacing wildfire were to occur.

Table 4.15 Short-Term Effects to Sediment Yield for Alternative 1.

	Entire Myrtle Creek Watershed	Lower Myrtle Creek subwatershed	Mack Creek subwatershed	Entire Snow Creek Watershed	Lower Snow Creek subwatershed	Deep Creek in the CE* Area
**Existing Condition	**33%**	**20%**	**17%**	**18%**	**23%**	**8%**
% Change	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**

****Existing Condition is displayed as % above natural condition** ***CE = Cumulative Effects Area**

b. Alternative 2 – Proposed Action

Direct and Indirect Effects

Myrtle Creek Watershed

Fuels Reduction Treatments

The felling, harvesting, and transport of timber, as proposed in the Myrtle HFRA Project, would not detrimentally affect sediment yield within the project area. The treatment units are located on landtypes with low sediment delivery potential. The unit location and treatments, and "Required Design Criteria for All Action Alternatives" (Chapter 2) have been site specifically designed to avoid or reduce the potential for sediment production and delivery. Accordingly, sediment production and delivery would not be adversely affected by the proposed timber harvesting, as was the case before the advent of BMPs. Logging practices have since changed and provide for better protection of aquatic resources. With the implementation of BMPs and other mitigation practices, such as Riparian Habitat Conservation Areas (RHCAs) as designated in the Inland Native Fish Strategy (INFS), timber harvesting can occur, even in impaired watersheds, without detrimentally contributing to the watershed condition. In some instances the use of new management practices can actually improve watershed conditions and aid in the recovery of impaired areas.

Sediment delivery rates from the proposed harvest activities are reflected in the WATSED, WEPP, and FuME model runs. Since the majority of these units are going to be helicopter logged, and there would be minimal activity within the designated, site-specific RHCAs, sediment delivery from these units is considered negligible (see Fisheries report). Research studies and monitoring results conducted on the Idaho Panhandle National Forests verify that when RHCAs or adequate buffer strips are incorporated into timber sales, sediment delivery to stream channels is "not measurable" or "is negligible" (USDA 1997-1999, 2001-2004, Belt et al 1992, Reid and Hilton 1998). Sediment mobilized by harvest activities would likely be filtered and captured by vegetation remaining in the RHCA buffers before reaching streams. Buffer strips are effective at trapping sediment from un-channelized flow. In a study conducted by Cacek (1989) it was determined that clearcut logging on sensitive landtypes within the Lightning Creek watershed (located on the Sandpoint Ranger District, about 20 miles southeast of the project area) only accounted for 1.4 percent of the mass failures. The dominant cause of the mass failure and resulting sedimentation to Lightning Creek was from abandoned road networks. This helps us to predict what could potentially happen in other watersheds with similar road network conditions, such as Myrtle and Snow Creek. Studies have shown that buffer strips are effective at trapping sediment (INFS, 1995).

Road Reconditioning

A road package would be included with the timber sale contract(s) that would be implemented under Alternative 2. The reconstruction, maintenance, and repair would occur on approximately 29 miles of existing system roads (displayed in Map Appendix – Aquatics Map 8) that would be used as haul routes for this project. This work is considered "certain to occur" when it is on a haul route that would be included in the timber sale road package.

Redesigning and Upgrading Existing Stream Crossings

The crossings that would be replaced are undersized relative to Forest Plan standards, or are at or near the end of their designed life expectancy, or both. Redesigning and replacing undersized culverts (please see project files) at stream crossings would reduce the risk of massive sediment delivery from either washouts or fill failures. The road fill would be moved away from the stream prior to pulling the pipe. Most of the crossings are intermittent or low base flows. Some sediment would be entrained and transported at these crossings. Standard erosion control measures (such as temporarily diverting flow into a culvert, using a plastic or rock lined channel, pumping water below the site, or using silt fences or hay bales) would be used to minimize sediment transport downstream (please see Appendix C - BMPs). Adverse Creek is the closest crossing to the City water diversion with any appreciable flow and is over three miles away. This distance would allow for additional downstream trapping of sediment and dilution of turbidity.

The small amount of sediment input would occur over a span of minutes to hours and is not expected to exceed turbidity standards for domestic water quality and cold water biota, and is inconsequential relative to the resulting reduction in crossing risk.

Strengthening Unstable Cut and Fill Slopes

Several tributaries have bin and gabion walls that require maintenance, partial replacement, and extensions. Bin and gabion walls stabilize road cuts by adding weight and/or strength to the base of the slope and by reducing the steepness of the cutslope to more closely match the natural angle of repose. The bin and gabion walls are in place to prevent mass and

surface erosion where the road prism cuts through steep stream break-lands at crossings. Excavated materials displaced by extending bin walls would be hauled to sites where slope stability is not a concern and where the materials would not be delivered to the stream network. Standard BMPs and erosion control measures would be used to assure that sediment would not be generated from newly excavated sites. The work would occur during the dry season to minimize the potential for entraining disturbed soil during the project. These bin walls greatly reduce the amount of sediment delivered from unstable cutslopes to the ditchlines and stream crossings so they are important to maintain. Geogrid and the associated compaction, add to fill slope stability by increasing tensile strength and soil "cohesion". Because of the proximity to the channels, very small volumes of fine sediment may increase stream turbidity during subsequent storm events the first fall or spring following construction work. However, the turbidity increase would not exceed State standards for domestic water quality or cold water biota, unless a catastrophic event was to happen (e.g. 100 year flood).

Overall, stream crossing risk and sediment production and delivery would be reduced by these activities by minimizing potential mass erosion and existing surface erosion near stream crossings.

Increasing the Frequency of Ditch Drainage

Installation of additional relief culverts would reduce the amount of water carried by and eroded from ditchlines. This would allow the ditchwater to infiltrate the forest floor and deposit sediment before reaching stream networks, and would help prevent culvert failure. The dispersion of surface runoff would help "normalize" the flow regime of a basin by recharging the groundwater that would slowly release into the live streams. There would be less opportunity for water to concentrate and be delivered to the naturally unstable stream breaklands. The volume of water and sediment delivered to stream channels (especially during peak flow conditions) would be reduced, as more water and sediment would be cross drained before reaching the channel.

Therefore, adding relief drainage would reduce the probability of roads increasing stream crossing risk and sediment production and delivery.

Rolling the Road Grade

Graded rolling dips and drivable dips would reduce the amount of water that runs down the road surface. This would reduce the loss of fine material from native and graveled surfaces. The changes in grade would be large enough to cross-drain water from the road surface even if wheel ruts are present. Gravel surfacing and re-compaction where the road grade is rolled would reduce erosion from these sites. Bypass dips would be installed at stream crossings that have the potential to divert streamflow to a ditchline or down the road prism. The dip surface and outflow would be armored so that the water could safely be returned to the stream channel. Most of this work would occur far enough way from crossings to prevent any sediment delivery to streams. However, standard erosion control practices would be applied as necessary (see Appendix C for BMPs).

The bypass dips would reduce stream crossing risk by eliminating the potential for severe erosion of the road prism that would otherwise occur if streamflow were diverted down the road surface. The potential for sediment production and delivery would be reduced because of the improved dispersion of water.

Surfacing

Surfacing native surface roads has been shown to decrease sediment production 70 to 84 percent (Swift 1984). Burroughs and others (1985) found that graveled road surfaces produced an average of 77 percent less sediment than bare roads. Existing gravel sources would most likely be used. Site excavation on any new pits would meet INFS (1995) standards and guidelines and would not occur within Myrtle Creek or Snow Creek drainages. Therefore, surfacing would reduce sediment production and delivery.

Standard Maintenance

Road brushing, blading, shaping, and ditch cleaning would help maintain the structures and method of drainage for which the road was designed. This work results in exposed soil, which can be eroded. The production and delivery of sediment would not be significant given the condition and locations of the roads being treated, the planned cross-drain improvements that would reduce water concentration and delivery to channels, and the fact that the loose soil particles would quickly be recompacted. Maintenance of existing stream structures reduces the risk of failure by assuring that debris is cleared from the inlets and that the crossing is functioning properly.

Helicopter Landings

The landing areas proposed for use with this project would be improved to accommodate landing, processing, fuel storage and refueling needs (see Map Appendix – Aquatics Map 8). This would include minor excavation to create safe usable landing

areas, and some spot graveling to better facilitate log truck parking/loading and to reduce dust from the helicopter rotor-wash during the yarding process. The Idaho Forest Practices Act and the site specific BMPs provide standard design criteria that would protect soil and water resources. RHCAs, as designated by INFS standards and guidelines, would be followed. The 300 foot stream buffers would protect municipal water quality, salmonid spawning and cold water biota in case of a fuel spill. By following BMPS and required design criteria listed in Chapter 2 for the proposed landing locations, improvement and use of the sites would not affect stream crossing risk or sediment production and delivery. All landings and helicopter pads would be located on system roads. When located on roads slated for decommissioning, landings would be decommissioned, as well. All landings would be rendered hydrologically inert upon completion of use.

Prescribed Burning for Fuels Treatments

Approximately 1100 acres are scheduled for prescribed burning (underburning in Units, F1, G2, G3, G4, G6, G7H, G7S, G8, and G9). On the south facing dry site units, the prescribed burns would only be done in the spring when fuel and soil moisture would not result in a severe burn that could produce hydrophobic soils or eliminate the soil duff layer. Higher elevation snow could also be used for control lines. Soil moisture would be at least 25 percent regardless of the season when a unit is burned. Firelines would be frequently waterbarred to prevent erosion. Chemical foaming agents would not be used for any units in Myrtle Creek above the point where the City diverts water. Nutrients such as nitrogen would be volatilized during the burn, but the higher soil moistures resulting from harvesting coupled with higher soil temperatures would increase nutrient cycling making more of the stored nutrients available to plants. Given the location of the proposed burns and the use of riparian buffers (INFS 1995), there is a low potential that sediment from firelines, released nutrients, or water foaming agents (if used outside of Myrtle Creek) would be delivered to streams and tributaries.

Alternative 2 would not reduce the amount of riparian vegetation in the vast majority of the RHCAs, due to the implementation of the appropriate RHCAs per the INFS Standards and Guidelines, which limits management activities within the RHCAs (see Chapter II – Features Designed to Protect Fish and Fish Habitat and Appendix B Fisheries). The RHCAs discussed in the above descriptions of the action alternatives could receive some underburning along their edges and could lose some ground cover and small brush in the affected areas, but would not be subject to prescribed burning with enough intensity to impact large brush or trees. The riparian conservation areas would function as filter zones for any upslope runoff. However, runoff from overland flow would not likely occur. The prescribed burning activities would not negatively affect stream crossing risk or sediment production and delivery. Reducing existing and post harvest fuel loadings would decrease the potential for stand-replacing wildfire on the dry sites.

Mechanical Slash Disposal and Site Preparation

Grapple piling would occur on several of the units (B1, B4, B5, B6, D1, D2, D6, D9, E3, E8, G1, G5, G10, and G11) within the project area. These units would be accessed from existing roads, skid trails, and firelines below or within the proposed units. Only areas that could be reasonably accessed would be treated. None of the trails would be excavated to facilitate access. The residual logging debris which was lopped and scattered or that could not be grapple piled and burned would increase potential fire intensity and severity for a few years until snow could compress the slash mat and the fine organics would be recycled. Overall, reducing existing and potential fuel loadings of large wood would reduce the long term potential for severe fire within the units. In some cases, burning of the slash piles would create small patches of hydrophobic soils for as much as one to two years, but the areas would not be large or extensive enough to alter the slope hydrologic response or slope stability. Some localized erosion from these treatments is anticipated, however, untreated forest and riparian habitat conservation areas between the grapple piling activity and the stream networks would prevent sediment delivery to stream channels.

Snow Creek Watershed

Temporary Road Construction

This alternative proposed temporary road reconstruction, in Snow Creek, to re-open Road 402C approximately 0.6 miles to move personnel, logs, and/or equipment to conduct the fuels reduction treatments. This was analyzed using the models described in Appendix D and may have direct affects to watershed condition. This road would be decommissioned by full obliteration upon the completion of use. Total obliteration of the temporary road would restore slope stability, eliminate surface erosion, and all crossings and associated fills would be removed from the channel and floodplain and then stabilized. With total obliteration these sites would need no future maintenance after decommissioning. Road obliteration (full-recontour) back to the junction of the main road (total distance of 1 mile) upon treatment completion, would most likely withstand the short-term pulses of the sediment mentioned above.

Road Obliteration Future Opportunities

Road obliteration opportunities are designed to restore normal slope hydrology and reduce existing road related sediment risks. The obliteration would occur on the existing system and non-system roads that are displayed in Chapters 2 and 3 (Maps/Figures). Multiple funding sources are potentially available and would be pursued to fund implementation of this work.

Obliteration of Roads and Stream Crossings

The crossings that would be obliterated are undersized relative to Forest Plan standards or are at or near the end of their designed life expectancy, or both. Throughfill currently situated over the crossings would be removed and stored outside the channel floodplain, which would make much of it unavailable to the stream network. The risk of massive sediment delivery from either washouts or fill failures would be eliminated at these sites. Most of the crossings are intermittent or have low base flows. A small amount of sediment would be entrained and transported at these crossings during the obliteration activities. Sediment would be entrained and could be transported for a few to several hundred feet as the stream channel and floodplains are restored.

Sediment would be created from the moment that the culvert is removed until a short time after the recontouring is completed. The road fill would be moved away from the stream prior to pulling the culvert or log bridge. Standard erosion control measures, such as temporarily diverting flow into a culvert, a plastic or rock lined channel, pumping water below the site, or use of silt fences or hay bales, would be used to minimize sediment transport downstream. All crossings would flush a small amount of fine sediment to parent streams during first mid-winter rain-on-snow events or spring snowmelt following the channel restoration.

The small amount of sediment input during and after obliteration would occur over a span of minutes to several hours. Provided that the "Required Design Criteria for All Action Alternative" are followed, the stream channel restoration is expected to exceed the Idaho 50 NTU (Nephelometric Turbidity Unit) turbidity criterion for short periods of time during instream work (Foltz and Yanosek, 2005). In addition to implementing BMPs, a short term activity exemption from IDEQ may be requested. It is not significant relative to the gains resulting from reduction in sediment risk. Past monitoring of similar project on the Bonners Ferry Ranger District and on the Forest (see Hydrology Project Files) verify that obliteration is an effective means to minimize sediment risk at stream crossings. Wildfire risk would not be affected because the roads proposed for obliteration are not needed for initial attack access for fire suppression and most are not located on the high-risk dry site areas (Myrtle-Cascade FEIS, 2001).

Obliteration between Crossings

Some of the obliteration between crossings would involve cutting brush from the road prism, cross draining the road with waterbars on roughly 45-foot spacing, and removing relief culverts. Under both obliteration scenarios (roads and stream crossings), a large percentage (greater than 50%) of the roadbeds in the project area would be disturbed. Vegetation usually becomes re-established on the disturbed soil by the end of the next growing season following obliteration. Until the vegetation does reestablish, the disturbed soil would be more susceptible to erosion. The frequent cross ditching would reduce the volume of water that could entrain and transport soil form the excavated sites, and would promote re-infiltration of surface water downslope. Eroded soil would no longer be moved once the water re-infiltrated the undisturbed forest floor. Additional filtering or buffering potential is provided by down slope vegetation, downed wood, and distance from the channel network, which is typically greater than 300 feet (Ketcheson and Megahan 1996). The obliterated roads would no longer concentrate and re-route water to naturally unstable slopes or other roads so landslide potential would be reduced. Recontouring would stabilize unstable road segments by restoring the natural slope (which is less steep than constructed cut and fill slopes) by buttressing the cutslopes with the soil excavated from the fill slopes, and by promoting the natural dispersion of water.

Reducing the potential for roads to cause mass erosion translates into an immediate reduction in sediment risk within the project watersheds. As a result, when "Required Design Criteria for All Action Alternatives" are followed, obliteration between crossings is expected to reduce the short and long term production and delivery of sediment to streams. Stream crossing risk would not be affected. Wildfire risk would not be affected because the roads proposed for obliteration are not needed for initial attack access for fire suppression and most are not located on the high-risk dry site areas (Myrtle/Cascade FEIS, 2001).

Other Activities

The following activities (discussed in detail in the previous Myrtle Creek section) would also occur in Snow Creek.

Fuels Reduction Treatments
Road Reconditioning
- Redesigning and Upgrading Existing Stream Crossings
- Strengthening Unstable Cut and Fill Slopes
- Increasing the Frequency of Ditch Drainage
- Rolling the Road Grade
- Surfacing
- Standard Maintenance

Helicopter Landings
Prescribed Burning for Fuels Treatment
Mechanical Slash Disposal and Site Preparation

Deep Creek Watershed

The following activities would occur in Deep Creek, as well, but at a much smaller scale. For further details of each activity, please refer to the Direct and Indirect Section for Myrtle Creek above.

Fuels Reduction Treatments
Road Reconditioning
- Redesigning and Upgrading Existing Stream Crossings
- Strengthening Unstable Cut and Fill Slopes
- Increasing the Frequency of Ditch Drainage
- Rolling the Road Grade
- Surfacing
- Standard Maintenance

Helicopter Landings
Prescribed Burning for Fuels Treatments

Cumulative Effects(Alternative 2)

Myrtle Creek Watershed

The combination of direct and indirect effects of Alternative 2, in conjunction with past, present, and reasonably foreseeable activities, would result in a short-term increase in sediment, but an overall reduction in sediment risk and a net decrease in sediment yield in the long-term. Based on the direct and indirect effects above, the risk of sediment delivery from harvest activities reaching a live channel is moderate to low, depending on the site-specific influences present. Studies have discussed that when disturbance patterns created by timber harvesting are used to achieve some of the benefits of natural disturbances, activities should be concentrated in a single drainage rather than dispersed, that riparian areas need protection (Reeves et al, 1995).

The short-term increase in sediment yield associated with the Proposed Action (Alternative 2) is small compared to the long-term reduction in sediment yield and risk of sediment delivery. The greatest sediment reduction activities within the watersheds are from the proposed removal of the at-risk culverts and decommissioning (obliteration) of existing roads. The amount of sediment produced by Alternative 2 combined with the sediment reduced by activities within the Myrtle HFRA project area would result in a net decrease in sediment delivery. Therefore, this project would not impair beneficial uses within Myrtle Creek. See Fisheries Appendix B for additional information.

Snow Creek Watershed

The combination of direct and indirect effects of Alternative 2, in conjunction with past, present, and reasonably foreseeable activities, would result in a short-term increase in sediment, but an overall reduction in sediment risk and a net decrease in sediment yield in the long-term. Based on the direct and indirect effects above, the risk of sediment delivery from harvest

activities reaching a live channel is moderate to low, depending on the site-specific influences present. Studies have discussed that when disturbance patterns created by timber harvesting are used to achieve some of the benefits of natural disturbances, activities should be concentrated in a single drainage rather than dispersed, that riparian areas need protection (Reeves et al, 1995).

The short-term increase in sediment yield associated with the proposed action - Alternative 2 - is small compared to the long-term reduction in sediment yield and risk of sediment delivery. The greatest sediment reduction activities within the watersheds are from the proposed removal of the at-risk culverts and decommissioning (obliteration) of existing roads. The amount of sediment produced by Alternative 2 combined with the sediment reduced by activities within the Myrtle HFRA project area would result in a net decrease in sediment delivery. Therefore, this project would not impair beneficial uses within Snow Creek. See Fisheries report.

Deep Creek Watershed

Due to the location, size, method, and prescription proposed, the cumulative effects to the Deep Creek Watershed would be undetectable.

Table 4.16 Short-Term Effects to Sediment Yield for Alternative 2.

	Entire Myrtle Creek Watershed	Lower Myrtle Creek subwatershed	Mack Creek subwatershed	Entire Snow Creek Watershed	Lower Snow Creek subwatershed	Deep Creek in the CE* Area
**Existing Condition	**33%**	**20%**	**17%**	**18%**	**23%**	**8%**
% Change	**+1%**	**+1%**	**+5%**	**+2%**	**+3%**	**1%**

****Existing Condition is displayed as % above natural condition *CE = Cumulative Effects Area**

As explained in Appendix D, models do not generate exact numbers, and the resultant data should be kept into perspective. For example, when WATSED predicts a 4% increase in sediment or peak flow, it is similar to saying that the effects are negligible. Such small increases are not normally perceivable in the field and are well within a normal range of values.

c. Alternative 5

Direct and Indirect Effects

Myrtle Creek Watershed

This alternative would have less impact than Alternative 2 in the Myrtle Creek Watershed. Sediment yield would have a minimal affect, as 865 acres of vegetation treatments and 22 miles of road reconditioning would occur. See Map Appendix – Aquatics Map 5. The only associated restoration activities, such as road decommissioning and soil restoration (see soils report), that would occur in this watershed is the decommissioning of 1309-UA. And a minimal amount of stream crossing improvements would occur. As previously stated, the density and distribution of roads within most of the watersheds, in combination with field observations, indicate there is a high probability that the hydrologic regime (i.e., timing, magnitude, duration, and spatial distribution of runoff) is altered, thus the potential for the scenarios described in the previous condition indicator.

There would be minimal change in sediment yield associated with roads, within Myrtle Creek Watershed, because minimal road decommissioning would occur. For the most part, soil compaction would continue to reduce water infiltration, so effects to sediment erosion would remain the same.

The activity specific analysis described above[•] under the subheading *Other Activities* refers to both Alternative 2, and Alternative 5, just at a different scale. For the Myrtle Creek Watershed, Alternative 5 is at a smaller scale than Alternative 2, thus less impact (positive or negative).

[•] (Fuels Reduction Treatments, Temporary Road Construction, Road Reconditioning, Redesigning and Upgrading Existing Stream Crossings, Strengthening Unstable Cut and Fill Slopes, Increasing the Frequency of Ditch Drainage, Rolling the Road Grade, Surfacing, Standard

Snow Creek Watershed

This alternative proposes temporary road reconstruction in Snow Creek to re-open Road 402C approximately 0.6 miles to move personnel, logs, and equipment to conduct the fuels reduction treatments. This was analyzed using the models described in Appendix D and may have effects to watershed condition. The road is currently categorized as decommissioned. The direct effects would be a temporary increase in sediment yield in Snow Creek. This would be a short-term effect on sediment yield, as this road would be decommissioned by full obliteration upon completion of use.

A moderate amount of road reconditioning would occur in Snow Creek. Installation of additional relief culverts would reduce the amount of sediment carried by and eroded from ditchlines. This would allow the ditch runoff to re-infiltrate the forest floor and deposit sediment before reaching stream networks, and would help prevent culvert failure. The dispersion of surface runoff would help "normalize" the flow regime of a basin by recharging the groundwater that would slowly release into the live streams. There would be less of an opportunity for sediment to concentrate and be delivered to the naturally unstable stream breaklands. The volume of sediment delivered to stream channels (especially during peak flow conditions) would be reduced, as more sediment and runoff would be cross drained before reaching the channel. Therefore, adding relief drainage would reduce the probability of roads increasing stream crossing risk and sediment production and delivery.

The activity specific analysis described above• under the subheading *Other Activities* refers to both Alternative 2, and Alternative 5, just at a different scale. For the Snow Creek Watershed Alternative 5 would be at relatively the same scale as Alternative 2.

Deep Creek Watershed

There would be no acres treated in the Deep Creek drainage, therefore there would be no direct or indirect effects to the Deep Creek Watershed.

Cumulative Effects(Alternative 5)

Myrtle Creek Watershed
The combination of direct and indirect effects of Alternative 5, in conjunction with past, present, and reasonably foreseeable activities, would result in a short-term increase in sediment, but an overall reduction in sediment risk and a net decrease in sediment yield in the long-term. This would be at a smaller scale than Alternative 2. Based on the direct and indirect effects above, the risk of sediment delivery from harvest activities reaching a live channel, especially in Myrtle Creek, is moderate to low, depending on the site-specific influences present. Studies have discussed that when disturbance patterns created by timber harvesting are used to achieve some of the benefits of natural disturbances, activities should be concentrated in a single drainage rather than dispersed, that riparian areas need protection (Reeves et al, 1995).

For Myrtle Creek the long-term sediment effects would be more negative than Alternative 2 but less than Alternative1, due to the increase in fire risk and its subsequent consequences. FuME models predict that, if a stand-replacing wildfire were to occur, sediment erosion could be as high as 100 times greater in magnitude than that produced by timber harvesting,.

Snow Creek Watershed
The combination of direct and indirect effects of Alternative 5, in conjunction with past, present, and reasonably foreseeable activities, would result in a short-term increase in sediment, but an overall reduction in sediment risk and a net decrease in sediment yield in the long-term. This would be at relatively the same scale as Alternative 2. Based on the direct and indirect effects above, the risk of sediment delivery from harvest activities reaching a live channel is moderate to low, depending on the site-specific influences present. Studies have discussed that when disturbance patterns created by timber harvesting are used to achieve some of the benefits of natural disturbances, activities should be concentrated in a single drainage rather than dispersed, that riparian areas need protection (Reeves et al, 1995).

The short-term increase in sediment yield associated with Alternative 5 is small compared to the long-term reduction in sediment yield and risk of sediment delivery for Snow Creek. The greatest sediment reduction activities within the watersheds are from the proposed removal of the at-risk culverts and decommissioning (obliteration) of existing roads.

Maintenance, Road Obliteration, Obliteration of Roads and Stream Crossings, Obliteration Between Crossings, Helicopter Landings, Prescribed Burning for Fuel, Mechanical Slash Disposal and Site Preparation.)

Deep Creek Watershed
No acres would be treated in the Deep Creek drainage, therefore there would be no cumulative effects to the Deep Creek Watershed.

Table 4.17 Short-Term Effects to Sediment Yield for Alternative 5.

	Entire Myrtle Creek Watershed	Lower Myrtle Creek subwatershed	Mack Creek subwatershed	Entire Snow Creek Watershed	Lower Snow Creek subwatershed	Deep Creek in the CE* Area
**Existing Condition	**33%**	**20%**	**17%**	**18%**	**23%**	**8%**
% Change	**0%**	**0%**	**0%**	**+1%**	**+1%**	**0%**

****Existing Condition is displayed as % above natural condition *CE = Cumulative Effects Area**

As explained in Appendix D, models do not generate exact numbers, and the resultant data should be kept in perspective. For example, when WATSED predicts a 4% increase in sediment or peak flow, it is similar to saying that the effects are negligible. Such small increases are not normally perceivable in the field and are well within a normal range of values.

4.2-I Indicator 4 – Channel Morphology

a. Alternative 1 – No Action Alternative

Direct and Indirect Effects

Myrtle Creek, Snow Creek, and Deep Creek

Channel morphology in project subwatersheds has been altered through two primary processes: sediment deposition and channel encroachment. Sediment deposition has occurred in areas subjected to significant development activity, including roading. Channel encroachment has occurred where roads and other activities have taken place adjacent to streams and their floodplains. Implementation of Alternative 1 would leave these conditions unchanged.

Channel Morphology would not be directly affected, as no vegetation treatments, roads reconditioning, or temporary road construction would occur.

Cumulative Effects

Myrtle Creek, Snow Creek, and Deep Creek

As discussed in the Affected Environment section, the greatest impacts observed from rain-on-snow events occur when culverts become plugged from resulting floods and debris flows. This could, in turn, have an affect on channel morphology, sediment yield, and watershed condition if the event was severe enough (such as a 100-year flood). Channel morphology conditions would continue their current trends. If conditions are such that the reach is currently at a downward trend then the reach may continue to degrade. Without the proposed improvements, the risk of sediment delivery increases over time. The potential to affect channel morphology, if the event is severe enough, is present.

The risk of stand-replacing wildfire on dry sites would increase under this alternative. The continuity and amount of biomass would continue to accumulate faster than the rate of decay.

Table 4.18 Short-Term Effects to Channel Morphology for Alternative 1

	Myrtle Creek	Cooks Creek	Mack Creek	Snow Creek	Deep Creek in the CE* Area
Existing Condition	**Functioning-At-Risk**	**Properly-Functioning**	**Functioning-At-Risk**	**Functioning-At-Risk**	**Functioning-At-Risk**
Risk for Change	**Low**	**Low**	**Low**	**Low**	**Low**

***CE = Cumulative Effects Area**

b. Alternative 2 – Proposed Action

Direct and Indirect Effects

Myrtle Creek

This action alternative is expected to have relatively minor effects on channel morphology. Generally, the ECA and sediment yield estimates are at levels where little channel erosion or deposition is anticipated. No temporary roads are proposed in the Myrtle Creek watershed. Several stream crossing improvements should improve channel morphology conditions in their immediate vicinity. These improvements are site-specific. In the case of culvert replacements, the improvements often result from less backwatering upstream of the site and less scour downstream. Similarly improvements occur where culverts are removed, with the additional benefit of enhanced floodplain function through the crossing site. Some of the road decommissioning involves crossings and riparian areas. Channel morphology would be improved in those areas.

Snow Creek

This action alternative is expected to have relatively minor effects on channel morphology. Generally, the ECA and sediment yield estimates are at levels where little channel erosion or deposition is anticipated. There are no new stream crossings on temporary roads, except for the re-opening of 0.6 mile of Road 402-C. Several stream crossing improvements should improve channel morphology conditions in their immediate vicinity. These improvements are site-specific. In the case of culvert replacements, the improvements often result from less backwatering upstream of the site and less scour downstream. Similarly improvements occur where culverts are removed, with the additional benefit of enhanced floodplain function through the crossing site. Some of the road decommissioning involves crossings and riparian areas. Channel morphology would be improved in those areas.

Deep Creek
Due to the location, size, method, and prescription proposed, the direct or indirect effects to Deep Creek would be undetectable. Approximately 36 acres of group selection harvest in Unit F1 is in the Deep Creek watershed.

Cumulative Effects

Myrtle Creek

Historically, the greatest impact to channel morphology in Myrtle Creek was caused by roads. Encroachment of roads in riparian areas and floodplains also had a direct effect on channel morphology. (Hydrology Project Files)

Estimated peak flow increases would not detrimentally affect channel incision, or stream bank erosion. The short-term increases in sediment yield associated with Alternative 2 are expected to be routed through the stream channel and would not be of a magnitude that would cause changes to stream channel morphology (e.g. migration, braiding, and widening of channels). Overall, stream channel morphology in Myrtle Creek would be maintained and somewhat improved upon since many known sediment delivery sources would be rehabilitated. This would be achieved through the removal and upgrades of at-risk culverts, road decommissioning, and road maintenance work.

Snow Creek

Historically, the greatest impact to channel morphology in Snow Creek was caused by roads. Encroachment of roads in riparian areas and floodplains also had a direct effect on channel morphology. (Hydrology Project Files)

Estimated peak flow increases would not detrimentally affect channel incision, or stream bank erosion. The short-term increases in sediment yield associated with Alternative 2 are expected to be routed through the stream channel and would not be of a magnitude that would cause changes to stream channel morphology (e.g. migration, braiding, and widening of channels). Overall, stream channel morphology in Snow Creek would be maintained and somewhat improved upon since many known sediment delivery sources would be rehabilitated. This would be achieved through the removal and upgrades of at-risk culverts, road decommissioning, and road maintenance work.

Deep Creek
Due to the location, size, method, and prescriptions proposed the cumulative effects to Deep Creek would be undetectable. Approximately 36 acres of group selection harvest in Unit F1 is in the Deep Creek watershed.

Table 4.19 Short-Term Effects to Channel Morphology for Alternative 2.

	Myrtle Creek	Cooks Creek	Mack Creek	Snow Creek	Deep Creek in the CE* Area
Existing Condition	**Functioning-At-Risk**	**Properly-Functioning**	**Functioning-At-Risk**	**Functioning-At-Risk**	**Functioning-At-Risk**
Risk for Change	**Low**	**Low**	**Low**	**Low**	**Low**

***CE = Cumulative Effects Area**

c. Alternative 5

Direct and Indirect Effects

Myrtle Creek

Channel morphology in project subwatersheds has been altered through two primary processes: sediment deposition and channel encroachment. Sediment deposition has occurred in areas subjected to significant development activity, including roading. Channel encroachment has occurred where roads and other activities have taken place adjacent to streams and their floodplains. Implementation of Alternative 5 would leave these conditions relatively unchanged in Myrtle Creek. Channel Morphology would not be directly affected, as approximately 96 acres of silvicultural/fuels reduction treatments, and about 16 miles of road reconditioning on main haul routes would occur. Associated minimal restoration activities, such as road decommissioning, soil restoration, and stream crossing improvements, analyzed in this document, would also occur.

This action alternative is expected to have relatively minor effects on channel morphology. Generally, the ECA and sediment yield estimates are at levels where little channel erosion or deposition is anticipated. No temporary roads are proposed in the Myrtle Creek watershed. Several stream crossing improvements should improve channel morphology conditions in their immediate vicinity. These improvements are site-specific. In the case of culvert replacements, the improvements often result from less backwatering upstream, and with backwatering there is aggradation of material. Similarly, improvements occur where culverts are removed, with the additional benefit of enhanced floodplain function through the crossing site. Some of the road decommissioning involves crossings and riparian areas. Channel morphology would be improved in those areas of Myrtle Creek.

Snow Creek

Channel morphology in project subwatersheds has been altered through two primary processes: sediment deposition and channel encroachment. Sediment deposition has occurred in areas subjected to significant development activity, including roading. Channel encroachment has occurred where roads and other activities have taken place adjacent to streams and their floodplains. Implementation of Alternative 5 would leave these conditions relatively unchanged in Snow Creek. Channel morphology would not be directly affected, as approximately 767 acres of silvicultural/fuels reduction treatments, and about 15 miles of road reconditioning on main haul routes would occur. Associated minimal restoration activities, such as road decommissioning, soil restoration, and stream crossing improvements, analyzed in this document, would also occur.

This action alternative is expected to have relatively minor effects on channel morphology. Generally, the ECA and sediment yield estimates are at levels where little channel erosion or deposition is anticipated. There are no new stream crossings on temporary roads, except for the re-opening of 0.6 mile of Road 402-C. Several stream crossing improvements should improve channel morphology conditions in their immediate vicinity. These improvements are site-specific. In the case of culvert replacements, the improvements often result from less backwatering upstream of the site and less scour downstream. Similarly improvements occur where culverts are removed, with the additional benefit of enhanced floodplain function through the crossing site. Some of the road decommissioning involves crossings and riparian areas. Channel morphology would be improved in those areas of Snow Creek.

Deep Creek

No acres treated in the Deep Creek drainage, therefore there would be no direct or indirect effects to Deep Creek.

Cumulative Effects (Alternative 5)

Myrtle Creek

Historically, the greatest impact to channel morphology in Myrtle Creek was caused by roads. Encroachment of roads in riparian areas and floodplains also had a direct effect on channel morphology. (Hydrology Project Files)

Estimated peak flow increases would not detrimentally effect channel incision, nor stream bank erosion. The short-term increases in sediment yield associated with Alternative 5 are expected to be routed through the stream channel and would not be of a magnitude that would cause changes to stream channel morphology (e.g. migration, braiding, and widening of channels). Overall, stream channel morphology in Myrtle Creek would be maintained and somewhat improved upon since known sediment delivery sources would be rehabilitated. This would be achieved through the removal and upgrades of at-risk culverts, road decommissioning, and road maintenance work.

Snow Creek

Historically, the greatest impact to channel morphology in Snow Creek was caused by roads. Encroachment of roads in riparian areas and floodplains also had a direct effect on channel morphology. (Hydrology Project Files)

Estimated peak flow increases would not detrimentally effect channel incision, or stream bank erosion. The short-term increases in sediment yield associated with Alternative 5 are expected to be routed through the stream channel and would not be of a magnitude that would cause changes to stream channel morphology (e.g. migration, braiding, and widening of channels). Overall, stream channel morphology in Snow Creek would be maintained and somewhat improved upon since known sediment delivery sources would be rehabilitated. This would be achieved through the removal and upgrades of at-risk culverts, road decommissioning, and road maintenance work.

Deep Creek

No acres would be treated in the Deep Creek drainage, therefore there would be no cumulative effects to Deep Creek.

Table 4.20 Short-Term Effects to Channel Morphology for Alternative 5.

	Myrtle Creek	Cooks Creek	Mack Creek	Snow Creek	Deep Creek in the CE* Area
Existing Condition	**Functioning-At-Risk**	**Properly-Functioning**	**Functioning-At-Risk**	**Functioning-At-Risk**	**Functioning-At-Risk**
Risk for Change	**Low**	**Low**	**Low**	**Low**	**Low**

***CE = Cumulative Effects Area**

4.2-J Indicator 5 – Water Quality

a. Alternative 1 – No Action Alternative

Direct and Indirect Effects

Myrtle Creek, Snow Creek, and Deep Creek

Water quality would not be directly affected, as no vegetation treatments, roads reconditioning, or temporary road construction would occur. Under this alternative, none of the at-risk road drainage crossings or road issues, analyzed in this document, would be improved, which could have a negative effect on water quality if a failure were to occur, as mentioned above. Monitoring of water quality parameters in Myrtle Creek by the City of Bonners Ferry, such as turbidity, metals, etc., indicate that municipal water use is currently being fully supported. An indirect effect would be in the event of a wildfire, which would reduce shade (thus increase water temperature), increase sediment and increase peak flows, thus negatively affecting the water quality of the watersheds.

Cumulative Effects

Myrtle Creek, Snow Creek, and Deep Creek

The beneficial uses would likely be fully supported in years that did not experience extreme events. However, the amount of resource damages experienced during the extreme events would be more severe than natural conditions. Accordingly, beneficial uses may be impacted to a greater extent and the recovery would be slower than under Alternatives 2 or 5. There is also the possibility that the aging of existing culverts could cause smaller return-interval flood events to trigger failures.

The continued accumulation of dead and down fuel loads could contribute to an increased potential for locally severe fire effects on soil. The effects of the wildfire in combination with the roads and culvert issues mentioned above, would contribute to detrimental effects. If a wildfire occurred, fire severity and effects could range from minimal to severe from site to site, depending on location (topography), size of the burned area, and fire behavior (for example, surface fire versus crown fire). The Fire Management Plan for the IPNF states that fire suppression tactics will have minimum impacts on the site resources and will follow guidelines set by the Northern Rockies Minimum Impact Suppression Tactics (MIST) and the Inland Native Fisheries Strategy (INFS) Amendment to the Forest Plan where appropriate (IPNF Forest Fire Management Plan 2006, p. 51) Forest Service Manual (FSM) 5130 (Wildland Fire Suppression) also addresses minimizing resource loss and damage

The risk of stand-replacing wildfire on dry sites would increase under this alternative. The continuity and amount of biomass would continue to accumulate faster than the rate of decay.

Under the No Action Alternative, insect and disease agents may tend to reduce shade over time in some riparian stands. Past activities would continue to have an effect on the watersheds, as they are still in the recovery process. Ongoing activities and reasonably foreseeable activities would still continue. This would, in turn, have cumulative effects on the system, as no improvements are scheduled to occur, and stresses would continue to be added (i.e. unstable culverts). Under this Alternative, risk to beneficial uses may increase, especially if there were a stand-replacing wildfire.

Table 4.21 Short-Term Effects to Water Quality for Alternative 1.

	Myrtle Creek	Cooks Creek	Mack Creek	Snow Creek	Deep Creek in the CE* Area
Existing Condition	**Functioning-At-Risk**	**Properly-Functioning**	**Functioning-At-Risk**	**Functioning-At-Risk**	**Functioning-At-Risk**
Risk for Change	**Low**	**Low**	**Low**	**Low**	**Low**

***CE = Cumulative Effects Area**

b. Alternative 2 – Proposed Action

Direct and Indirect Effects

Myrtle Creek Watershed

Alternatives 2 is designed to minimize effects on streamside temperature. There may be some incidental shade reductions at stream crossing improvement sites. An example would be if some roadside vegetation was removed during replacement of an existing culvert. This approach is expected to be in compliance with the temperature and sediment TMDLs. Beyond sediment yield described above, there would be little change in most water quality parameters. Beneficial uses would be protected under this alternative.

Most of the noxious weed controls used in Myrtle Creek have been biological. However, herbicides have been used on noxious weeds sparingly and judiciously in accordance with the requirements of the Bonners Ferry Noxious Weed EIS. Monitoring of water quality by the City of Bonners Ferry has not detected herbicide contaminants from this low level use in the past. Noxious weed control would not affect stream crossings or wildfire risk. Noxious weed treatments do kill vegetation that reduces vegetative ground cover, but does not remove protective organic layers and occurs over relatively small treatment areas away from streams.

Snow Creek Watershed

Alternatives 2 is designed to minimize effects on streamside shade. Under this action alternative, insect and disease agents may tend to reduce shade over time in some riparian stands. Fire would also reduce shade. There may be some incidental shade reductions at stream crossing improvement sites. An example would be if some roadside vegetation was removed during replacement of an existing culvert. This approach is expected to be in compliance with the temperature and sediment TMDLs. Beyond sediment yield described above, there would be little change in most water quality parameters. Beneficial uses would be protected under this alternative.

Most of the noxious weed controls used in Snow Creek have been biological. However, herbicides have been used sparingly and judiciously in accordance with the requirements of the Bonners Ferry Noxious Weed EIS. Noxious weed control would not affect stream crossings or wildfire risk. Noxious weed treatments do kill vegetation that reduces vegetative ground cover, but does not remove protective organic layers and occurs over relatively small treatment areas away from streams.

Deep Creek Watershed

Due to the location, size, method, and prescription proposed, the direct or indirect effects to Deep Creek would be undetectable. Approximately 36 acres of Unit F1 are within the Deep Creek Watershed.

Cumulative Effects (Alternative 2)

Myrtle Creek Watershed

Under Alternative 2, existing risks to beneficial uses would be decreased. By maintaining RHCAs, as designated by INFS standards and guidelines, following BMPs, reducing sediment concerns associated with at-risk culverts and roads, the water quality issues associated with the TMDLs would be addressed. Improvements would strive to benefit the TMDL process and reduce the pollutants of concern. See Fisheries Report for more information regarding temperature modification issues.

Mack Creek and two segments of Myrtle Creek are listed in the 2002 TMDL Integrated Report for thermal modifications. These subwatersheds have proposed activities, which would create site-specific affects, but would not result in detrimental cumulative impacts. By following site specific BMPs, and RHCAs, as designated by INFS standards and guidelines, there would be no detrimental cumulative effects to the streams, thus no violation to the TMDL regulations. The future activities (RAC and other opportunities) proposed for road decommissioning, culvert replacement, and road obliteration or improvements would, in fact, have a net beneficial effect to these streams and work towards the TMDL Desired Future Condition (DFC). See Fisheries Report for more information regarding temperature.

Snow Creek Watershed

Under Alternative 2, existing risks to beneficial uses would be decreased. By maintaining RHCAs as designated by INFS standards and guidelines, following BMPs, reducing sediment concerns associated with at-risk culverts and roads, the water quality issues associated with the TMDLs would be addressed. Improvements would be strived to benefit the TMDL process and reduce the pollutants of concern. See Fisheries Report for more information regarding temperature modification issues.

Two segments of Snow Creek are listed in the 2002 TMDL Integrated Report for thermal modifications. There are proposed activities within this watershed, which would create site affects, but would not result in detrimental cumulative impacts. By following site specific BMPs, INFS guidelines, and RHCA buffers, there would be no detrimental cumulative effects to the streams, thus no violation to the TMDL regulations. Any future opportunities proposed for road decommissioning, culvert replacement, and road obliteration or improvements would, in fact, have a net beneficial effect to these streams and work towards the TMDL Desired Future Condition (DFC). Please see Fisheries Report for more information regarding temperature.

Deep Creek Watershed

Deep Creek would have minor amounts of proposed activity (36 acres), which would create immediate site affects, but would not result in detrimental cumulative impacts. The activities in Deep Creek have a low potential for interception, concentration and re-routing of water and would have a low risk of delivery of erosion off site. As a result, the proposed management activities would not contribute to the negative effects for which Deep Creek is categorized in the 2002 TMDL Integrated Report (thermal modifications, siltation, and suspended solids). See Fisheries Report for more information regarding Deep Creek.

Table 4.22 Short-Term Effects to Water Quality for Alternative 2.

	Myrtle Creek	Cooks Creek	Mack Creek	Snow Creek	Deep Creek in the CE* Area
Existing Condition	**Functioning-At-Risk**	**Properly-Functioning**	**Functioning-At-Risk**	**Functioning-At-Risk**	**Functioning-At-Risk**
Risk for Change	**Low**	**Low**	**Moderate**	**Moderate**	**Low**

***CE = Cumulative Effects Area**

c. Alternative 5

Direct and Indirect Effects

Myrtle Creek Watershed

Water quality in Myrtle Creek would not be directly affected, as approximately 96 acres of silvicultural/fuels reduction treatments, and about 16 miles of road reconditioning on main haul routes would occur. Under this alternative, few of the at-risk road drainage crossings or road erosion concerns would be improved, which could have a negative effect on water quality if a failure were to occur, as mentioned above. Monitoring of water quality parameters by the City of Bonners Ferry, such as turbidity, metals, etc., indicate that municipal water use is currently being fully supported. An indirect effect would be in the event of a wildfire, which would reduce shade, increase sediment and increase peak flows, thus negatively affecting the water quality of the Myrtle Creek Watershed.

Most of the noxious weed controls used in Myrtle Creek have been biological. However, herbicides have been used sparingly and judiciously in accordance with the requirements of the Bonners Ferry Noxious Weed EIS. Monitoring of water quality by the City of Bonners Ferry has not detected herbicide contaminants from this low level use in the past. Noxious weed control would not affect stream crossings and wildfire risk. Noxious weed treatments do kill vegetation that reduces vegetative ground cover, but does not remove protective organic layers and occurs over relatively small treatment areas away from streams.

Snow Creek Watershed

This alternative in Snow Creek is designed to minimize effects on streamside shade. Under this action alternative, insect and disease agents may tend to reduce shade over time in some riparian stands. Fire would also reduce shade. There may be some incidental shade reductions at stream crossing improvement sites. An example would be if some roadside vegetation was removed during replacement of an existing culvert. This approach is expected to be in compliance with the temperature and sediment TMDLs. Beyond sediment yield described above, there would be little change in most water quality parameters. Beneficial uses would be protected under this alternative for Snow Creek.

Most of the noxious weed controls used in Snow Creek have been biological. However, herbicides have been used sparingly and judiciously in accordance with the requirements of the Bonners Ferry Noxious Weed EIS. Noxious weed control would not affect stream crossings and wildfire risk. Noxious weed treatments do kill vegetation that reduces vegetative ground cover, but does not remove protective organic layers and occurs over relatively small treatment areas away from streams.

Deep Creek Watershed

There would be no acres treated in the Deep Creek drainage, therefore there would be no direct or indirect effects to Deep Creek Watershed.

Cumulative Effects

Myrtle Creek Watershed

Under Alternative 5, existing risks to beneficial uses would be decreased in Myrtle Creek. By maintaining RHCAs, as designated by INFS standards and guidelines, following BMPs, reducing sediment concerns associated with at-risk culverts

and roads, the water quality issues associated with the TMDLs would be addressed. Improvements would strive to benefit the TMDL process and reduce the pollutants of concern. But, if a stand-replacing wildfire were to occur in Myrtle Creek, beneficial uses would be affected. There would be a decrease in shade and an increase in sediment. See Fisheries Report for more information regarding temperature modification issues.

Snow Creek Watershed

Under Alternative 5, existing risks to beneficial uses would be maintained in Snow Creek. By maintaining RHCAs, as designated by the INFS standards and guidelines, following BMPs, reducing sediment concerns associated with at-risk culverts and roads, the water quality issues associated with the TMDLs would be addressed. Improvements would strive to benefit the TMDL process and reduce the pollutants of concern. But, if a stand-replacing wildfire were to occur in Snow Creek, beneficial uses would be affected. There would be a decrease in shade and an increase in sediment. See Fisheries Report for more information regarding temperature modification issues.

Two segments of Snow Creek (1 in the project area, the other in the cumulative effects area) are listed in the 2002 TMDL Integrated Report for thermal modifications. There are proposed activities within the project area portion of the watershed, which would create site affects, but would not result in detrimental cumulative impacts. By following site specific BMPs, INFS guidelines, and RHCA buffers, there would be no detrimental cumulative effects to the streams, thus no violation to the TMDL regulations. The future opportunities proposed for road decommissioning, culvert replacement, and road obliteration or improvements would, in fact, have a net beneficial effect to these streams and work towards the TMDL DFC. Please see Fisheries Report for more information regarding temperature.

Deep Creek Watershed

There would be no acres treated in the Deep Creek drainage, therefore there would be no cumulative effects to Deep Creek Watershed.

Table 4.23 Short-Term Effects to Water Quality for Alternative 5.

	Myrtle Creek	Cooks Creek	Mack Creek	Snow Creek	Deep Creek in the CE* Area
Existing Condition	**Functioning-At-Risk**	**Properly-Functioning**	**Functioning-At-Risk**	**Functioning-At-Risk**	**Functioning-At-Risk**
Risk for Change	**Low**	**Low**	**Low**	**Moderate**	**Low**

***CE = Cumulative Effects Area**

4.2-K Watershed Summary

The Myrtle Creek and Snow Creek watersheds mainly contain moderate to high gradient streams. The watersheds have a range of disturbance conditions, as indexed by existing roads densities ranging from 0.6 to 3.1 mi/mi^2. Stream channels have been mostly affected by sediment deposition and road encroachment. (Hydrology Project Files)

The table on the next page summarizes the current existing condition, and the estimated effects of the proposed action in the entire Myrtle Creek, Lower Myrtle Creek, Mack Creek, the entire Snow Creek, Lower Snow Creek, and Deep Creek (sub) watersheds. As explained in Appendix D.3, models and professional judgment were used. The WEPP and FuME models were only run on the particular areas where the proposed activities would occur. There are no proposed activities in the upper portion of the Myrtle Creek subwatershed or the upper portion of the Snow Creek subwatershed.

This table shows the Percentage of Change and Rating of Risk to Effect by Alternative for each Condition Indicator. **The lines for the existing conditions have been shaded in gray.**

Table 4.24 Summary of Existing Watershed Conditions and Effects by Alternative

Watershed	Condition/Alternative	Watershed Condition (Road Density)	Water Yield	Peak Flow	*ECA	Sediment Erosion	Channel Morphology	Water Quality
Entire Myrtle Creek	Existing Condition**	2.51	6%	6%	14%	33%	F-A-R	F-A-R
	Alternative 1	0%	0%	0%	0%	0%	Low	Low
	Alternative 2	-<1%	+2%	+2%	+4%	+1%	Low	Low
	Alternative 5	0%	0%	0%	0%	0%	Low	Low
Lower Myrtle Creek	Existing Condition**	1.25	17%	16%	33%	20%	F-A-R	F-A-R
	Alternative 1	0%	0%	0%	0%	0%	Low	Low
	Alternative 2	-<1%	+2%	+4%	+6%	+1%	Low	Low
	Alternative 5	0%	0%	0%	+1%	0%	Low	Low
Mack Creek	Existing Condition**	1.85	4%	5%	7%	17%	F-A-R	F-A-R
	Alternative 1	0%	0%	0%	0%	0%	Low	Low
	Alternative 2	0%	+3%	+3%	+6%	+5%	Low	Moderate
	Alternative 5	0%	0%	0%	0%	0%	Low	Low
Entire Snow Creek	Existing Condition**	2.96	3%	4%	6%	18%	F-A-R	F-A-R
	Alternative 1	0%	0%	0%	0%	0%	Low	Low
	Alternative 2	-<1%	+4%	+4%	+6%	+2%	Low	Low
	Alternative 5	-<1%	+2%	+2%	+4%	+1%	Low	Low
Lower Snow Creek	Existing Condition**	3.20	5%	5%	8%	23%	F-A-R	F-A-R
	Alternative 1	0%	0%	0%	0%	0%	Low	Low
	Alternative 2	-1%	+6%	+8%	+13%	+3%	Low	Moderate
	Alternative 5	-1%	+4%	+6%	+10	+1%	Low	Moderate
Deep Creek	Existing Condition**	3.03	+1%	+1%	+3%	+8%	F-A-R	F-A-R
	Alternative 1	0%	0%	0%	0%	0%	Low	Low
	Alternative 2	0%	0%	0%	+1%	+1%	Low	Low
	Alternative 5	0%	0%	0%	0%	0%	Low	Low

*** Equivalent Clearcut Area**
****% above natural condition or current function status**
F-A-R = Functioning-At-Risk

The Myrtle HFRA project is expected to have some short term impacts, especially in terms of sediment yield, followed by long term improvements. The short term impacts are mostly in terms of sediment yield resulting from temporary road reconstruction (to reopen a segment of Road 402C), road decommissioning, culvert removal and soil restoration.

Short Term – generally a 5 to 10 year timeframe.

Long Term – greater than 10 years.

To disclose the expected trend in aquatic habitat condition, from the variety of influences both quantitative and qualitative, the activities and their expected contribution to aquatic condition are summarized in the following tables. The tables summarize the expected influence of the alternatives on the aquatic conditions in the Myrtle, Snow, and Deep Creek watersheds respectively. Various activities are considered with respect to the variety of aquatic processes that they potentially affect.

All of the processes potentially affected by an activity are listed in the Watershed Specific Tables in Appendix D. No ranking represents 'no expected' influence on conditions from this project. The expected contribution of a specific activity on aquatic condition is considered both in terms of short-term and long-term. Short-term influence is judged to be the immediate results of implementing the activity, generally expected to be around a 5-10 year timeframe. Long-term influence is judged to be the

influence the activity would have on aquatic condition as a result of changes in processes and resource conditions that would over time result in changes in aquatic habitat condition. The timeframe for this influence is greater than 10 years.

The ratings by activity in the Trend Analysis Section of Appendix D can be summarized by the effect pathways by assigning a value to the Low, Moderate, and High ranking (L=1, M=2, H=3). The values are then summed by column to get an overall numerical rating for that alternative. The overall ranking for the alternative is different than the 1, 2, 3-ranking for the individual effect pathways. The table below summarizes the alternatives by the effect pathway (overall) and for the alternative in general (total). It is the summary of the more specific Activity Ratings in Appendix D. The Table in Appendix D has the individual 1, 2, 3-rankings.

The columns showing the long term trends have a grey background to aid in readability.

Table 4.25 Aquatic Trend Summary – Myrtle Creek

Process Affected	Characteristic Indicator	Alt 1 Short Term	Alt 1 Long Term	Alt 2 Short Term	Alt 2 Long Term	Alt 5 Short Term	Alt 5 Long Term
Surface Erosion	Pulse & Chronic Sediment	0	-3	-4	3	-1	-2
Mass Failure Risk	Pulse sediment	0	0	0	0	0	0
Infiltration, runoff, peaks	Hydrologic process	0	-2	2	3	0	-1
Riparian Shade	Riparian shade	0	0	0	0	0	0
LWD Recruitment	Acting LWD	0	0	0	0	0	0
Fish passage	Habitat availability	0	0	1	1	1	0
Habitat Quality	Channel Dimensions	0	0	0	0	0	0
TOTAL		**0**	**-5**	**-1**	**7**	**0**	**-3**

The No Action Alternative (Alternative 1) and Alternative 5 in Myrtle Creek suggest no change in the short term, but a slight negative trend in the long term related to fire risk associated with untreated stands, as well as their affects on the current road system. FuME models predict that sediment erosion could be as high as 100 times greater in magnitude than that produced by timber harvesting, if a stand-replacing wildfire were to occur. According to the Fire and Fuels Analysis, Alternative 5 is better than Alternative 1, but not as good as Alternative 2 at reducing the risk of crown fire. Alternative 5 includes approximately 96 acres of silviculture treatment which has minor overall affects. Alternative 2 suggests a short term negative effect, followed by long term improving trend.

The following table shows the predicted effects of implementing the Future Opportunities as well as Alternative 2. See the list of the future road management opportunities and Map Appendix – Aquatics Map 5, Priority Ranking for Potential Road Decommissioning.

Table 4.26 Aquatic Trend Summary – Myrtle Creek With Future Opportunities

Process Affected	Characteristic Indicator	Alt 2 Short Term + *Opportunities	Alt 2 Long Term + *Opportunities
Surface Erosion	Pulse & Chronic Sediment	-7	7
Mass Failure Risk	Pulse sediment	0	0
Infiltration, runoff, peaks	Hydrologic process	-1	5
Riparian Shade	Riparian shade	0	0
LWD Recruitment	Acting LWD	0	0
Fish passage	Habitat availability	2	2
Habitat Quality	Channel Dimensions	0	0
TOTAL		**-6**	**14**

*Opportunities are restoration activities (such as road decommissioning) that have been identified in this watershed.

Alternative 2, followed up with the future restoration opportunities, suggests a short-term negative effect, followed by a greater long term improving trend than Alternatives 1 or 5. The larger amount of short term negative trend and larger amount of long

term improving trend, occurs in large part as a result of the greater amount of road decommissioning with the consideration of the future opportunities.

Cooks Creek, Jim Creek and Peak Creek are listed in the 2002 TMDL Integrated Report for thermal modifications. The Myrtle Creek HFRA project does not include activities in the upper portion of the watershed, thus not near or around Cooks, Jim, or Peak Creeks. Future opportunities for road decommissioning, culvert replacement, and road obliteration or improvements would have a net beneficial effect to these streams and work towards the TMDL Desired Future Condition (DFC).

Table 4.27 Aquatic Trend Summary – Snow Creek

Process Affected	Characteristic Indicator	Alt 1 Short Term	Alt 1 Long Term	Alt 2 Short Term	Alt 2 Long Term	Alt 5 Short Term	Alt 5 Long Term
Surface Erosion	Pulse & Chronic Sediment	0	-3	-7	2	-6	2
Mass Failure Risk	Pulse sediment	0	0	0	0	0	0
Infiltration, runoff, peaks	Hydrologic process	0	-2	-2	2	-1	2
Riparian Shade	Riparian shade	0	0	0	0	0	0
LWD Recruitment	Acting LWD	0	0	0	0	0	0
Fish passage	Habitat availability	0	0	1	1	1	1
Habitat Quality	Channel Dimensions	0	0	0	0	0	0
TOTAL		**0**	**-5**	**-8**	**5**	**-6**	**5**

The No Action Alternative (Alternative 1) in Snow Creek suggests no change in the short term, but a slight negative trend in the long term related to fire risk associated with untreated stands, as well as their affects on the current road system. According to the Fire and Fuels Analysis, Alternative 5 is better than Alternative 1, but not as good as Alternative 2 at reducing the risk of crown fire. Alternatives 2 and 5 are similar prescriptions in the Snow Creek Watershed, with Alternative 5 treating approximately 422 less acres. The significant difference in the action alternatives is within the Myrtle Creek watershed. Alternatives 2 and 5 suggest a short term negative effect, followed by long term improving trend.

The following table shows the predicted effects of implementing the Future Opportunities as well as Alternative 2. See the list of the road management opportunities and Map Appendix – Aquatics Map 5, Priority Ranking for Potential Road Decommissioning..

Table 4.28 Aquatic Trend Summary – Snow Creek With Future Opportunities

Process Affected	Characteristic Indicator	Alt 2 Short Term + *Opportunities	Alt 2 Long Term + *Opportunities
Surface Erosion	Pulse & Chronic Sediment	-9	7
Mass Failure Risk	Pulse sediment	0	0
Infiltration, runoff, peaks	Hydrologic process	1	5
Riparian Shade	Riparian shade	0	0
LWD Recruitment	Acting LWD	0	0
Fish passage	Habitat availability	2	2
Habitat Quality	Channel Dimensions	0	0
TOTAL		**-6**	**14**

*Opportunities are restoration activities (such as road decommissioning) that have been identified in this watershed.

Alternative 2, followed up with the future restoration opportunities projects, suggests a short-term negative effect, followed by a greater long term improving trend than Alternatives 1 or 5. The larger amount of improving trend in Alternative 2 occurs in large part as a result of the greater amount of road decommissioning, with the consideration of the future opportunities.
Due to the low direct, indirect, and cumulative effects to Deep Creek, no trend analysis was conducted for Deep Creek.

4.2-L Compliance with Forest Plan and Other Regulations

4.2-L.1 Idaho Panhandle National Forests Land and Resource Management Plan (Forest Plan)

Except where noted below, the alternatives meet the requirements of the IPNF Forest Plan for water resources. Specific requirements and how this project meets them are listed in Appendix C-Site Specific Best Management Practices.

a. Water (IPNF Forest Plan, p. II - 33)

1. Management activities on Forest lands would not significantly impair the long-term productivity of the water resource and ensure that state water quality standards would be met or exceeded.

   The degree to which the alternatives meet this criterion is discussed under the "Direct and Indirect Effects Common to All Alternatives", "Direct and Indirect Effects of the Action Alternative", and "Cumulative Effects to Values-at-Risk". Idaho State Best Management Practices (BMPs) are designed to protect the long-term productivity of the water resource and ensure state water quality standards would be met. The Myrtle HFRA Project would meet standard BMPs. Site-specific BMPs were also included with this project as mitigation measures to improve water quality (Appendix C).

2. Maintain concentrations of total sediment or chemical constituents within State standards.

   The net production and delivery of sediment from the No Action alternative would stay the same barring any catastrophic event (stand-replacing wildfire, 100-year-flood). Under the Action Alternatives, following the recommendations for road reconstruction and maintenance would result in a decrease in production and delivery of sediment.

   Petroleum products used in the operation and maintenance of heavy equipment are the primary chemical constituents which could be delivered to streams. The Action Alternatives would be highly effective in protecting State standards for chemical constituents given that "Required Design Criteria for All Action Alternatives", state and site-specific BMPs, and INFS standards would be applied for the action alternative.

3. Implement project level standards and guidelines for water quality contained in the Best Management Practices, including those defined by State regulation or agreement between the State and Forest Service such as:
   a. Idaho Forest Practices Rules
   b. Rules and Regulations and Minimum Standards for Stream Channel Alterations
   c. Best Management Practices for Road Activities.

   Due to their specific road maintenance and repair items, both Alternatives 2 and 5 are consistent with Idaho Forest Practices Rules. In addition to standard State BMPs, other soil and water conservation practices that are approved BMPs are built into the timber sale contract. Site specific "Required Design Criteria for the Action Alternative and BMPs in Appendix C, are specified and are listed in this report. Soil and water conservation principles were used during alternative design to determine the location and types of treatments, including which areas should be avoided or restored. The specified and designed measures surpass those required by the State Forest Practices Act and are consistent with Forest Service standards. Stream crossing upgrades would meet minimum standards for stream channel alterations and are covered under a Memorandum of Understanding with the State of Idaho.

4. Cooperate with the states to determine necessary instream flows for various uses. Instream flows should be maintained by acquiring water rights or reservations.

   Instream flows are not an issue with any of the proposed projects. Therefore, this standard is not applicable to any alternative.

5. Manage public water system plans for multiple use by balancing present and future resources with public water supply needs. Project plans for activities in public water systems would be reviewed by the water users and the State. Streams not defined as public water systems, but used by individuals for such purposes, would be managed to standards established by the state's forest practices rules and/or the National Forests' BMPs or to the fisheries standards, whichever is applicable.

   State and site-specific standards and INFS standards are specified and would be applied. Factors that put water quality at-risk were identified, as well as what can be done to minimize or eliminate those risks.

Myrtle Creek is defined as a public water system. Snow Creek is not defined as a public water system. All Source Water Protection BMPs under the Safe Drinking Water Act would be conducted.

6. Activities within non-fishery drainages, including first and second order streams, would be planned and executed to maintain existing biota. Maintenance of existing biota would be defined as maintaining the physical integrity of these streams. Best Management Practices (Appendix C) and riparian guidelines would be used to accomplish this objective.

   Protection of the integrity of riparian conservation areas (which includes first and second order streams) was approached through alternative design strategies and specified actions in the BMPs contained in Appendix C. Alternatives meet this standard as specified in the Chapter 4 effects discussions contained in this report.

7. It is the intent of this plan that models be used as a tool to approximate the effects of National Forest activities on water quality values. The models would be used in conjunction with field data, monitoring results, continuing research and professional judgment, to further refine estimated effects and to make recommendations.

   All alternatives meet this standard. The WATSED model was used to predict water and sediment yield changes. Road drainage crossings were inventoried to assess erosional hazards and risks to aquatic ecosystems, using the *Methods for Inventory and Environmental Risk Assessment of Road Drainage Crossings* (Flanagan et al 1998). This method gathered information on road-stream crossings that included fill volumes, culvert sizes, erosional features, and other variables, then ranked each crossing for treatment (Hydrology Project Files). WEPP and FuME models were used to predict sediment yield changes due to harvest and fire activity. These models also were used to predict sediment erosion from roads, to incorporate a more detailed component of sediment measurements.

   A modified version of the R1/R4 fish and fish habitat inventory (Overton et al 1997) was conducted along Myrtle and Snow Creek and some of their tributaries during several field seasons. Additional stream information was collected to determine stream channel types, cross sectional profiles, woody debris composition and stream temperature. Existing and potential in-channel and stream-bank erosion sites were also documented with this survey.

b. Inland Native Fish Strategy Amendment to the Forest Plan

General Riparian Area Management (INFS Standard and Guideline A-12)

RA-1 - Identify and cooperate with Federal, Tribal, State and local governments to secure instream flows needed to maintain riparian resources, channel conditions, and aquatic habitat.

This project does not affect instream flows; therefore this standard does not apply.

RA-2 - Trees may be felled in Riparian Habitat Conservation Areas when they pose a safety risk. Keep felled trees on site when needed to meet woody debris objectives.

Alternatives 2 and 5 propose some fuels reduction activities within the RHCAs. See Fisheries report for details on the compliance with INFS.

RA-3 - Apply herbicides, pesticides, and other toxicants, and other chemicals in a manner that does not retard or prevent attainment of Riparian Management Objectives and avoids adverse effects on inland native fish.

BMPs listed in the Bonners Ferry Noxious Weed EIS meet this standard.

RA-4 - Prohibit storage of fuels and other toxicants within Riparian Habitat Conservation Areas. Prohibit refueling with Riparian Habitat Conservation Areas unless there are no other alternatives. Refueling sites within a Riparian Habitat Conservation Area must be approved by the Forest Service and have an approved spill containment plan.

This is a standard BMP that is part of the timber sale contract; and is also noted within Chapter 2 under required design for all action alternatives – Hazardous Materials.

RA-5 - Locate water drafting sites to avoid adverse effects to inland native fish and instream flows, and in a manner that does not retard or prevent attainment of Riparian Management Objectives.

Drafting of water would only be needed for prescribed fire operations. The amount of water needed for these operations would not significantly affect fish or instream flows. The use of foaming agents would not occur near stream channels. See Chapter 2 design criteria for additional information.

Watershed and Habitat Restoration (INFS Standard and Guideline A-12)

WR-1 - Design and implement watershed restoration projects in a manner that promotes the long-term ecological integrity of ecosystems, conserves the genetic integrity of native species, and contributes to attainment of Riparian Management Objectives.

The proposed watershed restoration projects as described in Chapters 2 & 4 originate from this standard. The action alternatives would meet this standard. Alternative 1 would not meet this standard.

WR-2 - Cooperate with Federal, State, local, and Tribal agencies, and private landowners to develop watershed-based Coordinated Resource Management Plans (CRMPs) or other cooperative agreements to meet Riparian Management Objectives.

Cooperation at the multiple levels as listed occurred within the framework for developing the proposed activities of this project (Hydrology project Files) and that future resource management would develop a CRMP for the Kootenai River system.

c. Clean Water Act, Including State of Idaho's Implementation

The proposed project would be consistent with the requirements of the Clean Water Act, 33 U.S.C. 1251. Sediment and heavy metals (the pollutants of concern) would not permanently increase in the municipal waters of Myrtle Creek. Risks to beneficial uses would not be changed by this project. There would be no detrimental increase in sediment through management activities in Myrtle or Snow Creeks.

d. Safe Drinking Water Act

The proposed harvesting and road maintenance would adhere to the Source Water Protection BMPs under the Safe Drinking Water Act by conducting restoration activities, fuels reduction activities, road management activities, and monitoring. Source Water Protection was included in the design of the monitoring plans. The public and Kootenai Tribe of Idaho were consulted (Hydrology Project Files).

e. U.S. Army Corps of Engineers Discharge, Dredge and Fill Permits

The proposed harvesting and road maintenance would not affect wetlands or streams. The proposed stream crossing upgrades proposed under "Watershed and Fisheries Improvement Opportunities" are covered under the "silvicultural road exemption" of the nationwide permit. No wetlands would be affected by the reconstruction work.

f. Water Quality Limited Stream Segments

As stated in Chapter 3, using the currently approved 2002 Integrated Report, 14 designated Assessment Units (Table 3.1) are within the project and cumulative effects analysis areas. No cumulative detrimental effects are expected from the action alternatives. By following site specific BMPs, INFS guidelines, and RHCA buffers, there would be no detrimental cumulative effects to the streams, or net increase in siltation, suspended solids, or thermal modifications, thus no violation to the TMDL regulations or Clean Water Act.

The future opportunities identified for road decommissioning, culvert replacements, and road obliteration or improvements would have a net beneficial effect to these streams and work towards the TMDL Desired Future Conditions.

Please see Fisheries Report (Appendix B) for more information regarding temperature concerns. Please see Hydrology Project Files for Assessment Unit Status Reports and support status of Beneficial Uses.

g. Antidegradation Policy for Beneficial Uses

Application of the antidegradation policy is described in Chapter 4 under "Evaluation of Alternatives". The effects analysis in Chapter 4 describes the anticipated effects for each alternative.

h. Idaho Forest Practices Act

Best Management Practices or Soil and Water Conservation Practices would be applied. All activities are in compliance with the guidelines in the Soil and Water Conservation Handbook. See Appendix C for additional information.

Executive Order 11988 - Floodplain Management

This project meets the requirements of Executive Order 11988, which apply to protection of floodplains. These features are protected through implementation of BMPS and Forest Plan Standards and Guidelines. The riparian restoration components of the project are designed to improve condition of riparian areas and floodplain function.

Executive Order 11990 - Protection of Wetlands
This project meets the requirements of Executive Order 11990, which apply to protection of wetlands. These features are protected through implementation of BMPS and Forest Plan Standards and Guidelines. The riparian restoration components of the project are designed to improve condition of riparian areas and floodplain function.

Executive Order 13084 - Consultation and Coordination with Indian Tribal Governments
This project meets the requirements of Executive Order 13084, which applies to consultation and coordination with Indian Tribal Governments. This feature was followed through the Healthy Forest Restoration Act (HFRA) process. Multiple public meetings with the Kootenai Valley Resource Initiative (KVRI) were held, in which the Indian Tribal Government took a lead role.

Idaho Stream Channel Protection Act/Idaho Stream Alteration Rules
This project meets the required BMPs in the Idaho State Water Quality Standards (IDAPA 37.03.07) and (IDAPA 58.01.02.350.03).

4.3 - Fire and Fuels

Myrtle Creek, and the ephemeral streams that feed into it, provide drinking water to thousands of citizens of Bonners Ferry, Idaho. As was the case for the Myrtle Creek Fire of 2003, extreme wildfire behavior is often followed by severe effects to the soil and water resources. Surface fires that burn too hot can cause resource damage including hydrophobic soils that can lead to problems with infiltration, allowing the water to run off the surface and carry debris and other material with it. The immediate and post-fire effects of the 2003 fire included raised levels of sedimentation into the creek and in the short-term, poor tasting water – this raised concerns about future wildfires in this drainage and those adjacent. In addition, the drainage is oriented with the prevailing wind direction, thus another concern is the citizens living downwind.

Reducing the risk of unwanted wildfire in the watershed is a goal of the Myrtle HFRA project. Generally fire risk is associated with the likelihood an ignition will occur (Brown, Reinhardt, Kramer, 2003). Therefore, fire and fuels for each alternative were analyzed by the following measurable indicators associated with the affected environment.

Table 4.29 Fire and Fuels Objectives and Indicators

Objective	Indicator and Measurement
Reduce Fuels	Surface Fuels measured as Fuel Model 10 vs. Fuel Model 8
	Ladder Fuels and Crown Fuels
Reduce risk of unwanted fire and improve fire adapted ecosystems	Fire behavior prediction (flame length, rate of spread, fire type)
	Improvement of Condition Class – measured by treated acres
Reduce risk of unwanted fire to life and resources	Suppression Capabilities

4.3-A Scope of Analysis

The direct and indirect effects of the alternatives from the perspective of fire and fuels management were analyzed for National Forest System lands within the Myrtle HFRA project area. The cumulative effects of the alternatives in relation to fire and fuels management were analyzed across all ownerships within the Myrtle HFRA project area, including the proposed treatment and adjacent areas which include portions of Snow Creek as well as Myrtle Creek.

Fuel Treatment:
Manipulation or removal of fuels such as, lopping, chipping, crushing, piling and burning to reduce the likelihood of ignition and/or lessen potential damage and resistance to control (FSM 5105)

4.3-B Methodology Used to Identify Effects and Environmental Consequences

The proposed treatment area was assessed as to the condition of the fuels, the location in the drainage, and the locations of fuels treatments that will achieve the greatest reduction in fire risk to the resources associated with the municipal watershed (determination made by District Fire Management Officer, Fuels Planner, and Project Team Leader).

For the purpose of identifying the effects for the alternatives, the potential fire behavior associated with a Fuel Model 10 in the proposed treatment area, was compared to the potential fire behavior associated with a Fuel Model 8, and the resulting change in fuel characteristics such as crown base heights, canopy bulk density, canopy cover, and surface fuel load.

Fuel Model 10 (current condition; also the result of the No Action alternative).

Fuel Model 8 (this is the target fuel model for treated fuels, which would be achieved with the action alternatives).

4.3-B.1 Fire Behavior Prediction Modeling

Fire behavior prediction models are useful to assist in management decisions for planning fuels treatment priorities or making decisions on suppression tactics for wildfires. Surface fire behavior models and models that link surface and crown fire behavior were used to predict fire hazard (unwanted crown fire, flame lengths, rate of spread, suppression capabilities) specific to the analysis area. Model capabilities, limitations, and assumptions, as well as data used, and outputs are described later.

For the purpose of this analysis, several models were used to compare the effects of Alternative 1[•] with Alternative 2 and Alternative 5 on the following factors:

- Expected fire behavior and Potential for Crown Fire by Alternative
- Suppression Capabilities by Alternative based on fire behavior
- Improvement in Condition Class by Alternative

Several indicators were used to evaluate the potential for crown fire and suppression capabilities between the alternatives. The first to be discussed are:

- Flame Length
- Crown Fire Hazard

Flame length is the first indicator; direct suppression tactics are limited and the potential for crown fire initiation increases or decreases depending on the surface flame lengths. For example, flame lengths less than four feet can be effectively attacked using hand crews to construct direct fireline. However, flame lengths greater than four feet require other tactics for suppression, such as direct attack by equipment or aerial resources (the availability of which can be limited during fire season) or indirect attack, which raises safety concerns to firefighting resources (Fireline Handbook, NWCG 1993 p. B-59).

The effects of crown fires are longer lasting and more severe than surface fires, thus learning as much as possible about them is a priority for fire managers (Scott and Reinhardt 2002). *Crown fire* hazard was analyzed for both the treated and untreated fuels, based on crown base heights and the 20-foot winds (winds measured at 20 feet above the upper layer vegetation) necessary to initiate and sustain crown fire (torching and crowning indexes).

3 Key *Fuels* Factors for Crown Fire

- How much surface fuel?
- How close are the tree crowns to the ground?
- How dense are the crowns?

High flame lengths coupled with low aerial fuels and tree crowns (CBH – canopy base heights) and high winds can lead to crown fire behavior; the flames are greater than the void between the surface fuels and the aerial fuels (crown fuels).

[•] Alternative 1 is the No Action Alternative and represents the effects of taking none of the management actions proposed with this project. Alternative 2 (Proposed Action) would treat approximately 2086 acres; Alternative 5 would treat approximately 865 acres. See Chapter 2.

Once a fire has moved into the tree canopy, the density of the tree crowns will influence whether or not a crown fire persists, or the fire moves back to the surface. Dense canopies allow a fire to move from one tree-top to the next, especially if there is wind driving the fire. Crown fires have a high resistance to control and direct attack tactics are ineffective in stopping the spread of these types of fires. Crown fires often display unpredictable and erratic behavior. Changes in topography, weather, or fuels (fuels being the contributor to fire behavior that can be managed) are necessary to bring these fires under control.

As one of the overarching goals of this project is to reduce fire hazard to ultimately protect the municipal watershed so there is clean water for the city into the future, mitigating unwanted fires is crucial. In this case, crown fires are considered unwanted because the effects to water and soil resources, thus the municipal water supply, can be severe.

Nearly 50 percent of the proposed treatment units are on dry sites dominated by ponderosa pine, larch, and Douglas-fir in the overstory. Over the last century, stand structure and fire behavior have been altered in these dry forest types (Pollet and Omi 2002). Mortality due to competition and other factors, is contributing to uncharacteristic vegetative conditions trending these stands further from natural condition. As mentioned, fires in these forest types are burning hotter and with more intensity than they did in the past (Arno and Fiedler 2005). Thus, allowing these forest types to burn is not a viable option, especially if the project objectives are a perpetual supply of clean water, protection of fish and wildlife habitat, and reduced risk of high severity or unwanted fire.

a. Fire behavior and growth models

For this analysis, fire behavior prediction models were used to predict fire hazard (crown fire) and suppression capability indicators such as flame length, rate of spread, and crowning index for all three alternatives. A fire growth model was also used during the collaboration phase with the Kootenai Valley Resource Initiative (KVRI) to show the difference in fire growth across time and space between treated and untreated fuels, given the same set of weather and topographic inputs. All models used require at least basic user inputs on fuels, including fuel models and fuel moistures, weather conditions, and topography, such as slope and aspect.

Fire Area Simulator – FARSITE

Many fire behavior prediction models are one dimensional, generally showing the behavior of fire at a particular space on the landscape. Two-dimensional models show fire growth and behavior through space *and* time. *FARSITE* (Fire ARea SImulaTor) is a fire growth model incorporating existing surface fire behavior models, crown fire behavior models, spotting, point-source fire acceleration, and fuel moisture (Finney 1998). It was used in the early analysis to assist in determining the need for hazardous fuels reduction and treatment activity placement to most effectively reduce the potential of large fire development and extreme fire behavior in the Myrtle Creek watershed. The analysis was based on fire spread direction dictated by weather (wind direction), fuels, and topography,.

The original intention of using *FARSITE* was to demonstrate fire growth prior to treatment across the landscape, from a variety of hypothetical ignition locations throughout the analysis area, for two different sets of weather conditions and fire dangers. The two conditions were 1) weather indicative of a more moderate fire season, such as 2004, and 2) weather leading to high fire danger, such as in 2003. Confidence was gained in the model accuracy by calibrating it to the Myrtle Creek Fire in 2003.

FARSITE is supported by GIS. For the analysis area, elevation, slope, and aspect grids were created in ArcView from a digital elevation model to be imported into the *FARSITE* landscape. Fuel models, canopy coverage, canopy bulk density, canopy base heights, and stand heights were also developed from stand-level vegetation attributes to be imported into *FARSITE*. Weather, wind, and fuel moisture data are also necessary to condition the fuels and provide a more accurate example of fire behavior over the time frame established for the *FARSITE* run.

The vegetation layer is an important component of the *FARSITE* landscape. When used to compare the current fuels condition with that of treated fuels within the project area, the general findings were that fire behavior would be increased (flame lengths, rate of spread, crown fire potential) in the untreated stands, all other factors being held constant. These comparisons were repeated using the same values for weather and topographical features for both treated and untreated scenarios. Untreated fuels, on average, had a greater crown bulk density and higher canopy coverage while having lower crown base heights, and for the most part were considered a Fuel Model 10 due to the amount of down-woody material and other surface and aerial fuels.

Crown bulk densities, canopy coverage, stand heights (average heights of the overstory vegetation), and crown base heights were first estimated in collaboration between a district assistant fire management officer, fire behavior analyst, and district fuels specialist and based on information obtained in the field and knowledge from local fuels managers (October 2004 and April and May 2005 – field notes available in project file). Further refinement of these estimates took place as the project progressed.

Two post-treatment landscapes were created: the proposed action – 2080 acres converted to fuel characteristics consistent with a Fuel Model 8, and the second action alternative – 860 acres converted to a Fuel Model 8, where the critical crown fire factors such as canopy bulk density and canopy cover decreased, while the crown base heights increased, creating more void between

the surface and aerial fuels. (The model inputs a value for surface fuel dependent on the fuel models selected across the scenario landscape.)

Random ignition locations (to simulate the unpredictable nature of lightning ignitions in the project area) were selected on the *FARSITE* landscapes and duplicated in the same locations for both the treated and untreated scenarios. Files created in GIS can be imported into the FARSITE landscape, thus a roads layer was used to simulate human ignitions from heavily used roads. As mentioned, ignitions showed increased fire behavior in untreated fuels when compared to the same location having been treated. Images for comparison of fire growth are shown later in this section of Chapter 4.

These models do not predict whether a fire will occur on the landscape, nor were they used to estimate the probability of a fire ignition. The models were only used to depict fire behavior as if a fire were to occur – as tools to compare the alternatives. Models are, by definition, "an example for imitation or emulation" (Merriam-Webster online, http://www.m-w.com). They are limited, as the real world is dynamic and forest conditions are continually changing. It is understood that certain factors, such as daily weather conditions will not be exact to the values used in the model.

The following are example outputs for a FARSITE simulation – the first is data for a portion of the fire perimeter that is in a Fuel Model 8 and the second example is for data queried in a Fuel Model 10. Other outputs are available in the project file.

Table 4.30 Fire and landscape data from a *FARSITE* simulation in Treated Fuels.

Land and Fire Data	
X: 536629	Y: 5396219
Landscape Data	
Elevation (m)	1217
Slope (%)	19
Aspect (^{o})	5
Fuel Model	***8***
CBH (ft)	6.0
CBD (kg/m^3)	0.110
Fire Data	
Status	Active
ROS (ft/min.)	0.2
FLI (BTU/ft/s)	6.4
FL (ft)	0.3
HPA (btu/ft^2)	1856.4

Table 4.31 Fire and landscape data from a *FARSITE* simulation in Untreated Fuels

Land and Fire Data	
X: 537306	Y: 5396138
Landscape Data	
Elevation (m)	987
Slope (%)	35
Aspect (^{o})	30
Fuel Model	***10***
CBH (ft)	1.0
CBD (kg/m^3)	0.250
Fire Data	
Status	Active
ROS (ft/min.)	1.4
FLI (BTU/ft/s)	644.9
FL (ft)	2.9
HPA (btu/ft^2)	28,129.1

The table on the right shows queried data where the "fire" was burning through a Fuel Model 10 with the following characteristics:

canopy base height (CBH) is 1.0 foot, and
canopy bulk density (CBD) is 0.25 kilograms per cubic meter (kg/m3) (CBD is described in more detail later).

The associated fire data is as follows:

rate of spread (ROS) of 1.4 feet per minute,
fire line intensity (FLI) of 644.9 BTUs per feet per second,
heat per unit area (HPA) is 28129.1 BTUs per square foot of the flaming front, and
flame length (FL) is 2.9 feet.

A CBH of 1.0 foot coupled with a flame length of 2.9 feet means the fire will move into the tree crowns. If the fire were to remain a surface fire, direct attack suppression would be possible; however, once the fire moves into the crowns of the trees, direct attack would no longer be an option. Compare those values to Fuel Model 8, in the table on the left.

NEXUS

In NEXUS (an Excel™ spreadsheet), existing models of surface and crown fire behavior are linked to produce a system to assess the potential for crown fires at the stand level. It shows fire behavior at a particular point and does not predict fire behavior across a landscape (is not spatial). Inputs include: fuel model, dead and live fuel moistures, wind direction and speed, slope, canopy description (canopy fuel load, canopy base height, bulk density), and additional multipliers. NEXUS is useful for the following:

evaluating alternative treatments for reducing crown fire risk, and
assessing the potential for crown fire activity.

One of the objectives of the fire and fuels analysis is to reduce surface fuels to alter fire behavior in the event of a wildfire in the project area. One measure that has been described previously, is changing the fuel model of the treatment areas from a Fuel Model 10 (timber with heavy surface fuels) to a Fuel Model 8 (timber with light surface fuels). Surface fire prediction models give outputs of reduced fire behavior (such as lower flame lengths, slower rates of spread, and greater winds required to move a surface fire from the surface fuels to the crown fuels), as a result of removing ladder fuels, increasing the crown base heights, and opening the tree canopies.

BehavePlus (Version 2.0.2)

BehavePlus uses a minimum amount of site-specific input data to predict fire behavior for a point in time and space (i.e., spatially-explicit data layers are not used). The primary modeling capabilities of BehavePlus are:

surface fire spread and intensity,
safety zone size (for firefighting resources),
size of a point source fire,
fire containment,
spotting distance,
crown scorch height,
tree mortality, and
probability of ignition from fire brands or from lightning.

Use of NEXUS and Behave Plus

- For both BehavePlus and Nexus, surface fuel loading defaults within the model were used
- Depending on desired outputs, model inputs can be limited, but always include user defined information on the three factors contributing to fire behavior - fuels, weather, and topography. The period of burn time is usually short.
- Basic assumption: prediction of fire behavior originating from a point source and burning on flat, level terrain, or where the wind is parallel to the slope, plus or minus 30 degrees.

FlamMap

Fire behavior indicators such as crowning index, flame length, and rate of spread are helpful in determining risk of value loss due to wildfire. FlamMap software creates raster maps of the following characteristics over an entire *FARSITE* landscape:

potential fire behavior characteristics (rate of spread, flame length, crown fire activity, etc.), and
environmental conditions (mid-flame winds, dead fuel moistures).

It uses the same data as *FARSITE*, but does not replace *FARSITE* (or a fire growth simulator) because there is no temporal component to FlamMap (only spatial), so it creates fire behavior characteristics at one instant. FlamMap incorporates several fire behavior prediction models such as Rothermel's surface fire model (1972), Van Wagner's crown fire initiation model (1977), Rothermel's crown fire spread model (1991), and Nelson's dead fuel moisture model (2000) (www.fire.org).

For the purposes of this project, FlamMap was used in the early collaboration phases to provide a visual display of the potential for crown fire and flame lengths dependent on certain fuels, weather, and topographical data. After the alternatives were defined, FlamMap was used to compare fire behavior indicators (potential crown fire, flame length) between the alternatives. Examples of the outputs and maps that can be created using this software are available in the project file.

FlamMap calculates fire behavior characteristics cell by cell, the crown fire activity or flame length of any cell is independent of any adjacent cells. This means active crown fire cannot "spread" cell to cell and spotting is not modeled in FlamMap.

Forest Vegetation Simulator – Fire and Fuels Extension (FVS-FFE)

The Forest Vegetation Simulator (FVS) is the USDA Forest Service's nationally supported framework for forest growth and yield modeling. Local variants of the model (Northern Idaho, Inland Empire) were used to model current and future conditions of stands in Alternative 1 and Alternative 2.

The Fire and Fuels Extension (FFE) of FVS was used with selected stands with inventory data in FSVeg database for the following analysis:

to simulate fire behavior and affects on simulation stands,
to identify current fuels conditions,
conditions before and after treatments, and
conditions into the future.

FVS-FFE was primarily used to analyze typical stands by forest type in the project area to:

model expected mortality in the case of a wildfire.

Mortality data was used for severity estimates in the Fire Regime Condition Class analysis. (Modeling results in fire and fuels section of the project file.) Missing or inaccurate data will affect the applicability of the model.

4.3-B.2 General Limitations of Fire Behavior Models

- Model Applicability
  - Continuous, uniform, and homogeneous fuel beds.
  - Many models do not estimate fire spread from firebrands or embers.
  - Fire whirls and other fire-induced disturbances are not modeled, however, they are usually expected with extreme fire behavior.
- Accuracy of Data
  - Some models may be highly sensitive to certain parameters such as wind speed or fuel moisture – the accuracy of the outputs may be highly dependent on the accuracy of the input

4.3-C Environmental Consequences

4.3-C.1 Effects Common to All Alternatives

a. Fuel Accumulation

Regardless of the alternative chosen, fuel build-up will continue indefinitely in the Myrtle HFRA project area and proposed treatment area as stands go through successional changes and disturbance regimes. An action alternative (Alternative 2 or Alternative 5) would reduce fuels in the near-term and future entries would be needed to control fuels accumulation into the future. The No Action Alternative would not address the current fuels and the affected area would be at elevated risk of a large, uncontrollable (unwanted) wildfire, due to increased fire intensity associated with higher fuel loads, which would hamper fire suppression efforts. One of the main objectives for the Myrtle HFRA project is to protect resources in the wildland urban interface (the municipal watershed) from the effects of intense and severe wildfire.

b. Probability of Ignition

Probability of ignition is strongly related to the following characteristics (Graham, McCaffrey, Jain, 2004):

fine fuel moisture,
air temperature,
shading of surface fuels, and
an ignition source.

Implementation of a treatment alternative will not affect the likelihood of lightning strikes; however the risk of human caused fires may increase to some degree depending on how completion of the chosen alternative affects public access and use in the area. Regardless of the alternative chosen, ignitions would still be expected across the proposed action area, because fuels would be reduced, not removed completely. Altered stand structure can affect stand temperature and humidity – there is generally a warmer and dryer microclimate in more open stands (Graham, McCaffrey, Jane 2004). Dense stands, such as those in Alternative 1, generally have more shading of the surface fuels and higher relative humidity and air temperature (thus, higher surface fuel moistures) (Graham, McCaffrey, Jane 2004).

An open forest structure would have contributed to the maintenance of ponderosa pine and other fire-dependent forests – where fire starts may have been common due to an increased probability of ignition, but intensities and severities were generally lower due to maintained surface fuels. Alternative 2 would aim to mimic these surface fuel conditions. Even with a fire start in areas treated under the proposed action, fire spread would be expected to decrease due to projected slower rates of spread and lower flame lengths. In the case there is an ignition and resulting wildfire, spotting that accompanies crown fire may be reduced because of modified surface, ladder, and canopy fuels.

c. Access for Suppression Resources

Success in initial attack relies heavily on arrival time at a fire. Well maintained roads allow for safer travel and allow for a variety of resources to support a fire, including the larger Type 4 engines (750 gallons of water) used on the Bonners Ferry Ranger District. Although road maintenance will be necessary to accomplish treatments, no new permanent roads are proposed for this project, thus access routes for suppression resources will not change. However, an open canopy and reduced surface and ladder fuels allow for quicker and safer foot travel to and from wildfires not accessible by an engine or other vehicle.

d. Influence of Topography and Weather on Fire Behavior

There are two contributing factors to wildfire behavior that cannot be controlled regardless of the action taken or alternative chosen for this project – the topography (elevation, aspect, parent material, etc.) of the project area, and the daily and seasonal weather contributing to fire danger. However, modification of fuels can affect microclimate, especially wind and solar radiation, influencing surface fuel moistures.

The Myrtle Creek drainage is oriented with the prevailing wind direction - typical winds are light to moderate from the southwest. Strong winds are generally associated with cold fronts, which can have an effect on fire behavior due to shifts in wind direction and downdrafts. Late afternoon winds tend to funnel down the Myrtle Creek drainage. This orientation to the wind may aid in fire spread. More open stands created with fuels treatments would generally have greater surface winds than adjacent dense stands, affecting rates of spread and fire intensities based on that factor alone. However, the effect to fire behavior caused by the increased wind is offset by the effect of reduction in the fuel load.

Slopes range from gentle to steep (30-80%), as does elevation from approximately 2100 feet (creek bottom) to 5500 feet (ridgetops). There are steep slopes on both sides of the creek, which can contribute to "rapid upslope runs," (Myrtle Creek Fire Behavior Report, 2003) as was the case for the Myrtle Creek Fire – this would be a particular concern on south facing aspects where fuel moistures are the lowest.

4.3-C.2 Direct and Indirect Fire and Fuels Effect for Each Alternative

The following table summarizes the effects within the analysis area. Fire behavior indicator values are for periods of high fire danger – a hot and dry year.

Table 4.32 Summary of Direct and Indirect Effects for Each Alternative, by Indicator

Indicator	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 5
Condition Class			
Improvement in Condition Class (Acres)	0	2,080	860
Fire Risk – Crown Fire Hazard			
Potential Flame Length (feet)	29	1.3	1.3
Canopy Base Height (approx feet)	1	6	6
Canopy Bulk Density (approx kg/m^3)	0.30	0.15	0.15
Predicted Fire Type•	Crown Fire	Surface Fire	Surface Fire
Area Treated (approx acres)	0	2080	860
Potential Rate of Spread (chains/hr)	68.6	2.5	2.5
Fuels			
Fuel Model	10	8	8

• The Fire Type indicator displays the predicted type of fire that would occur if a fire burned in the treated and untreated areas. The amount of treatment (acres) displays the portion of the landscape where there would be a change in predicted fire type as a result of fuel reduction treatments.

Risk to Life and Resources – Suppression Capabilities			
Direct Attack by Hand Crews	No	Yes	Yes
Production Rates	Low	High	High
Fire Severity▪	Mod-High	Low	Low

Table 4-32 Continued

In relation to fire, the environmental consequences of No Action in the project area increase or decrease depending on the fire risk – the likelihood of a fire start, especially during periods of high fire danger, and the related fire behavior. Any level of risk, whether wildfire risk or other, is associated with some level of uncertainty. In this case, that uncertainty comes from the inability to predict where an ignition will occur on the landscape. Due to roads, trails, and multiple ownerships, there is a risk of human caused fires in the project area. During fire season, when the weather is hot and dry, thunderstorms can be common and lightning strikes may well lead to positive ignitions and wildfire. Archives reveal that lightning caused wildfires have occurred across the landscape, at both high and low elevations and on all aspects.

For the Myrtle HFRA proposed action, the first step in analyzing risk, was to look at fire occurrences throughout the municipal watershed or analysis area. Location, size, and cause of wildfires have been recorded since 1941 on the Bonners Ferry Ranger District. Since records have been kept, there have been 11 known fire starts within the proposed treatment area; 81 known in the entire project area. The map below gives a visual representative of the locations where these fires have started, and that fires were common across the collective area, regardless of elevation or aspect – they occur at the headwaters as well as low in the drainage. Therefore, the question becomes not if and where a fire will start, but when. Ninety-four percent of these fires were ignited by lightning – providing evidence that fire was naturally occurring throughout the drainage. Had suppression not occurred, these fire starts may have been adequate to maintain the historic fire regimes.

Table 4.33 Myrtle HFRA Project Area Fires and Causes

81 Fires Originating in Myrtle HFRA (1941 – 2005)			
Lightning Caused	94%	Originating on Private Land	17%
Human Caused	6%	Greater than 10 acres	2%

▪ Fire Severity – A product of fire intensity and residence time (the time in seconds, required for the flaming front of a fire to pass a stationary point at the surface of the fuel = the total length of time that the flaming front of the fire occupies one point). Generally greater in a Fuel Model 10 as compared to a Fuel Model 8 due to the presence of heavy down woody material that contributes to longer burn periods and smoldering (Brown, Reinhardt, Kramer, 2003).

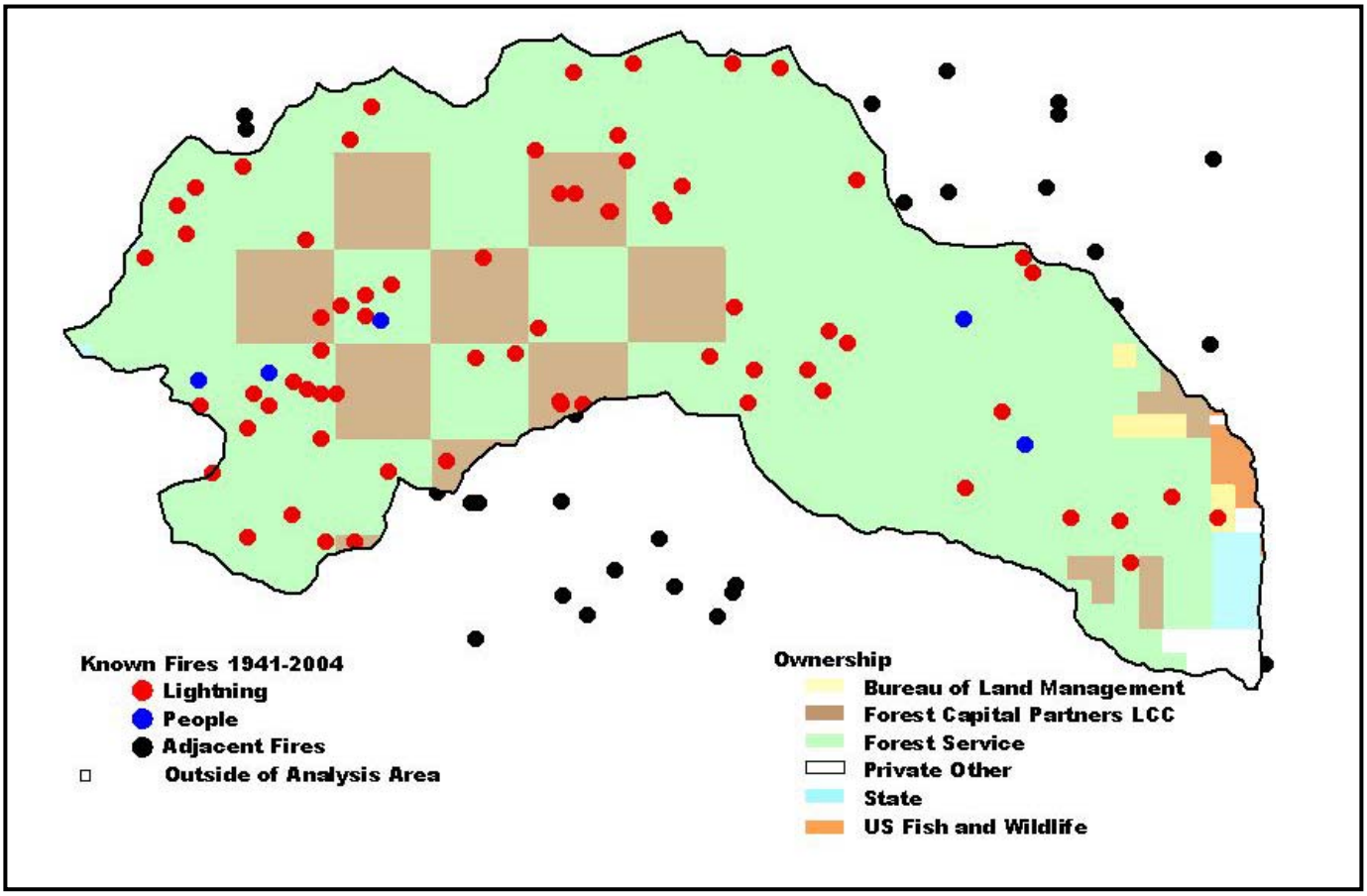


Figure 4.1 Known Fire Occurrences (1941-2005)

Fire ignition locations (colored dots) are not to scale in terms of size of fire. The majority of these fires were suppressed to a size of less than 5 acres. Only 2% grew to be larger than 10 acres, including the Myrtle Creek Fire in 2003 that was 3,200 acres.

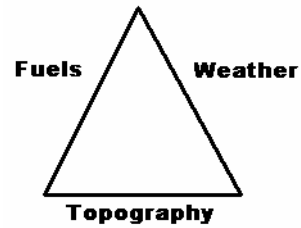
The 1926 fire started in the Caribou Creek drainage south of Snow and Myrtle Creeks and moved north through the proposed treatment area (see Figure 3-9 in the Vegetation section of Chapter 3). The Myrtle Creek Fire in 2003 burned comparable, moving north towards the next drainage. Changes in weather that brought rain stopped the fire short of this happening. Archived fire data show similar burn patterns through these landscapes due to steep topography, wind patterns, and fuel arrangements. This knowledge is critical in consideration of including the dry site stands on the south aspects of Myrtle Creek and Snow Creek for treatment in order to reduce fire behavior and slow the rate of spread as a wildfire moves north.

The primary effects of failing to implement the proposed action are indirect and cumulative. These include the continuation of surface fuel accumulation through mortality that would occur naturally or that may be exacerbated by competition. Approximately half of all western forests have missed natural fire cycles, while at the same time being altered by logging activities. This alters fire behavior and further removes fire regimes from what they were historically. Thus, lightning fires today burn hotter and cause greater mortality than historic fires (Arno and Fieldler 2005). The proposed action includes 83 acres of allocated dry forest old growth and 159 acres of potential dry forest old growth.

Two dry-site old growth stands are included in the proposed treatment for fuels reduction. These two stands are among the furthest removed from historical fire regime of any in the proposed treatment area. Ponderosa pine dominated (dry) sites are experiencing fire behavior today that was uncommon in the past. Historically, these areas burned as non-lethal, low-intensity surface fires, with patches of mixed and high-severity (see Vegetation sections of Chapter 3 and 4). Recent fire seasons (2000 – 2003), have shown that these forests are now among the most susceptible to crown fires – stand replacing fires – and are burning as mixed or lethal fires (potentially more than 90% overstory mortality). In addition to the increased probability of lethal fire occurring in these old growth stands, the IPNF Forest Plan guides the development of the Fire Management Plan with standards for fire suppression in designated old-growth stands that will prevent a loss of old-growth due to fire (IPNF Forest Plan page II-38). Thus letting a wildfire burn in these areas, especially under periods of high fire danger when mortality of overstory trees is a concern, is not an option for management.

The vegetative structure and function in this watershed tells us a lot about the fire behavior and control problems we can expect to witness with the current conditions, depending on where a fire starts on the landscape and the associated weather. There are three general influences on fire behavior – fuels, weather, and topography ("the fire triangle").

Fire Behavior Triangle: Weather, Topography, and Fuels



There are three main influences to the behavior of wildland fire – the available fuels, the weather (weather leading up to and during a fire), and the topography. Daily and seasonal changes in weather play a large role in wildfire risk, as does topography – slope, elevation, and aspect. In addition, the amount, structure, and composition of forest fuels will influence fire burn patterns, combustion periods, flame lengths and rates of spread, potential for crown fire, smoke emissions, etc.

- **Weather**

Many weather factors contribute to high fire danger – low relative humidity, high temperatures, high winds, long-term drought leading to the curing of fine fuels, etc. For example, prior to the Myrtle Creek Fire of 2003, extremely hot and dry weather for the year, and a prolonged drought (average rainfall is generally 22 inches/year and for the three years leading up to the fire it was averaged at 14.6 inches), cured the grasses and brush and dropped the fine dead fuel moistures to single digits for all categories. Fire danger, based on the energy release component (described later), was very high to extreme just prior to the start of a fire and during the first few days.

Fuel moisture and wind speeds are critical weather factors influencing the behavior of surface fires and the transition to crown fire (especially wind speed) (Scott and Reinhardt 2001). As mentioned, modifying the structure of the proposed treatment units will change how weather factors affect the remaining fuels. Removing canopy fuels will reduce the moderating effect of canopy on wind speed, so surface winds will likely increase in treated units under the proposed action. Scott and Reinhardt (2001) addressed this issue:

> "The increased fuel-level wind speed coupled with increased insolation also leads to lower dead fuel moisture in treated stands during summer. These two factors tend to exacerbate surface fire behavior. However, properly executed treatments also tend to reduce the crown fire potential. Crown fire mitigation treatments often represent a tradeoff - the decrease in crown fire potential comes at the expense of increased surface fire spread rates and intensity. The greatly increased spread rate and intensity of crown fires makes this tradeoff reasonable."

Because changes in fire behavior for successful suppression and reducing the potential for unwanted fire (crown fire) are key measurement indicators for this analysis, crown fire prediction modeling was used to determine the wind necessary to transition a fire to a crown fire (torching index) and sustain a crown fire (crowning index) under both Alternatives – results are shown on the following pages. The following weather data was used in fire behavior prediction modeling (conditions recorded at the Bonners Ferry Weather Station #101001 on 8/30/2003 (dry year) and 2004 (normal year).

Table 4.34 Fire Danger Weather Conditions used in fire behavior modeling

	"Dry" Conditions	"Normal" Conditions
1 hr fuels	4 %	5 %
10 hr fuels	5 %	8 %
100 hr fuels	9 %	17 %
1000 hr fuels	13 %	20 %
Woody	97 %	157 %
Herbaceous	85 %	145 %
Wind (eye level)	2 mph	4 mph
Temperature	85° F	85° F
Relative Humidity	15 %	30 %

- **Topography and its influence on fire behavior**

Topography will dictate, to a large degree, the influence the weather will have on the fuels. For example, north aspects in this region are generally moist because they do not receive direct sunlight, thus fuel moistures tend to be higher and there is a greater abundance of fuels. Slope is a huge contributor to fire behavior because fires will generally extend uphill with greater rates of spread, the more steep the slope. Natural barriers such as creeks, talus slopes, and rocky outcrops can aid in suppression by serving as fuel breaks. There are few natural fuel breaks within the project area (Myrtle Creek Incident Final Narrative, 2003). No permanent roads or other changes to the topography are being proposed, therefore, there will be little change in fire behavior between the alternatives due to topography.

- **Fuels**

  Of the three main factors influencing fire behavior, only the fuels can be truly modified or controlled by forest managers. Fuels can be managed to modify the following characteristics to decrease the probability of extreme fire behavior in the event of a wild land fire:
  - volume and spacing of both surface and aerial fuels,
  - the structure of those fuels, and
  - the vegetative composition (for example, choosing to manage for fire adapted tree species over those non-adapted to fire).

  Fuels in the proposed treatment area are generally heavy, abundant, and continuous (see field notes in project file). Alternative 1 proposes no treatment to modify fuel structure within the analysis area with this assessment and Alternative 2 and Alternative 5 propose modifying fuel structure in surface, ladder, and aerial fuels in the proposed treatment units on approximately 2086 and 865 acres respectively, as described throughout the remainder of this section.

Forest Fuels and Fire Behavior, Including Crown Fire Potential

One way to measure fire hazard is by the potential of a surface fire to transition to a crown fire. Depending on the forest type and its structure, certain fuels reduction activities, such as thinning, can have both positive and negative effects on crown fire potential (Graham et. al. 1999). Crown bulk density (the density of the small twigs and needles (Arno and Fiedler 2005)), surface fuel, and canopy base heights are stand characteristics that generally determine the potential for crown fire (crown bulk density and canopy base heights explained in depth below). Crown thinning that maintains multiple layers of the crown or individual tree selections will not reduce the risk of crown fires "except in the driest ponderosa pine (pinus ponderosa Dougl. Ex Laws.) forests" (Graham et al 1999). In addition, unless the surface fuels created from these thinnings are treated, intense surface wildfires may result, negating positive effects of reducing crown fire potential. The best general approach for managing wildfire damage seems to be managing tree density and species composition with well-designed silvicultural systems that include a mix of thinning, surface fuel treatments, and prescribed fire (Graham et al 1999). All three of these types of silvicultural systems would be chosen for treatment to some degree, to manage tree density and treat surface and aerial fuels, by implementing a fuels reduction alternative.

The torching and crowning indexes are also important – the torching index is the 20-foot wind necessary to transition a fire from the surface fuels into the fuel canopy and the *crowning index describes the 20-foot windspeed necessary to maintain a crown fire once the fire reaches the canopy (Arno and Fiedler 2005).* Random fuel treatment arrangements are extremely inefficient in changing fire behavior, requiring perhaps 50 to 60 percent of the area to be treated compared to 20 percent when treated in a strategic fashion (Finney, 2001).

As previously described, most of the untreated fuels within the proposed treatment area can be classified as a Fuel Model 10, where the fuels characteristics are generally greater than they would be in a treated stand. Ladder fuels (regeneration and suspended dead woody material) will be removed, as will some of the live surface vegetation (brush and small diameter trees) and dead material (branch wood and large diameter woody material) that provide an avenue for fire to move into the crowns of individual trees or groups of trees. Commercial timber harvest will space the tree crowns, thus the probability of a passive crown fire (single and group tree torching) becoming active decreases because there is no path for fire to move from one tree to the next, except under very high winds (See - Comparison of Alternatives for Fire Behavior Characteristics - following page).

a. Surface Fuels and Fire Severity

Where historic fire return intervals have been skipped – specifically in the frequent, low-intensity fire regimes – it is often the ground fuels (duff, roots, and buried woody material (Graham et al 2004)) that contribute to severity. In some cases the duff loading is four-times heavier than historic duff loads (Smith and Fischer 1997). This is the case in the Myrtle HFRA project area where fire regimes are most removed from natural range and these duff layers have accumulated around the base of trees from falling needles and bark, as in the figure below.

Figure 4.2 Example of duff and litter build-up around base of ponderosa pine.

In the event of a fire, these duff layers hold heat and can smolder for long periods of time. Soil damage, tree mortality, and smoke impacts can occur during these long durations of smoldering (Graham et al 2004).

Mixed-severity fire regimes, such as those that exist within the project area, encompass a wide range of fire severities, frequencies, and extents (Raymond and Peterson 2005). Because of the high variability, it is more difficult to measure the role of fire on the ecosystem than in ponderosa pine or Douglas-fir forests. However, the mature mixed-severity moist forests in the project area are dominated by fire-intolerant tree species such as western redcedar and western hemlock, so tree mortality and resource damage would be expected from wildfire burning during periods of high fire danger.

Alternative 1

When a fire occurs, the thick layer of fuels as described above can hold heat next to the base of the trees, causing damage to fine roots and boles of the trees. Alternative 1 proposes no treatment of this material and further build-up will continue. This will have both short and long-term affects on fire severity as well as fire intensity, as surface fuels will continue to accumulate in addition to what is already there. Surface fire behavior would be predicted to have potentially high flame lengths and high rates of spread.

Alternative 2

Alternative 2 would remove surface material around larger diameter leave trees before introducing prescribed fire, in order to decrease the risk of mortality occurring from surface fire. In the long-term, further treatment would be necessary as this material begins to accumulate around residual trees once again.

One effect from implementation is increased surface fuels within harvest units in the short-term – after harvest but prior to surface fuels treatments such as slashing then grapple-piling and/or underburning. These increases in fuel loadings would consequently increase the potential flame lengths and surface rates of spread in these areas in the event of a fire before treatment was completed.

Alternative 5

Alternative 5 would accomplish similar treatments of fuels as Alternative 2, however, on only 40% of the area compared to Alternative 2. This alternative leaves out approximately 900 acres of critical treatment on south aspects – areas historically prone to the rapid movement of fire through this portion of the Selkirk Mountains. Archives show that wildfire tends to move

north from one drainage to the next. As mentioned throughout several sections of this document, the 1926 fires behaved in this manner. This alternative would have positive effects on the reduction of surface fuels where treatment occurred, however, it would leave an additional 1320 total acres of heavy fuels untreated in locations where fast rates of spread and high flame lengths would be expected.

b. Crown Fuels and Ladder Fuels: Canopy Bulk Density and Canopy Base Heights

Determining the susceptibility of stands to crown fire and designing treatments to mitigate the potential damage that crown fires can create, are priorities for fire and fuels management (Scott and Reinhardt 2002). **Canopy bulk density** is the dry weight of the available fuels per unit of canopy volume, including the spaces between the tree crowns. The most open stands, where there is no canopy, have a CBD of zero. The high end of the range is 0.4 kg/m^3 occurring in the densest stands (Scott and Reinhardt 2002). **Canopy base height** is the lowest height above the ground at which there is enough available canopy fuel to propagate fire vertically into the tree crowns (Scott and Reinhardt 2002). The lower the canopy base heights (the closer they are to the surface fuels), the greater the risk of the fire moving into the crown fuels.

Alternative 1

The analysis between Alternative 1 and Alternative 2 has focused on the fuels as a Fuel Model 10 compared to a Fuel Model 8; respectively; a Fuel Model 10 typically being dense with ladder fuels and low growing canopies and heavy surface fuels. The CBD will be greatest in these untreated, dense stands, thus there is more available canopy fuel to burn in the flaming front of a crown fire. CBD was estimated at 0.3kg/m^3 for untreated stands with heavy canopy fuels (determination by recommendations from Scott and Finney, IDT communications). The canopy base heights for Fuel Model 10 stands were averaged at 1 to 3 feet.

Alternative 2

Alternative 2 proposes to change the fuel structure and thus reduce the CBD by nearly half in most places (to 0.15kg/m^3), thereby reducing the available fuel to burn in the tree crowns by half. In addition, the CBH would be increased to a level where a surface fire would be unlikely to move into the crown fuels (raised to at least 6 feet), except under the most extreme conditions including hurricane-like winds. Effective fuel treatments in forested stands that have a large amount of fuel build-up generally "require" thinning in order to increase the CBH, increase the spacing between the tree canopies, and lower the CBD and "require a substantial reduction in surface fuel through prescribed fire or mechanical treatment or both" (Peterson et. al 2005). Alternative 2 proposes to do all of these types of restoration treatments in the proposed treatment area.

Alternative 5

Alternative 5 has some effects in common with Alternatives 1 and 2. Alternative 5 would reduce CBD and CBH to more manageable levels in a similar manner as Alternative 2. However, this treatment would occur on only 40% of the acres. Canopy fuels would remain heavy on 1320 acres as in Alternative 1. Canopy base heights estimated at 1 to 3 feet for those acres left untreated would remain to carry a surface fire into the tree crowns. Once there, a crown fire would be sustainable on untreated acres where the canopy bulk density remained high.

Although not measured, another positive affect to be noted is that treating some areas will affect the initiation of crown fire on adjacent untreated and dense stands. Surface fires burning with slower rates of spread and lower flame lengths in treated stands may not build-up enough intensity by the time the fire reaches stands normally susceptible to crown fire, to make the transition from surface fire to crown fire.

Table 4.35 Fuel Model Crown Characteristics Within the Proposed Treatment Area

Alternative	Fuel Model	CBH*	CBD**
1	10	1 to 3 feet	0.3 kg/m^3
2 and 5	8	Greater than 6 feet	0.15 kg/m^3

*****CBH (canopy base heights) approximated from field observations and used for modeling purposes.

**0.3kg/m^3 and 0.15kg/m^3 were used for the high end estimates of Fuel Models 10 and 8 (respectively) to simulate an obvious difference in canopy fuels prior to and post-treatment.

c. Fuel Model 10 (Alternative 1) vs. Fuel Model 8 (Alternatives 2 and 5)

To compare crown fire potential for the alternatives, NEXUS (Scott and Reinhardt 2001) was used to predict the torching and crowning indexes; relating to the 20-foot wind speeds necessary to initiate and sustain crowning. BehavePlus2 can predict surface fire spread including rate of spread and flame lengths as shown here, as well as probability of mortality, probability of ignition and spotting distance depending on parameters chosen. Fuel Model 10 was used for the untreated fuels (Alternative 1) and Fuel Model 8 was used for the treated fuels (Alternatives 2 and 5). The following conditions were used as constants for both fuel models:

- Temperature = 85°
- 20' Winds = 20 MPH - Moderate (reduced to eye-level variable on fire model)
- Slope = 40%

The following tables and figures display expected fire behavior parameters by alternative based on the fuel model and associated characteristics of that fuel model related to each alternative. The Map Appendix, Fire Maps, provide a visual of fuel models across the proposed treatment area for Alternatives 1, 2 and 5, respectively.

The following table provides an example of potential fire behavior characteristics as calculated from NEXUS (Scott and Reinhardt 2001).

Table 4.36 *Example* Comparison of Fire Behavior Characteristics in Treatment Area, by Alternative

Alternative	Fuel Model	Fire Behavior	Rate of Spread (chains/hour)	Flame Length	Torching Index	Crowing Index
1	10	Active*	68.6	29	0	9
2 and 5	8	Surface	2.5	1.3	149	24.9

*Active fire behavior is crown fire. Relative Humidity, microsite influences in fuels arrangements, etc. would influence fire behavior.

The following table basically means that in the proposed treatment area a crown fire could be initiated under the conditions found under Alternative 1 even with a high canopy base height (9.7'), a slow rate of spread (0.3 chains/hour), and a low flame length (1.2'). However, with the action alternatives, where treatment occurs it would take very low canopy base heights (1.1'), much faster rates of spread (31.3 chains/hour), or higher flame lengths (4.1') to initiate crown fire.

Table 4.37 Critical crown fire parameters – *Crown Fire Initiation*

Alternative	Fuel Model	Canopy Base Heights	Rate of Spread Ch/Hr	Flame Length
1	10	9.7	0.3	1.2
2 and 5	8	1.1	31.3	4.1

The following chart displays the differences in the predicted rate of spread of a fire burning in Fuel Models 10 and 8, and the differences during a year of normal weather (represented by 2004 conditions) and a year of dry weather (represented by 2003 conditions). Rate of spread in chains per hour is measured along the left side of the chart; open windspeed values are measured along the bottom of the chart.

The chart shows that the greatest rate of spread would occur in a Fuel Model 10 during dry weather. For example, with a windspeed of 3 miles per hour, the rate of spread would be approximately 13 miles per hour. During a normal weather year, the rate of spread would be approximately 3 miles per hour. In Fuel Model 8, there is very little difference in rate of spread between the normal year and the dry year (the two lines are practically one on top of the other). Windspeed also has very little influence on the rate, increasing only slightly as windspeed increases from 3 miles per hour to 15 miles per hour.

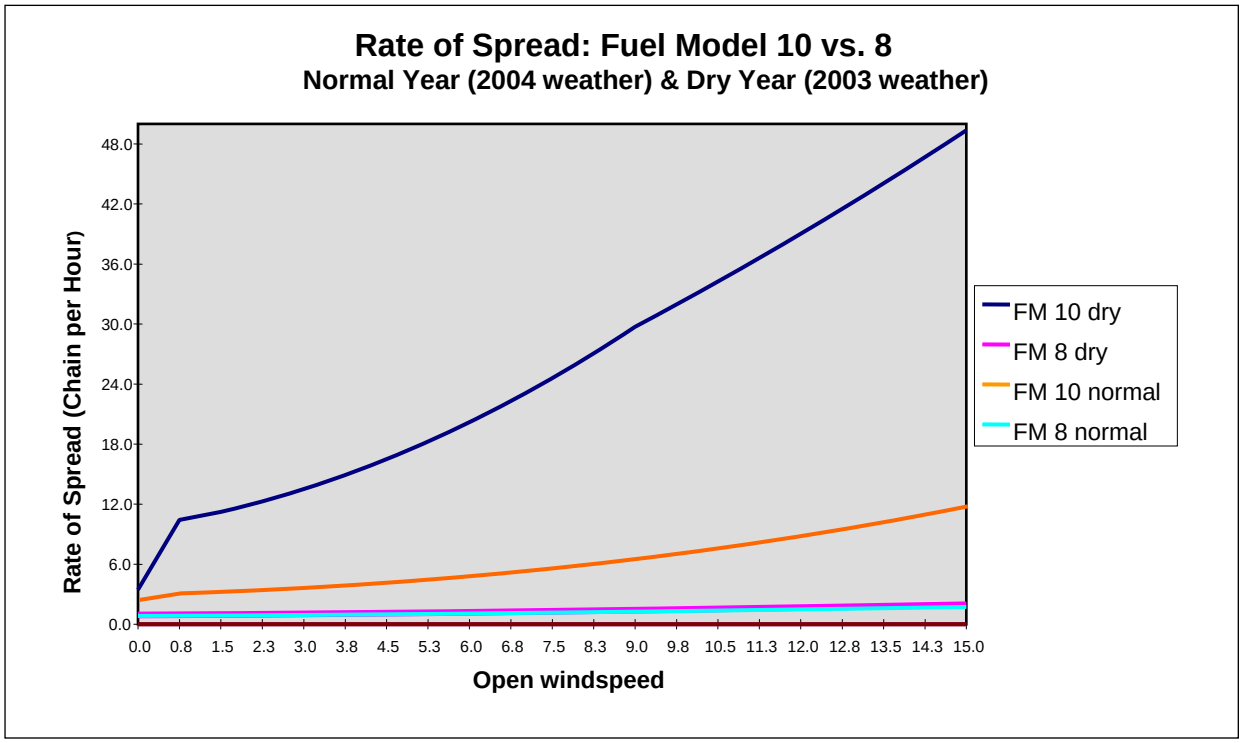


Figure 4.3 Rate of Spread by Fuel Model and Type of Weather

The following chart displays the differences in the predicted flame length of a fire burning in Fuel Models 10 and 8, and the differences during a year of normal weather (represented by 2004 conditions) and a year of dry weather (represented by 2003 conditions). Flame length in feet is measured along the left side of the chart; open windspeed values are measured along the bottom of the chart.

The chart shows that the greatest flame length would occur in a Fuel Model 10 during dry weather. For example, with a windspeed of 3 miles per hour, the flame length would be between nine and ten feet. During a normal weather year, the flame length (with the same windspeed) would be approximately three feet. In Fuel Model 8, there is very little difference in rate of spread between the normal year and the dry year (the two lines are practically one on top of the other). Windspeed also has little to no influence on the flame length.

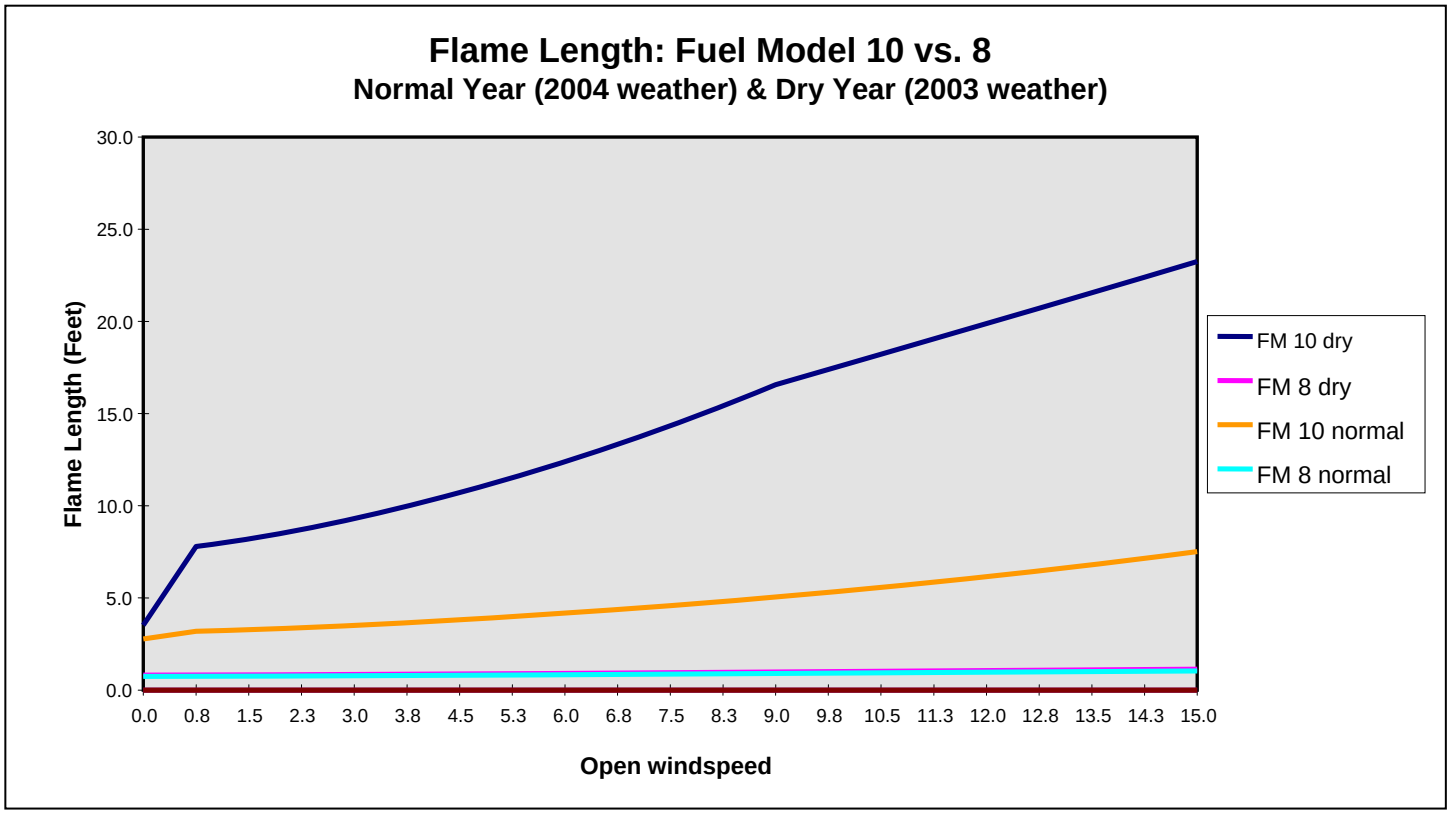


Figure 4.4 Flame Length by Fuel Model and Type of Weather

As discussed earlier in the Fire and Fuels section, the Forest Vegetation Simulator – Fire Fuels Extension was used to analyze the predicted mortality following a wildfire in the treatment areas. The following table shows the results of the model for typical vegetation stands in the area (moist forest stand number 71-702059; and dry forest stand number 76-201049). The table also displays the fuel models and fire characteristics by alternative.

Table 4.38 FVS-FFE Model Results: Predicted Mortality

Alternative 1	**Flame Length (ft)**	**Scorch Height (ft)**	**Mortality (%)**
Fuel Model 10 – Dry	Greater than 4	Greater than 30	Greater than 80
Fuel Model 10 – Moist	Approx 4	Greater than 30	Greater than 80
Alternatives 2 and 5	**Flame Length (ft)**	**Scorch Height (ft)**	**Mortality (%)**
Fuel Model 8 – Dry	1	3	Less than 5
Fuel Model 8 – Moist	1	3	Less than 10

Typical Moist Stand: 71702059 Typical Dry Stand: 76201049

d. Dry-site ponderosa pine and old growth

As stated, fire suppression has been a contributing factor to fuel accumulation, especially on lower elevation dry-sites. With frequent fire return intervals, an open-canopy structure would have been maintained with grass as the predominant understory fuel (classified as a Fuel Model 2). If an action alternative is selected, dry ponderosa pine dominated stands will be converted to a Fuel Model 8 or 2 depending on the amount of timber litter remaining after project activities. Studies in ponderosa pine forests (dry forests) show that treatments which remove small diameter trees may be beneficial for reducing crown fire hazard in ponderosa pine sites (Fiedler). Although fire intensity (flame lengths) can be higher in a Fuel Model 2 than a Fuel Model 8 (Anderson 1982), ladder fuels will be removed and tree crowns will be thinned, thus reducing the chance that a surface fire in the grasses would move to the tree crowns and be sustained.

Pollet and Omi (2002) demonstrated the effectiveness of fuels treatments in reducing wildfire severity in four different ponderosa pine sites across the western United States, including the Kootenai National Forest. They found treated plots had lower fire severity than untreated plots, with sites mechanically treated reducing fire severity to a greater extent than sites where only prescribed fire was used. Within the Myrtle HFRA project area, dry-site old growth stands are included in Alternative 2 for fuels reduction treatment. Projects authorized under HFRA (Section 102(e)(2)) are to "fully maintain, or contribute toward the restoration of, the structure and composition of old-growth stands according to the pre-fire suppression old-growth conditions characteristic of the forest type, taking into account the contribution of the stand to landscape fire adaptation and watershed health, and retaining the largest trees contributing to old-growth structure" (FS-799, pg. 25).

Restoration treatments in these dry forest habitats – whether old-growth or not – are important because they are generally the furthest removed from natural fire regimes (Arno and Fiedler 2005, Peterson et. al. 2005). This means that without management, the risk of losing the old growth (key ecosystem component) is moderate to high – vegetative attributes have been altered and fire frequencies are departed by several fire return intervals. As previously mentioned, prolonged fire return intervals, outside of the natural return frequency, not only contribute to surface fuel build-up, but ground fuel build-up as well, such as is occurring in all proposed treatment units. Duff and needle bed layers on these dry sites are deeper around the base of overstory trees than would have been the case on a regular fire return interval. Eventually, fine roots and ectomycorrhizae of trees accumulate in these layers (Arno and Fiedler 2005) and even low intensity surface fires can lead to tree mortality where smoldering fires in these ground fuels occur. Removing these fuels around the base of the trees would be necessary before fire can be introduced on a large-scale basis in these stands (Jain 2005).

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e. Fire Growth and Behavior

There are two basic purposes for fuels reduction activities – to limit fire severity and fire size. The greatest reduction in fire size and severity takes place when treatment limits spread at the fire head (fire moving with the wind direction or slope) (Finney 2001). Fires move through these drainages from south to north. Thus, fuels treatment on the south aspect of Snow Creek is important in preventing fire spread from the south into Myrtle Creek. The following figures compare fire growth by alternative, from a single ignition point in Myrtle Creek – to illustrate how fire spread and size can be limited with treatment.

Ignition points during the modeling and analysis phase were selected randomly on south and north aspects – future fires may start at any location in this drainage, as fire history shows ignitions have occurred throughout the drainage.

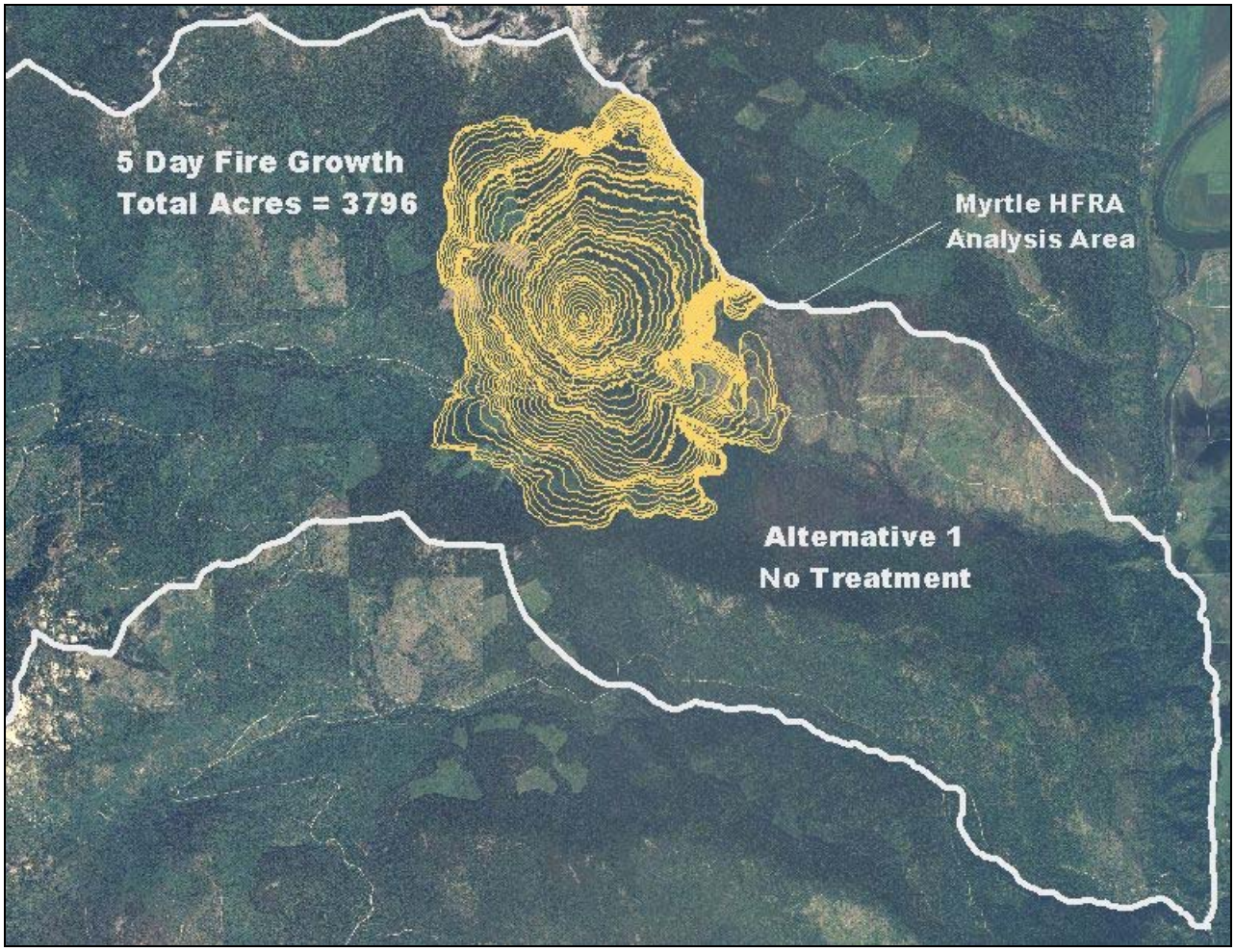

Figure 4.5 Example of predicted fire growth without treatment (Alternative 1) using *FARSITE*

The fire growth prediction shown above uses an aerial photo of the project area taken in 2004. The yellow concentric circles show the fire perimeter at 2-hour intervals burning in untreated fuels, after 5 days of growth, using real weather data for Sept. 2 – Sept. 7, 2003 (project file). The while line indicates the analysis area boundary.

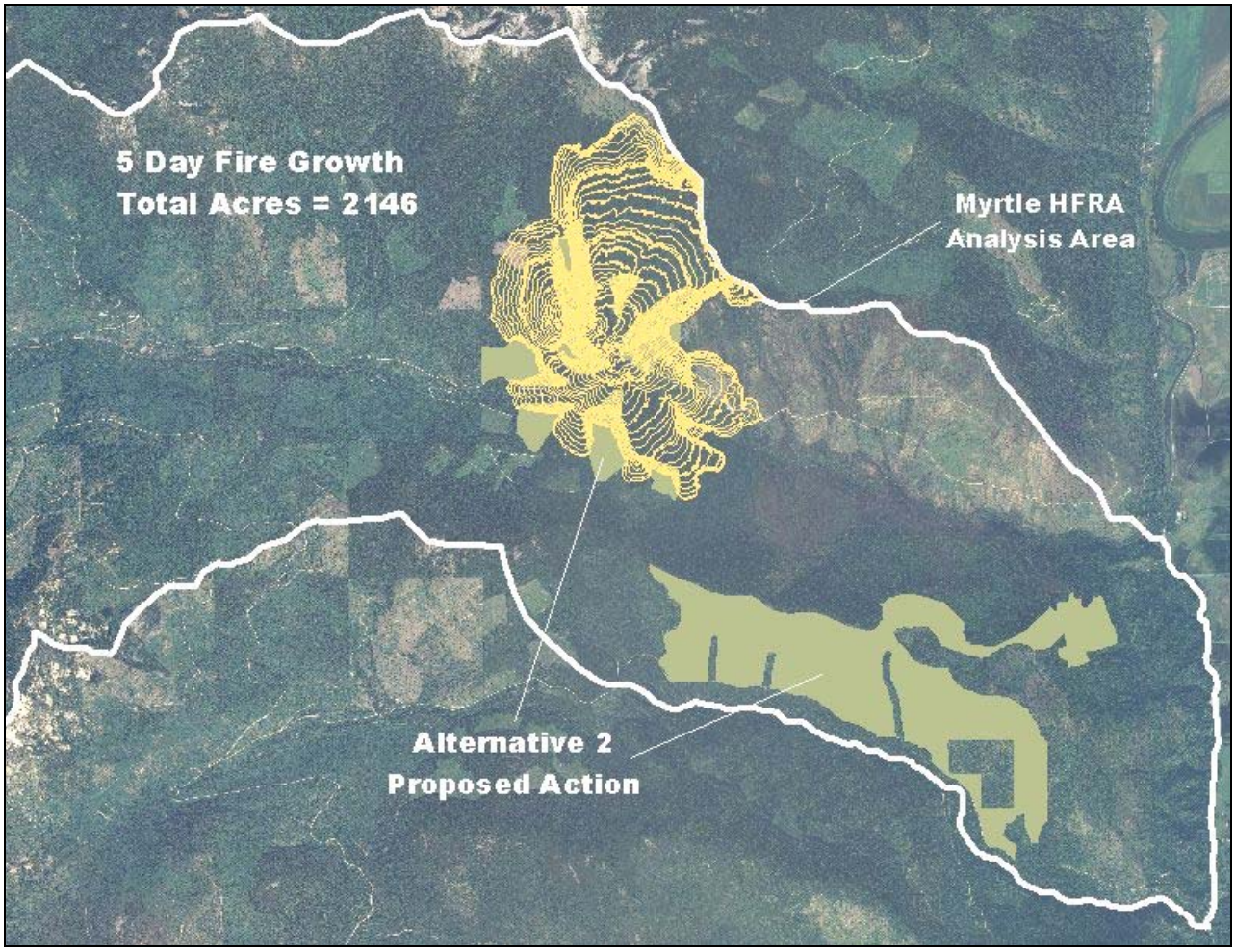

Figure 4.6 Example of predicted fire growth with treatment (Alternative 2) using *FARSITE.*

The fire growth prediction shown above uses the same aerial photo as used in the previous figure. The locations of the Alternative 2 fuel reductions treatments are overlain in light green. The while line indicates the analysis area boundary.

The yellow concentric circles show the fire perimeter at 2-hour intervals burning in untreated fuels, after 5 days of growth using real weather data for Sept. 2 – Sept. 7, 2003 (project file).

Other critical observations from these fire growth runs include growth patterns, rate of spread, flame length, and heat per unit area along the fire perimeter. Notice how close the yellow fire growth lines get when the fire is moving through a treated unit (Figures 4.6 and 4.7) – this shows slowed rates of spread.

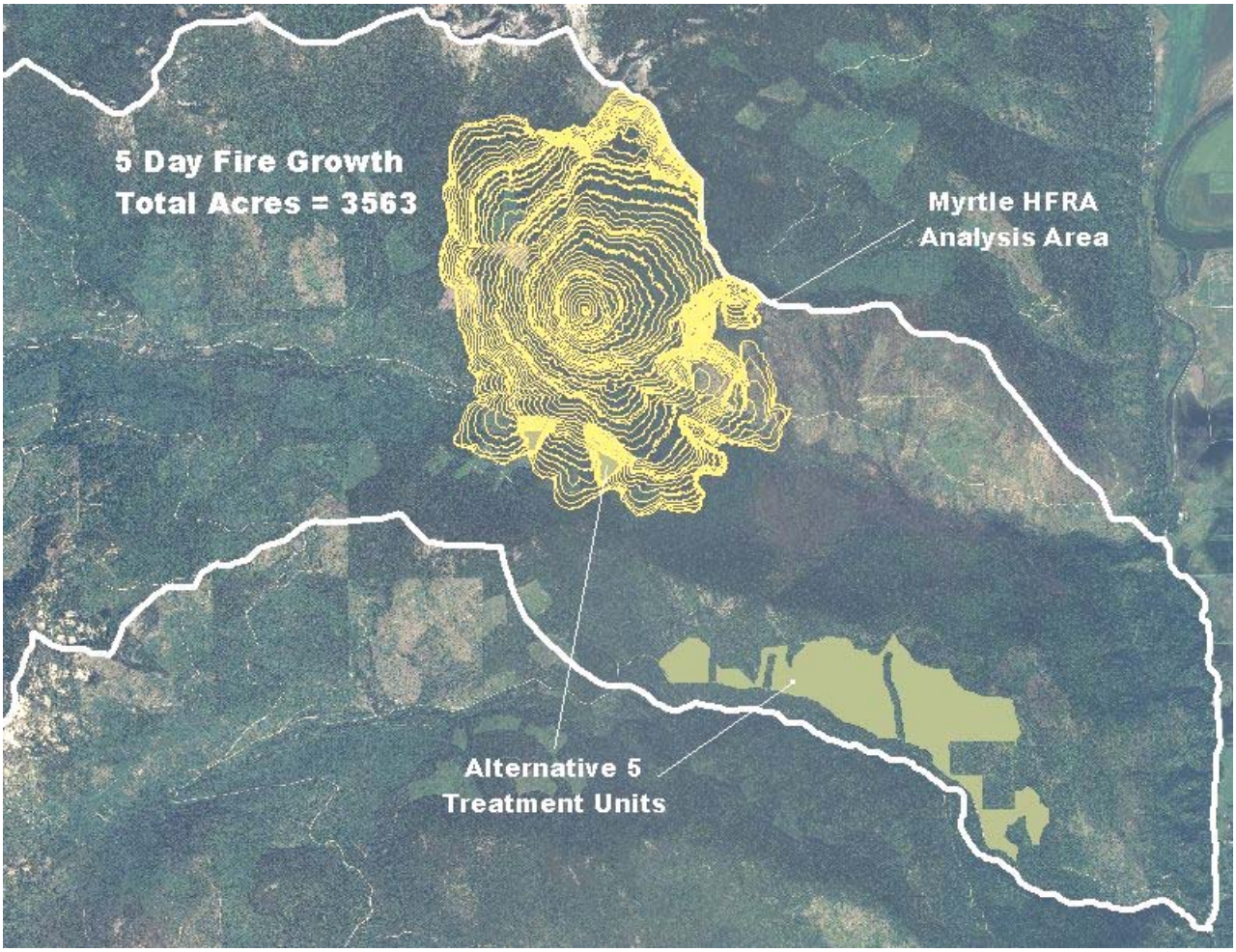

Figure 4.7 Example of predicted fire growth with treatment (Alternative 5) using *FARSITE.*

The fire growth prediction shown above uses the same aerial photo as used in the previous figures. The locations of the Alternative 5 fuel reductions treatments are overlain in light green. The while line indicates the analysis area boundary.

The yellow concentric circles show the fire perimeter at 2-hour intervals burning in treated and untreated fuels, after 5 days of growth using real weather data for Sept. 2 – Sept. 7, 2003 (project file).

The three figures shown above compare fire growth for untreated fuels (Figure 4.5), the proposed treated fuels on 2086 acres (Figure 4.6), and treated fuels on 865 acres (Figure 4.7). Weather, topography, burn duration, and ignition points are the same for all scenarios – the only difference being the fuels.

According to this example, fire in the proposed treatment area (Alternative 2) would be much smaller than both Alternative 1 and Alternative 5 as in the table below.

Table 4.39 Fire Growth Simulation Comparison

Alternative	Fire Size	Difference Between Untreated – Alt 1, and Treated – Alts 2 and 5
1	3796	-
2	2146	1650
5	3563	233

These images display the potential fire behavior during high fire danger and once again illustrate the importance of treating fuels on the south aspect of Myrtle Creek, some of which is in roadless, in order to alter fire behavior and growth. Additional examples of the differences in fire growth between alternatives are shown in Map Appendix, Fire Maps.

Fire Danger

Fire season in North Idaho usually begins any time after mid-May, and continues into September. Hot, dry weather, accompanied by dry-lightning storms that pass through the region starting typically in late-July, make the conditions on the ground right for extreme fire behavior (torching, crowning, spotting from torching trees) and large fire development. This is important because the fire behavior for this project was analyzed from the assumption that a level of fire danger was present.

There are several tools available for rating the fire dangers by regions and geographic areas. The National Fire Danger Rating System is used to set preparedness levels for suppression resources and provides those resources with useful information concerning the potential for fire growth and behavior. It gives seasonal trends for fire potential for large areas, quantifying weather trends for an area in terms of an index.

- **Energy Release Component (ERC):** The Energy Release Component is a National Fire Danger Rating System index related to how hot a fire could burn. It is directly related to the 24-hour, potential worst case, total available energy (BTUs) per unit area (in square feet) within the flaming front at the head of a fire. It can serve as a good characterization of a fire season as it tracks seasonal fire danger trends well.

  ERC is a function of the fuel model and live and dead fuel moistures. Fuel loading, woody fuel moistures, and larger fuel moistures all have an influence on the ERC – thus decreasing the fuel loading and availability of fuels will also have an influence on the ERC values and overall fire danger in this area. ERC has low variability, and is the best fire danger component for indicating the effects of intermediate to long-term drying on fire behavior (if it is a significant factor) although it is not intended for use as a drought index. For fire danger, ERCs are compared to a maximum, average, and critical level (97th percentile – where only 3% of days are over that critical level).

  For reference, the Myrtle Creek Fire in 2003 (within the project area and occurring on both north and south aspects) started when ERCs were above the 97th percentile and at or near record levels. As mentioned, extreme fire behavior (crowning, torching, spotting) was not only observed on the Myrtle Creek Fire – it was expected, due to the high fire danger at the time.

4.3-C.3 Fire Suppression Capabilities

Direct Attack Capabilities

Fuels treatments are intended to assist in limiting fire size by reducing fire behavior and by facilitating suppression (Finney 2001). Constructing direct or indirect fireline can occur more quickly and is more effective if heavy brush and other vegetation are removed (Finney 2001).

The next two tables summarize suppression capabilities as related to expected fire behavior. Production rates for direct attacking a fire change depending on the concentration and arrangement of fuels; thus, altering the fuel model in the proposed treatment area from a Fuel Model 10 to a Fuel Model 8 will increase suppression capabilities.

Table 4.40 Fire Behavior by Alternative and Fuel Model During High Fire Danger

Alternative	Fuel Model	Flame Lengths	Surface ROS (chains/hr)	Heat per Unit Area (BTU/ft2)*	Wind to Initiate Crowning**	Direct Attack by Hand Crew
1	10	Greater than 4 ft	7 – 8	1384	0	No
2 and 5	8	1 – 2 ft	1 - 2	210	Greater than 100 mph	Yes

* Total amount of heat released per unit area as the flaming front of the fire passes, expressed as Btu/square foot; a measure of the total amount of heat released in flames.

**Predicted windspeed necessary to move a surface fire into the crown of a tree or group of trees. (NEXUS outputs available in project file).

Fuel Models 8 and 10 are timber litter fuel models.

The following table shows the anticipated production rates for firefighting resources typically used during direct attack operations. A hand crew is comprised of 20 trained firefighters supplied with hand equipment such as backpack water pumps, shovels and pulaskis. The values in the table are for specified resources, with flame length limitations and production rates for timber litter fuel models in chains/hour (1 chain = 66 feet)

Table 4.41 Direct Attack Capabilities

Resource	Production Rate* Alt 1 Fuel Model 10	Production Rate* Alts 2 and 5 Fuel Model 8
Hand Crew	6	7
Dozer (Type II) Upslope 26-40%	7 – 10	45 - 70

* Chains/hour

Fireline Handbook: National Wildfire Coordinating Group January 1998, NWCG Handbook 3, PMS 410-1, NFES 00G5, Appendix B October 1993, NFES 2165

Incident Response Pocket Guide: National Wildfire Coordinating Group January 2004, PMS 461, NFES 1077

Alternative 1 proposes no action to decrease flame lengths in the proposed treatment area (treatments would assist in limiting fire size by facilitating suppression).

Alternative 2 stands were partially chosen as high priority treatment areas to alter fire behavior to facilitate in successful suppression. Accessibility for suppression resources in the event of a wildfire is crucial for success. Many of these stands are located in roadless areas. Reducing flame lengths and rates of spread and creating a more open stand structure with reduced surface fuels will allow for safer travel and working conditions for firefighters, and reduced fire intensity and spread rates will allow for higher likelihood that the fire is controlled at a smaller size.

Alternative 5 would treat areas outside of grizzly bear core habitat, old growth, and roadless areas in a small portion of the lower-north aspect of Myrtle Creek and the south aspect of Snow Creek. Reducing fuels and altering fire behavior under this alternative will create a fire environment conducive to direct attack to limit fire size where treatment occurs. However, excluding areas in roadless specifically, leaves real challenges on the ground for fire suppression operations. Remaining heavy fuels on 1300 acres that were not included in this alternative, will slow suppression efforts. Expected fire behavior will remain high in these areas – control actions may be prolonged, allowing a fire to grow larger and burn with greater severity than Alternative 2.

4.3-C.4 Fire Regime Condition Class

Improvement in Fire Regime Condition Class (FRCC) is an indicator for the assessment of fire and fuels in the Myrtle HFRA analysis area. A fire regime condition class analysis is sensitive to three measures:

fire frequency departure from reference condition,
fire severity departure, and
vegetative structure departure.

A combination of harvest and fuels treatments will affect all three measures by varying degrees; treatments including the use of prescribed fire (underburning) will reflect the greatest overall improvement in FRCC on dry-sites because the largest contributor to departure in condition class is skipped fire intervals.

The following table shows improvement in FRCC by acreage for each alternative.

Improvement in percentage departure from reference conditions will occur on the most acres under Alternative 2. Stands currently departed 59% (condition class 2) would move *towards* a lower condition class after completion of Alternative 2 with a departure of either 17% (condition class 1) or 36% (condition class 2) depending on the use of prescribed fire. Eighty-one percent of the dry site stands in the proposed treatment area (Alternative 2) will be underburned, which will reflect the greatest immediate improvement in FRCC.

Table 4.42 Improvement in Condition Class by Alternative

Alternative	Condition Class Improvement			
	Acres moved *toward* natural range			Total acres moved *toward* Improved Condition Class
	59% Departed – Moved to 17%	59% Departed – Moved to 36%	39% Departed – Moved to 30%	
1	0	0	0	0
2	1039	260	787	2086
5	519	250	96	865

Acres shown are approximate.

4.3-D Air Quality and Smoke Emissions

Sources of smoke from wildland fire are generated from incomplete combustion of fuel. Fuel consumption and smoke production are influenced by pre-burn fuel loading categories (such as grasses, shrubs, woody fuels, litter, moss, duff, and live vegetation), condition of the fuel (live, dead, sound, rotten); fuel moisture; fuel arrangement; and fuel continuity (Ottmar 2001). Fire behavior, fire size, and consumption of these fuels will dictate the amount of emissions from a wildland fire.

The No Action Alternative (Alternative 1) would have the least impact to air quality *from project activities*. However, it is difficult to assess in a quantitative manner, the effect wildfires have on the environment because of the uncertainty in the size of the burned area and the amount of emitted pollutants (Graham et al. 2003).

Smoke emissions include carbon dioxide and water, carbon monoxide, hydrocarbons, nitrogen oxides, and particulate matter. Carbon Monoxide and $PM_{2.5}$ (particles less than 2.5 µm) are two major pollutants of concern emitted from biomass burning. $PM_{2.5}$ is inhalable and respirable and it has a long residence time in the atmosphere. It also reduces visibility and absorbs harmful gases. The Environmental Protection Agency exempts smoke from wildfire or wildland fire use because they are deemed as "natural events". In addition, extreme fire behavior (where a lot of smoke is emitted into the atmosphere) generally occurs due to heavy fuels, fuels that may smolder for a prolonged period of time, emitting more smoke over a period of days or weeks.

Direction for fire management actions are provided in the Idaho Panhandle National Forests (IPNF) Fire Management Plan (FMP) and defined in the IPNF Land and Resource Management Plan (LRMP – Forest Plan. Appendix F, Table 10; F-3) and Forest Service Manual (FSM) 5100. Wildland fire use and protection standards included in all management areas include a development of prescribed fire objectives, which comply with the requirements of the *Clean Air Act.*

The Montana/Idaho Airshed Group is composed of three members: Montana, North Idaho, and South Idaho. The Bonners Ferry Ranger District of the Idaho Panhandle National Forests is a member of the North Idaho Unit. The intent of the Airshed Group is to minimize or prevent smoke impacts while using fire to accomplish land management objectives and/or fuel hazard reduction. The Montana/Idaho Airshed Group has a joint operating plan, which details policy and procedures all members agree to abide by. The monitoring unit in Missoula, Montana is the administrative unit that coordinates prescribed burning for each unit. Airshed group members abide by operating procedures of the monitoring unit in order to prevent or reduce smoke impacts to communities. The Department of Environmental Quality (DEQ), in both Montana and Idaho, interact directly and continuously with the monitoring unit. The monitoring unit is responsible to the airshed group for the daily operation of the smoke management program and provides the daily coordination to implement burning restrictions.

Figure 4.8 Example of smoke emissions in heavy fuels. Northwest Peaks Fire, August 2000 lightning-caused wildfire - Bonners Ferry Ranger District

Alternative 2 would be expected to have the greatest overall impact to air resources due to project implementation because this alternative proposes to treat the most acres using prescribed fire, including pile burning. However, after project implementation, a wildfire would be expected to create fewer emissions due to the reduction of heavy fuels that tend to smolder for prolonged periods.

Alternative 5 would fall somewhere between No Action and Alternative 2 (the proposed action). Prescribed fire would occur on fewer acres, so intentionally produced smoke emissions would be less than if Alternative 2 were implemented. However, wildfire burning in the heavy fuels left untreated in the proposed treatment area would be expected to produce greater emissions than a wildfire burning in the same area of Alternative 2.

Table 4.43 Emissions by treatment for Alternatives 2 and 5

Alternative	Fuels Treatment	Acres	PM10 and PM2.5 Total Emissions (Tons)
2	Underburn	1038	1472
	Pile Burn	1022	2800
5	Underburn	519	992
	Pile Burn	346	651

All acres are approximate.

Common to Alternatives 2 and 5: Prescribed fire, both underburning and pile burning, is proposed for fuels treatment on all acres (2,080 or 860 respectively). Where feasible, prescribed underburn will be used to reintroduce fire where current fire regimes are highly removed from historic frequencies (the majority of which is on southern slopes in the Snow Creek drainage dominated by ponderosa pine and other dry-site vegetation). While prescribed pile burning helps reduce the activity fuels, it does not play the same role in reintroducing fire that underburning does.

As previously stated, the project area lies west of the community of Bonners Ferry and is visible from town. Any smoke created from burning activities would be noticeable to the public, and the general and local winds would create the potential for

decreased visibility due to smoke. Prolonged combustion of heavy fuels would perpetuate the duration of smoke and emissions of potentially harmful particulates. Thus, decreasing the amount of fuels available to burn would decrease the impacts to local communities from smoke. Prescribed fire behavior can be manipulated by lighting pattern and the rate at which the fuels are ignited – both of which can affect the amount of smoke introduced into the atmosphere at a given time. Following the restrictions of the DEQ and monitoring unit will mean that prescribed fire activities occur on days when smoke dispersion is greatest and conditions are favorable.

For both action alternatives, it is also important to convey that all fuel treatments do not occur at once. For one, the district does not have the personnel and other resources necessary to burn that many acres on any one day. In addition, smoke restrictions limit the location and amount of acres that can be ignited at once. Prescribed burning (both underburning and pile burning) tends to occur over a few seasons, maybe years; with pile burning generally occurring in the fall and underburning generally occurring in the spring.

By treating the approximately 2080 acres included in the proposed treatment area (Alternative 2), the amount of surface, ladder, and aerial fuels will be reduced, thus combustion time would likely decrease during a wildfire as compared to untreated. However, treating the fuels does not protect the area from a wildfire ignition; it alters the fuels to reduce the intensity and severity in the case of a wildfire. Smoke would still be produced; however the flaming and smoldering phases of combustion would be lessened, due to a decrease in the amount of fuel.

4.3-D.1 4.Air Quality and Smoke Emissions Cumulative Effects

Cumulative effects are changes to the environment that are caused by an action in combination with other past, present, and reasonably foreseeable future human actions.

Past actions that effect fuels and fire behavior in the project area include fire suppression, previous timber harvest across all ownerships, and road building. Fire suppression has led to fuel build-up where fire regimes were frequent, such as on south slopes in Snow Creek. Past timber harvest activities would have altered fuel arrangements, fuel loadings, species compositions and stand structures in the areas in which they occurred. Construction of forest roads has provided access for forest visitors, which as previously described, could have an impact on the amount of human caused fires in the project area. These past activities together have all contributed to the current conditions in the project area as described in Chapter 3.

Present and reasonably foreseeable actions include fire suppression and timber harvest (especially on private land – including a 120-acre shelterwood cut planned for 2007). Both of these factors will affect large scale fire behavior as fire moves from dense stands that have not been treated to more open-canopy stands that have been. Depending on how activity fuels are treated in harvested stands will affect expected surface fire behavior.

a. Alternative 1 (No Action)

This alternative would have no *immediate* effect on overall fuel conditions in the project area. However, in the short to long term, both live and dead fuel loadings would continue to increase in the proposed treatment areas and overall project area. Long-lived seral species most adapted with fire will continue to drop out of the system as shade tolerant species move in. With continued fire suppression and no fuels treatment, areas in Condition Class 2 will move toward Condition Class 3. For dry site stands with a historically frequent fire regime, this could result in an overall higher risk of extreme wildfire behavior and negative effects to water quality, soil resources, and other key ecosystem components (such as long-lived seral species), depending on fire severity.

In Hydrologic Section B, patches of surface fuels more closely resemble a Fuel Model 2 or 5. This is due to a lack of heavy down woody material, not for a lack of tree density and ladder fuels. The 1926 Fire (Chapter 3.1 Figure 3-9) burned so hot and severe in these areas that most all of the fuels were completely consumed. These stands regenerated with lodgepole pine and larch, which are early seral species for these habitat types. Now, the lodgepole is dense and is the dominant overstory species. Lodgepole pine forests are susceptible to stand-replacing fires due to their thin bark and the density in which they grow (Arno and Fiedler 2005), and whereas western larch are long-lived seral species, lodgepole fall out of the system quickly, as they are highly susceptible to insects and disease. Such is the case in Myrtle Creek – mountain pine beetle is prevalent throughout these stands and the dead and dying lodgepole will contribute to the surface and ladder fuel loading into the future. In addition, the fine fuel loading from small twigs and branches is abundant and continuous enough to carry a surface fire, potentially into the ladder fuels and canopy. Even if crown fire is not observed in the event of a fire start, lasting effects from prolonged smoldering in the accumulating ground fuels, could effect soil (and water) resources and lead to tree mortality, which could set some of these stands up for the potential of a double burn, once these trees begin to fall over and add to the surface fuels.

Conclusions:

Long-term effects from inaction include fuel build-up in all fuel layers that could compromise the goal of firefighter and public safety during wildfire suppression activities.

Alternative 1 does not focus on reducing fuels in the municipal watershed to ensure high-quality drinking water into the future.

Alternative 1 does not trend toward the desired condition as described in Chapter 3. Alternative 1 proposes no treatment, and therefore no effort to move fire adapted forest systems to an improved condition class.

b. Alternative 2 (Proposed Action)

This alternative will provide mechanical and prescribed fire fuel reduction treatments. In particular, on portions of the project area nearing Condition Class 3, "appropriate" mechanical treatments coupled with prescribed fire can control excessive amounts of saplings and reduce surface fuels, recycle nutrients back to the ground in a "semblance" of natural processes, and also reduce the hazard of extreme and severe wildfire (Arno and Fiedler 2005). As related to fire, cumulative effects are mostly due to previous harvest and fire suppression. Restoration (fuels treatment) will trend portions of this watershed towards the desired condition – one that is "…sustainable – that is vigorous, self-perpetuating, and at low risk to…catastrophic fire" (Arno and Fiedler 2005 (Fiedler 2000a)).

Prescribed fire will be utilized after harvest to treat fuels on 925 acres in section G and 112 acres in section F[•], which are dominated by dry-site vegetation – reintroducing fire on these sites is a necessary step in condition class improvement, due to the fact that fire return intervals have been missed. Underburning alone will improve the condition class rating of these stands. Modification of succession classes through commercial harvest and other project activities will also move acres between succession class stages, lending to an improvement trend in condition class as well.

Prescribed fire would be conducted in the spring when soil moistures are adequate (see Chapter 2 soils recommendations). It is possible that fire from these activities could back into Riparian Habitat Conservation Areas (RHCAs) adjacent to treatment units due to the absence of constructed fuel breaks. Generally, fuel moistures and relative humidity's are greater in these areas than in areas outside the RHCA under the same weather conditions – due to the presence of water. The alternative, to prevent any prescribed fire from entering these areas, would be to construct mechanical or hand fireline. Detrimental effects to the water resource from these activities may be greater than would occur from prescribed fire (see Aquatics report).

Conclusion:

Fuel reduction treatments on about 2086 acres will trend portions of the watershed toward the desired condition.

Prescribed fire will be utilized on approximately 1037 acres of dry-site vegetation, resulting in an improving trend in Condition Class.

Past, present, and future activities on both public and private lands that include surface, ladder, and crown fuels reduction will contribute to the reduced risk of unwanted, extreme fire behavior at the landscape level.

c. Alternative 5 (No activities in Old growth, Roadless, or Grizzly Bear Core Habitat)

Alternative 5 would have an immediate affect on surface, ladder, and crown fuels on approximately 865 acres of treatment area. Cumulative effects would be similar as described for the Alternative 2; however, fewer acres will be treated. Therefore, short to long-term effects include risk to firefighter and public safety where fuels are not treated such is the case in Alternative 1, as well as no attempt to alter fuels to reduce crown fire and move those untreated acres towards an improved condition class.

Conclusion:

Fuel reduction treatments on about 865 acres will trend portions of the watershed toward the desired condition.

Prescribed fire will be utilized on approximately 600 acres of dry forest vegetation, resulting in an improving trend in Condition Class. Underburning would take place in Units G2 through G7H and G7S.

There would be less reduction in the risk to firefighter and public safety, and less improvement in condition class than would be achieved with Alternative 2, but, of course, there would be more than under the No Action Alternative.

The cumulative air resource analysis is unique compared to the analysis for resources such as fuels or vegetation, because past impacts to air quality are not usually evident. However, present and reasonably foreseeable effects could include impacts from other forest and agricultural burning, dust, residential wood combustion, traffic exhaust, or point source pollution.

Relative comparison and quantification of prescribed fire and wildfire smoke emissions are shown in the following table (2001 Smoke Management Guide).

[•] Hydrologic Sections G and F are shown on a map located in the Map Appendix

Table 4.44 - General Comparison of Forest Emissions

Pounds of emission per ton of fuel consumed (burned)

Fuel Configuration	Combustion Phase	PM10	PM2.5
Broadcast Burn Mixed Conifer	Flaming	11.7	9.6
	Smoldering	25.3	23.6
	Average	20.5	28.8
Pile and Burn Slash Mixed Conifer	Flaming	7.4	6.6
	Smoldering	15.9	14.0
	Average	12.4	10.8
Wildfire (Forests)	Fire Average	30.0	27.0

PM_{10} and $PM_{2.5}$ refer to particulate matter that is, respectively, less than 10 micrometers, or 2.5 micrometers in size. Fine particles from fuel combustion are often called respirable particles because they are efficient at penetrating the lungs (Smoke Management Guide, 2001).

4.3-D.2 Forest Plan Consistency

Under Alternative 2 (Proposed Action), Forest Plan compliance occurs through efficient fire protection and fire use to help accomplish land management objectives (Forest Plan, Chapter II, pages 10 and 38). Forest Plan Standards for fire management are listed below:

1. Fire protection and use standards are specified by management area. Cost effective fire protection programs will be developed to implement management direction based on on-site characteristics that effect fire occurrence, fire effects, fire management costs and fire caused changes in values.
2. The Fire Management Action Plan will be guided by the following Forest-wide standards:
    a. Management area standards.
    b. Human life and property will be protected
    c. Fire will be used to achieve management goals according to direction in management areas.
    d. Management area standards will be used in Escaped Fire Situation Analysis as a basis for establishing resource priorities and values.
    e. The appropriate suppression response for designated old-growth stands in all management areas, except in wilderness, will result in preventing the loss of old growth.
    f. Activity fuels will be treated to reduce their potential rate of spread and fire intensity so the planned initial attack organization can meet initial attack objectives.
    g. Forest Fuel Management Fund expenditure priorities are:
        i. Natural fuels that pose a threat to human life and property
        ii. Unfounded activity fuel projects
        iii. Areas where fuels/fire behavior is a threat to management area objectives

Following is a description of how each alternative meets Forest Plan standards. Forest Plan standard 2d relates to wildfire suppression policy and requirements which are not affected by this project, and therefore compliance with these standards is not described. In addition, this project does not determine Forest Fuel Management expenditure priorities, so compliance with standard 2g will not be addressed.

a. Alternative 1 (No Action)

Alternative 1 is ***inconsistent*** with the Forest Plan standard to use fire to achieve management goals according to the direction in Management Areas 1, 2, 7, and 9. With Alternative 1 there is no effort to develop cost-effective fire programs because no-action allows the fire exclusion trends to further remove all affected stands from Condition Class 1 and continue increasing the risk of intense and severe fire behavior. Given intense and severe fire behavior it is reasonable to expect expensive wildfire suppression costs, which generally "…outweigh the costs of fuels treatments…" (Pollet and Omi 2002), and damages / changes to wildlife habitat, water quality, soil productivity, recreation, aesthetics, etc. Effects to these resources could be lessened with activities that treat forest fuels.

Alternative 1 takes no preventative steps to protect human life and property within the wildland urban interface (municipal watershed) from an uncontrolled wildfire, and/or erratic fire behavior. The continued succession of fuels, vegetation, mortality

from insect and disease, and the exclusion of fire will create areas where the trend in fire behavior characteristics exceed the goals, objectives and standards established in the Forest Plan. No activity fuels are created in Alternative 1, so there is no need to treat activity fuels, which is consistent with the Forest Plan.

Alternative 1 does not take any action to prevent the loss of old growth characteristics in the resource area. Given that the No Action Alternative analysis shows modeled flame lengths greater than four feet, the appropriate fire suppression tactics would include indirect tactics. These tactics do not contribute to any goals that prevent the loss of old growth, thus inconsistent with the Forest Plan standard 2e. The modeled flame lengths would also contribute to an increased risk of crown fire, where severe fire effects, including tree mortality, are expected.

b. Alternative 2 (Proposed Action)

Alternative 2 is ***consistent*** with the Forest plan standards, as it proposes to use fuels treatment such as thinning, lopping, slashing, piling, pile burning and prescribed fire (underburning) to help meet the goals of Management Areas 1, 2, 7, and 9 across all of the proposed treatment area. This alternative includes prescribed underburn following harvest treatments on approximately 1,000 acres. Fuels reduction is the primary goal across the entire project area as proposed in Alternative 2, and all activities will be accomplished in accordance with that goal. Implementation of Alternative 2 will facilitate suppression in the event of a wildfire by reduced flame lengths, rates of spread, and crown fire potential.

Alternative 2 takes action to prevent the loss of old growth stands, as the proposed treatment is tailored to retain the large diameter individuals while removing the small diameter trees that are not only contributing to overcrowding, but increasing crown fire risk to the old growth because they act as ladder fuels.

c. Alternative 5 (No Action in old growth, Grizzly Bear Core Habitat, or Roadless)

Alternative 5 is ***consistent*** with the Forest plan standards as it proposes to use fuels treatment such as thinning, lopping, slashing, piling, pile burning and prescribed fire to help meet the goals of Management Areas 1, 2, 7, and 9 across approximately 865 acres, with prescribed underburn following harvest treatments on approximately 500 acres. Fuels reduction is the primary goal across the entire project area as proposed in Alternative 5, and all activities will be accomplished in accordance with that goal.

Alternative 5 takes no action to prevent the loss of dry-site old growth stands, as the alternative is designed to avoid treatment in old growth. Many of these stands have missed fire return intervals contributing to increased fuel loads and corresponding higher fire intensities.

4.3-D.3 Monitoring

Monitoring for reduction in fuels – including surface fuels (coarse-woody debris in tons/acre), ladder fuels (increase in canopy base heights), and crown fuels (reduction in crown bulk density, canopy closure, and spacing) will take place across the proposed treatment area. Photo points and fuels plots were established throughout the proposed treatment area (project file), and will be revisited after completion of fuels activities if Alternative 2 or 5 are selected.

4.3-D.4 Summary of Analysis

From a fire and fuels management perspective, Alternative 1 will simply not accomplish the objectives of the project.

Alternative 5 will reduce fuels and trend the treated stands towards an improved condition class, but only on 860 acres, most of which is entirely in Snow Creek. Although treating those dry-site stands is critical for reducing uncharacteristic fire behavior, and treating Snow Creek will reduce the risk of unwanted wildfire spreading into the Myrtle Creek watershed from the south, fuels treatment limited to Snow Creek will do nothing to address fire behavior and growth from a fire *starting* within Myrtle Creek. Only Alternative 2 proposes fuels treatment on both the north and south aspects of Myrtle Creek, where ladder fuels are abundant and predicted fire behavior would be unwanted in the municipal watershed – the Myrtle Creek Fire in 2003 being a testament to that, as it burned on the same aspects in similar forest types with extreme fire behavior, affecting the quality of drinking water.

Alternative 2 proposes to treat fuels on over twice the acres as Alternative 5. In the event of a fire start, that will result in reduced flame lengths, reduced rates of spread, and reduced risk of unwanted crown fire on twice the acres, as well as an improvement trend in condition class and an increase in safety for direct attack suppression crews on twice the acres.

From the perspective of fire and fuels management, Alternative 2 best meets the Myrtle HFRA project goal and objective of reduced risk of unwanted fire in the municipal watershed.

4.4 - Forest Vegetation

This chapter describes the probable environmental consequences of the alternatives described in Chapter 2; including associated post harvest work, such as sale area improvement activities and slash disposal. Chapter 4 forms the scientific and analytical basis for the comparison of alternatives. Impacts to resources described in this chapter are linked to the alternative driving (key) issues discussed in Chapter 2. Both positive and negative effects are considered. Environmental consequences that relate to issues discussed in Appendix A are not described in this Chapter.

4.4-A Old Growth

4.4-A.1 Alternative 1

a. Direct, Indirect, and Cumulative Effects

In the short-term, since there would be no proposed treatments in any old growth type, there would be no direct effects on old growth forest structures and no changes in their allocation to the Forest Plan.

However, there are indirect and cumulative ecological effects of no action. The Myrtle Creek HFRA assessment area includes 7,640 acres of allocated old growth, which equates to 28% of the forested area in the assessment. Over 60% of the old growth in the assessment area is located in cool-moist and cold-dry, subalpine forests that typically occupy the higher elevation environments in the project area. In combination, over 75% of the subalpine forests are mature and old growth forests. The relatively large expanses of mature and old growth subalpine forests are directly related to fairly long fire-free intervals. Where fire has been excluded successfully over large areas, more area is in mature stands than prior to European settlement. Discontinuities in stand structure and fuel arrays, created historically by low-severity fire, have largely been eliminated so structural homogeneity has increased across the landscape in these forests. Effects may include increased dominance by climax species, expansion of root disease centers, and increased vertical continuity of fuels (Smith and Fischer 1997). Covington, et. al. (1994) also stated that where subalpine landscapes contain increasingly continuous stands of mature Engelmann spruce and subalpine fir, they may be increasing in flammability and vulnerability to insects and disease.

Moist (cedar-hemlock) forest old growth accounts for about 35% of the old growth in the assessment area. In pre-settlement times, stand replacing fire intervals in these forest types averaged 200-250 years; however, many forests were characterized by mixed severity fire regimes, and small, nonlethal burns that occurred more frequently than high-severity fires (Smith and Fisher 1997). However, given that most of the past even-aged regeneration harvesting within the assessment area occurred within the moist forest types, these forests probably have the greatest variation in structural characteristics in the assessment area, which would provide some disruption in the vertical fuel continuity and decreased risk of stand-replacing fire in old growth. Of all the old growth forest types in the assessment area, the moist forests probably have the lowest risk of stand-replacing fire.

In the dry forest types, old trees need relatively open conditions to maintain modest growth rates and survive several hundred years. Low-vigor trees are unable to marshal enough resources to maintain adequate defense. Large trees growing in a dense layer of smaller trees (photo at right) are especially vulnerable to attack, underscoring the importance of maintaining reasonable growth rates (Arno and Fiedler 2005).

Figure 4.9 Dry forest old growth stand in the assessment area characterized by dense canopies of small-diameter Douglas-fir in the understory and scattered patches of old growth ponderosa pine in the overstory.

In their study of old growth ponderosa pine and Douglas-fir stands on three National Forests in Montana, Arno et al (1995) found that eight out of nine plots had pre-1900 basal areas of less than 145 ft^2 and that seven out of nine plots had pre-1900 basal areas of 100 ft^2, or less. The dry forest old growth stands in the assessment area are typically stocked with more than 250 trees per acre (TPA) larger than three inches DBH and overall stand densities average about 145 square feet (ft^2) of basal area.

An historical stand dominated by large fire-resistant trees growing at wide spacing would likely respond to a summer lightning fire quite differently than its modern counterpart. Under historical conditions, the large fire-resistant trees could survive and continue to dominate the forest, whereas modern stand structures favor stand replacement burning (Arno and Fiedler 2005). Absent fire, understory trees out-compete the old trees for moisture and nutrients. The old trees lose vigor and often succumb to insects and disease, or the stress imposed by even low- moderate intensity fires (Arno et al 1995, Biondi 1996).

Given their current composition and structure, the indirect and cumulative effects of no action in dry forest old growth stands in the assessment area would be an increased long-term risk of losing valuable components to insects, disease, stress, and ultimately severe fire, which would not only kill smaller diameter Douglas-fir, but would likely kill the old growth ponderosa pine, western larch, and Douglas-fir as well.

4.4-A.2 Proposed Action – Alternative 2

Methodologies

Changes in forest structure and composition are subtle until they are looked at over a longer period of time. The Simulating Patterns and Processes at the Landscape Level (SIMPPLLE) model was used as a tool to help provide an understanding of the dynamics of landscapes. SIMPPLLE is not designed to provide a precise prediction of when and where processes occur. A range of possible outcomes can be quantified with multiple simulations. These simulations can provide a prediction of general trends for the processes on a specific landscape (Chew, et. al. 2002). This model was used to assess the risk of stand-replacing fire in the old growth stands in the project area compared to the No Action alternative. The model was run assuming an attempt to suppress all fires would continue. However, the model assumes a probability that some suppression efforts would be unsuccessful and a certain number of fires would escape.

Direct, Indirect, and Cumulative Effects

Moist, cool-moist, and cold-dry forest old growth – Since there are no proposed treatments in moist, cool-moist, and cold-dry forest old growth; the direct, indirect, and cumulative effects of the proposed action on these types of old growth are similar to those described above for No Action.

The SIMPPLLE model does estimate a slight decrease in the overall risk of stand-replacing fire in these old growth forest types of 11%. The nature of the model is such that when the probability of stand-replacing fire is reduced in a given stand this effects the probability of stand-replacing fire in adjacent stands. Therefore, although there are no proposed treatments in these old growth types, the SIMPPLLE model estimates, indirectly and cumulatively, a slight reduction in the risk of stand-replacing fire due to neighboring fuel treatments.

> The Proposed Action (Alternative 2) would have no *direct* effects on moist, cool-moist, and cold-dry forest old growth. There would be a slight decrease in overall risk of stand-replacing fire in these old growth forest types.

Dry forest old growth – The proposed action does include treatments in 83 acres of allocated dry forest old growth and 159 acres of potential dry forest old growth. Proposed group selection prescriptions in these stands would do the following:

- feature maintenance of large (greater than 21" DBH) old growth trees (ponderosa pine, larch, and Douglas-fir),
- culture intermediate size trees, especially ponderosa pine and larch, and
- create small openings of two to three acres to promote regeneration of these species (ponderosa pine and larch), which will not regenerate in shaded conditions (smaller openings).

Although it is obviously critical to retain the larger old growth trees, it is equally as critical in the long-term maintenance of dry forest old growth to develop replacement cohorts within the these stands.

Fiedler, et. al. (1988) recommended residual densities of 50 to 80 square feet of basal area for management of uneven-aged ponderosa pine stands in the Northwest. For ponderosa pine, maintaining stand densities of less than 100 ft^2 of basal area will minimize tree mortality from mountain pine beetle (Schmid and Mata, 1992). Stands cut to 60 ft^2 of basal area would remain relatively unsusceptible for about 50 years; those cut to 80 ft^2 of basal area, for about 25-30 years; and those cut to 100 ft^2 of basal area, for about 11-15 years (Schmid and Amman, 1992).

The average basal area of the dry forest old growth stands in the assessment area is 145 ft^2. Data taken from an old growth ponderosa pine and larch stand in Myrtle Creek estimated 1926 post-fire basal areas of less than 70 ft^2 per acre (Behrens 1999). As stated earlier, in their study of old growth ponderosa pine and Douglas-fir stands Arno and Fielder (1995) found that pre-1900 basal areas were less than 145 ft^2 on eight out of nine plots and most often densities were less than 100 ft^2. Treatments in an old growth larch and ponderosa pine stand on the Lolo NF in the late 1990s reduced basal area about 16% from 144 to 121

ft^2 per acre using the least intensive treatment, compared to the most intensive treatment that reduced basal area by about 48% from 145 to 76 ft^2.

Prior to treatment, increment borings showed growth rates slowing in old growth trees and several old pines succumbed to beetle attacks (Arno and Fiedler 2005). Results three years later showed old growth trees had increased sap flow, higher foliar nitrogen content, and higher foliage production (Sala and Calloway 2001), indicating improved tree vigor and increased resistance to insects and disease. Stone, et. al. (1999) also found that restoration of pre-Euro-American stand structure by thinning, improved vigor of ancient, pre-settlement ponderosa pines in northern Arizona. Increased canopy growth and increased uptake of water, nitrogen, and carbon indicated improved tree vigor. They concluded in their study that the negative influence of post-settlement trees on pre-settlement trees likely resulted from competition for soil resources. Their conclusion agreed with correlative studies conducted at their study site by Sutherland (1983) and Biondi (1996).

Using these above reference conditions and recommendations, the average target density for the proposed group selection prescriptions in dry forest old growth would be 80-100 ft^2 of basal area. Based on data taken from similar prescriptions on the District it is estimated that the average size tree harvested would be less than 11 inches DBH and that 90% of the trees would be less than 14 inches DBH. Douglas-fir, grand fir, and lodgepole pine would be the primary species selected for cutting. Although average densities would be 80-100 ft^2, there would be considerable within-stand variability. Some areas where old growth-sized trees dominate would exceed the average density and may be as high as 200 ft^2. Other areas, with predominantly small diameter trees, would be opened up to less that 60 ft^2.

Subsequent entries would be designed to approximate historic disturbance cycles. Based on field exams and fire history data collected in Myrtle Creek (Zack 1994) there is very good evidence that the south faces of Myrtle and Snow Creek burned on average between every 35-40 years. There is also evidence that some intervals were less than 20 years and some were more than 50 years. However, the mere presence of old growth ponderosa pine indicates intervals of less than 50 years (Smith and Fischer 1997). Treatments would be scheduled about every 30-40 years, but would allow for earlier (20 years) or later entries (50 years) depending on the progress of the stand. For example, in another 20 years managers may decide a combination of prescribed fire and pre-commercial thinning is needed to meet target stand objectives, or perhaps a prescribed fire only treatment would meet the objectives. In the long-term, these variable treatment cycles would capture the natural variability of the disturbance cycles in these dry forest types. Most importantly, these treatments, after 80 years of fire suppression, would trend these stands in a direction that would provide future managers with a much broader array of management options.

The SIMPPLLE model estimates that the proposed treatments would reduce the risk of stand-replacing fire in dry forest old growth stands by 62%, while the overall reduction of stand-replacing fire in all treated dry forest stands is estimated at 54%. These results suggest the proposed landscape treatments would not only meet fuels management objectives for the project area, but would also help maintain the health and vigor of the dry forest old growth stands. As Fiedler (2000) states, the objective of such treatments is to emulate the size, pattern, and intensity of disturbances to approximate historical forest structures and conditions – not because they are historical, because they are sustainable – that is, vigorous, self-perpetuating, and at low risk to biotic agents and catastrophic fire.

> The proposed landscape treatments would not only meet fuels management objectives for the project area, but would also help maintain the health and vigor of the dry forest old growth stands.

4.4-A.3 Alternative 5

a. Direct, Indirect, and Cumulative Effects

Since neither Alternative 1 (No Action) nor Alternative 5 include treatments in any old growth type forests, their direct effects would be similar. Under Alternative 5 the SIMPPLLE model actually estimates there would be a slight increase (1%) in the risk of stand-replacing fire in dry forest old growth within the project area. The absolute number (1%) the SIMPPLLE model generates is not as important as the relative differences in risk-reduction between alternatives. When comparing Alternative 2 (an estimated 62% reduction) and Alternative 5 (an estimated 1% increase) the differences are considerable. The results of the SIMPPLLE model are consistent with the findings of Smith and Fischer (1997) who reported that fire severity in the these forest types tended to be greater where fire-free intervals were greater than 50 years. The fire-free interval in the dry forest old growth forests proposed for treatment is now 80 years.

Even in the absence of stand-replacing fire these dry forest old growth forests would continue to decline in health over time. Old trees need relatively open conditions to maintain modest growth rates and survive several hundred years. Low-vigor trees are unable to marshal enough resources to maintain adequate defense. Large trees growing in a dense layer of smaller trees are especially vulnerable to attack, underscoring the importance of maintaining reasonable growth rates (Arno and Fiedler 2005).

Given there would be over 500 acres of treatments in dry forest types, which do not meet the IPNF's minimum criteria for old growth allocation, the model does estimate a reduction in the risk of treated dry forest types of 55%.

Consistency with the Forest Plan

Standard 10(a) – This standard incorporates the definitions of old growth developed by the Regional Old Growth Task Force, documented in Green, et. al. (1992 - errata corrected September 2004), "Old Growth Forest Types of the Northern Region. USDA, Forest Service, Northern Region." The allocated old growth within the Myrtle Creek HFRA project area meets the old growth definitions included in Green et al. The Myrtle Creek HFRA project complies with Forest Plan standard 10 (a).

Standard 10(b) – This standard calls for maintaining "at least 10% of the forested portion of the Idaho Panhandle National Forests as old growth". The forest plan identified 2,310,000 forested-acres on the Idaho Panhandle National Forests. Therefore, the forest plan standard requires maintaining 231,000 acres of old growth on the forest. Based on two independent inventories and monitoring tools (FIA and IPNF stand level inventory) the IPNF is maintaining over 12% allocated old growth on its forested acres. As part of the Forest Plan strategy, 65,853 acres (16.7%) on Bonners Ferry Ranger District are allocated for old growth management (USDA 2005). The Myrtle Creek HFRA project complies with Forest Plan standard 10 (b).

Standard 10 (c) – For distribution purposes, the Forest Plan directs Districts to select and maintain at least 5% of the forested portion of those old-growth units that *have* 5% or more old growth. These forests have a unique structure and composition that provides critical habitat for a wide range of plants, animals, and other biota. Forest Plan direction is to maintain at least 10 percent of the forested portion of the IPNF as old growth.

The Myrtle Creek HFRA assessment area intersects OGMUs 14, 16 and a small portion of 18.

OGMU 14 is 17,555 acres and contains 7,074 acres (40%) of old growth.

OGMU 16 is 9,395 acres and contains 753 acres (8%) of old growth.

The portion of OGMU 18 within the assessment area (791 acres) contains zero acres of old growth.

In total, there are more than 27,500-forested acres in the vegetation assessment area and more than 28% of the acres are included in the IPNF's old growth allocation, which is within the estimated HRV of 15-35% for the North Zone forests. The Myrtle Creek HFRA project complies with Forest Plan standard 10 (c).

Standard 10 (d) – Existing old growth stands may be harvested when there is more than 5% old growth in an old-growth management unit, and the Forest total is more than 10%. The proposed action includes entry into allocated dry-forest old growth. Silvicultural prescriptions would be designed to retain the old growth ponderosa pine, western larch, and Douglas-fir, in the treated stands. Additionally, trees from smaller size classes would be retained to provide additional structural diversity and replacement old growth for the future. In the long-term, these conditions would be more sustainable. The proposed action would result in no net loss of allocated old growth. The Myrtle Creek HFRA project complies with Forest Plan standard 10 (d).

Standard 10(e) – At the Forest level, old-growth stands should reflect approximately the same habitat type series distribution as found on the IPNF. As discussed in the 2004 IPNF Forest Plan Monitoring report (p.72), old growth on the IPNF does reflect approximately the habitat type series distribution of the forest. The OGMUs within the assessment area are dominated by subalpine fir (58%), western hemlock (28%), western red cedar (10%) old growth, Douglas-fir (4%) and grand fir (<1%) forest old growth. As discussed in Chapter 3 the amount of old growth in each forest type is directly related to past disturbance patterns. The Myrtle Creek HFRA project complies with Forest Plan standard 10 (e).

Standard 10 (f) – The Forest Plan also has standards for size of old growth stands (Forest Plan II-29). Preference is to have at least one stand per OGMU over 300 acres and stands should be at least 25 acres. Preference should be given to a contiguous stand; however, the stand may be subdivided into stands of 100 acres or larger if the stands are within one mile.

This old growth review showed that all of the contiguous old growth patches larger than 300 acres are located in OGMU 14, of which eight patches are larger than 300 acres. Three patches in OGMU 14 (Figure 4-10) are actually larger than 1,000 acres, and one of these patches in the Slide Creek area is nearly 1,900 acres. Six other patches in OGMU 14 are larger than 100 acres. Three stands are less than 25 acres, but these stands are generally less than a quarter-mile from other larger patches of old growth. In OGMU 14, stands less than 25 acres in size account for about 0.4% (25 acres) of the total old growth. Consequently, even if these acres were not considered as part of the allocation, OGMU 14 would still meet old growth standard 10(c), which calls for maintenance of 5% old growth in each OGMU, if available.

OGMU 16 contains considerably fewer acres of old growth than OGMU 14. Only one patch of old growth is larger than 100 acres, and five patches are smaller than 25 acres. In OGMU 16, stands less than 25 acres in size account for about 1.1% (81 acres) of the total old growth. Once again, even if these acres were not considered part of the allocation, OGMU 16 would still meet old growth standard 10(c).

The Myrtle Creek HFRA project complies with Forest Plan standard 10 (f).

Standard 10 (g) – This standard states that roads should be planned to avoid old-growth management stands to maintain unit size. No roads will be built through old growth under either action alternative (Alternative 2 or 5). The Myrtle Creek HFRA project complies with Forest Plan standard 10 (g).

Standard 10 (h) –Existing grazing allotments will be honored, however, a long-term objective should be to minimize or exclude domestic grazing within old-growth stands. New allotments in old-growth stands will not be allowed. There are no grazing allotments in the Myrtle Creek HFRA project area, and consequently, no allotments in old growth. Furthermore, no new allotments are planned for the area. The Myrtle Creek HFRA project complies with Forest Plan standard 10 (h).

Standard 10 (i) –Goals for lands to be managed as old growth within those lands suitable for timber production are identified in the management area prescriptions. Only Management Areas 1, 2, 3, and 4 have specific Forest Plan old growth goals. The 2004 IPNF Forest Plan Monitoring report (p.71) shows those goals by management area, and what we have currently allocated for old growth. Current old growth allocations meet and far exceed these Forest Plan goals.

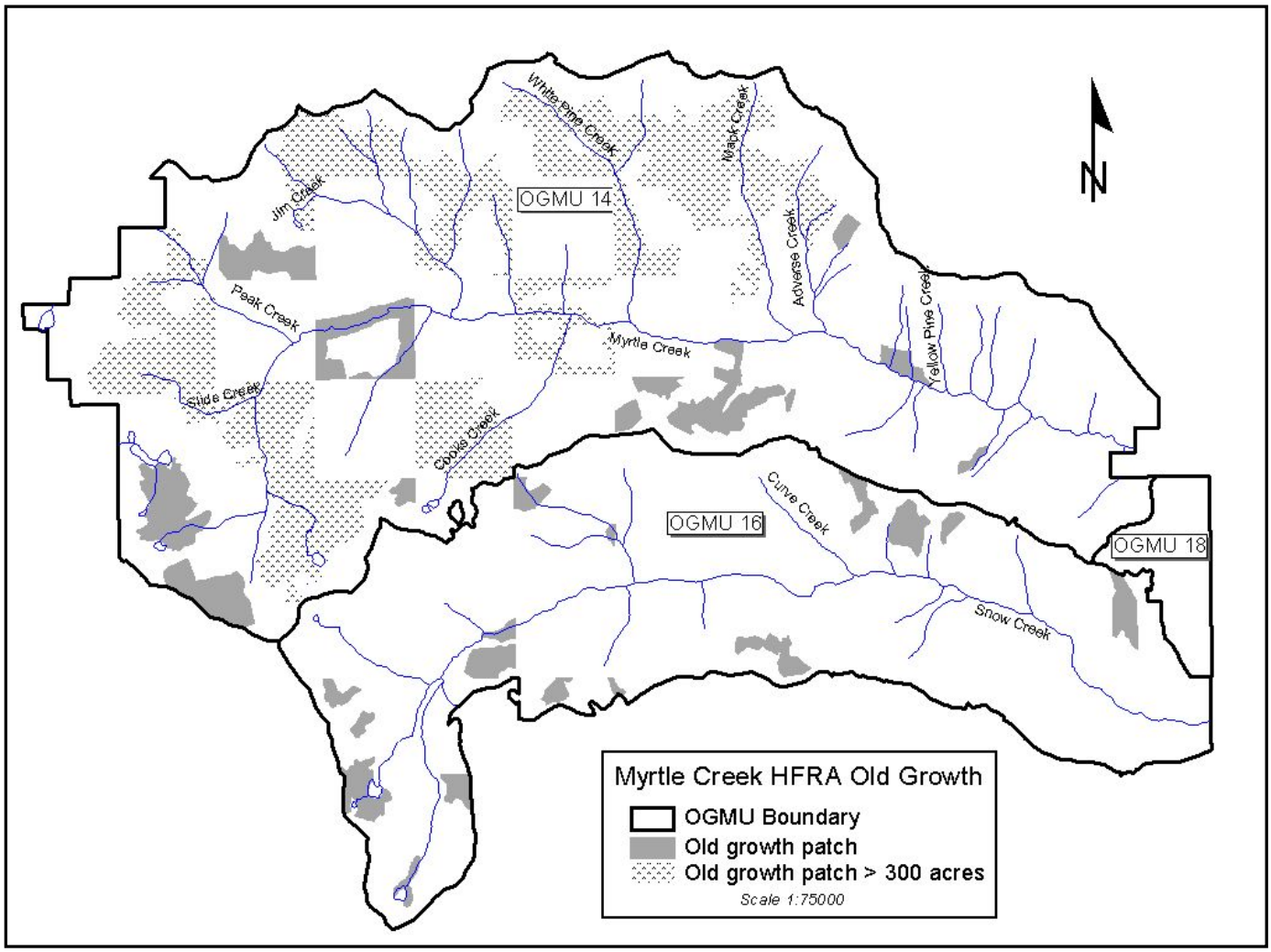

Figure 4.10 Myrtle Creek HFRA Project Old Growth Patches

4.4-B Reforestation

Alternative 2 and Alternative 5

Regeneration harvests are included in the proposed action. Site preparation and fuel reduction activities are planned to provide appropriate sites for planting. Following site preparation, usually underburning, regeneration would occur through artificial (planting) and natural methods. Stands would be planted with seral species (white pine, western larch, and ponderosa pine) to

promote stand structures and species composition, which reduce susceptibility to insect and disease damage. For details on unit prescriptions and sizes, refer to the tables and maps in Chapter 2.

The best quality ponderosa pine, western larch, and white pine would be retained for natural seed sources. This is consistent with Forest Plan direction that "reforestation would feature seral tree species." All stands proposed for regeneration harvests are on lands suitable for timber production and can be adequately restocked within five years of the final harvest. As directed by the Forest Plan, stands would be regenerated with trees from seed that is well adapted to the specific site conditions, and would be regenerated with a variety of species (Timber Standard 4 and 5, page II-32, Forest Plan). Forest Plan standards for reforestation would be met under the proposed action.

4.4-C Lands Suitable for Timber Production

Proposed Action – Alternative 2

This project includes lands that were designated as unsuitable for timber production in the Forest Plan (MA9). Forest Plan Timber Standard 3, page II-32, allows for changes in land suitability classification based on recommendations of a certified silviculturist. In accordance with this standard, all or portions of Units F1, G1, G2, G8, G9, and G10 have been field reviewed and re-classified as suitable for timber production. Units G1, G8, G9, and G10 contain the dry site old growth that is at risk from insect, disease and stand replacement fire.

Alternative 5

This project includes lands that were designated as unsuitable for timber production in the Forest Plan (MA9). Forest Plan Timber Standard 3, page II-32, allows for changes in land suitability classification based on recommendations of a certified silviculturist. In accordance with this standard, all or portions of units G1, G2, and G10 have been field reviewed and re-classified as suitable for timber production. Units G1 and G10 contain the dry site old growth that is at risk from insect, disease and stand replacement fire.

4.5 - Soil Resources

4.5-A Introduction

This section provides information regarding the potential consequences on the soil resource that may be affected by the proposed actions. All direct, indirect, and cumulative effects are disclosed, qualitatively discussed, and quantified where possible. Soil quality standards are applied to “activity areas” or individual harvest units (PF Soil document Soil-R-35). The activity area is considered an appropriate geographic unit for assessing soil environmental effects because soil productivity is a site-specific attribute of the land, and is not dependent on the productivity of an adjacent area.

Soil physical, chemical, and biological properties can be detrimentally impacted by management activities or natural events.

- **Soil physical properties** would be most affected by temporary road construction, use of ground-based logging, and site preparation systems (Page-Dumroese 1993). Alteration of soil physical properties can result in loss of soil capacity to sustain native plant communities and reductions in storage and transmission of soil moisture that may affect water yield and stream sediment regimes. Effects can be long lasting and impacted areas may become less productive and more favorable for weed invasion. Surface soil loss from roads through displacement and mixing with infertile substrata also has long lasting consequences for soil productivity because of the superiority of the volcanic ash surface layer over subsoils and substrata.
- **Soil chemical properties** would be most affected by activities that result in excessive loss or redistribution of nutrients. This is likely where rotations are short, whole tree yarding removes green tops and branches, heavy machine piling and burning concentrates slash in few large piles, or where hot broadcast burns sterilize soils. Alteration of soil chemical properties can also result in loss of soil capacity to sustain native plant communities and support natural levels of tree growth and resistance to pathogens (Garrison and Moore 1998).
- **Soil biological properties** would be most affected by activities that result in high levels of loss or redistribution of existing and recruitable fine and coarse woody debris (snags and green trees). This could also include loss of substrate for micro- and macroinvertebrates, bacteria, and fungi that are essential for decomposition and soil productivity (Jurgensen et al. 1997).

Direct Effects

> ***Direct Effects*** *are caused by the action and occur at the same time and place.*

Compaction, displacement, rutting, and severe burning from management activities can have effects on soil physical, chemical, and biological properties. The duration of impacts on the soil resource depend primarily on soil texture, parent material, aspect, slope, climate, and degree of disturbance. The analysis of direct and indirect effects is based on how the various components of the project (e.g., location, activity area, logging systems, road construction, and reasonable foreseeable actions) are expected to affect soils in Myrtle Creek and Snow Creek.

a. Ground-based Yarding

The greatest detrimental impacts are expected from ground-based yarding and generally average around 13 percent (Niehoff 2002) when improved protection measures are in place. The majority of disturbance is created through compaction, displacement, and rutting. Coefficients used to estimate effects on soils from proposed logging systems are shown in the following table.

The following table displays the coefficients used to predict potential detrimental disturbance for proposed logging and slash treatment scenarios including burning and piling (Niehoff 2002).

Table 4.45 Detrimental Disturbance Coefficients

Ground-based Logging	**Detrimental Disturbance Coefficients (%)**
Summer logging with broadcast burning or grapple piling on slash mat	13
Winter logging with broadcast burning or grapple piling on slash mat	8 - 11
Skyline or Helicopter Logging	**Detrimental Disturbance Coefficients (%)**
With Underburning	2
With grapple piling	8

b. Helicopter and Skyline Logging

These systems tend to have less detrimental effects (above table; Niehoff 2002; McIver and Starr 2000, pp. 11-16; Poff 1996) than ground-based systems because equipment stays on the road, or in the air - with helicopter logging - and logs are partially or fully suspended over the ground. Soil impacts from skyline logging are caused when one end of a log is dragged over unprotected ground (Krag 1991; Seyedbagheri 1996 pp.7-9).

c. Roads and Landings

Roads and landings that remain on the landscape for future use (system roads) are considered irretrievable effects on productivity as these lands become “dedicated” to the permanent transportation system. Temporary roads (i.e., only needed for the project) have detrimental effects initially. Although rehabilitation through decompaction and/or recontouring cannot assume complete reversal to natural conditions, efforts initiate a long-term recovery process.

d. Broadcast Burning and Piling

Past monitoring has found no detectable degradation of soil when broadcast burning occurs while soil moisture content is greater than or equal to 25 percent (Niehoff 1985 and 2002). Additional soil impacts are expected from grapple piling (above table), but can be lessened if machinery operates on slash mats, is limited to slopes less than 35 percent, and does not displace surface soils. These actions would not involve skidding logs.

Indirect Effects

> ***Indirect Effects*** *are caused by the action and occur later in time or are spatially removed.*

Indirect effects on soils may include the potential loss of site productivity due to removal of large woody debris and nutrients, loss of soil wood, and their resulting effects to vegetative and hydrologic processes. Erosion, mass wasting, soil biology changes, and fertilization effects of ash after fire can also be of consequence.

4.5-B Environmental Consequences

4.5-B.1 Direct and Indirect Effects

Direct and indirect effects on the soil resource are described below for proposed activities identified in Chapter 2. Effects assessed were based upon their potential to create detrimental impacts and impair soil productivity in the activity areas.

a. Direct and Indirect Effects Common to All Alternatives

Direct and Indirect Effects of Wildfire

The continued accumulation of dead and down fuel loads could contribute to an increased potential for locally severe fire effects on soil. Deteriorating effects usually include loss of organics and nutrients, and a reduction of water infiltration (Wells et al. 1979, p. 26). High intensity burns that create high soil surface temperatures, particularly when soil moisture content is low, may result in a complete loss of soil microbial populations, woody debris, and the protective duff and litter layer over mineral soil (Hungerford 1991; Neary et al. 2005). Since erosion increases following a fire are often directly proportional to fire intensity (Megahan 1990, p. 146), the removal of ash-capped surface soils could reduce soil productivity.

Fire-induced soil hydrophobicity is presumed to be a primary cause of the observed post-fire increases in runoff and erosion from forested watersheds (Huffman et al. 2001). Though hydrophobicity is a naturally occurring phenomenon that can be found on the mineral soil surface, it is greatly amplified by increased burn severity (Huffman et al. 2001; Neary et al. 2005).

Soil hydrophobicity usually returns to pre-burn conditions in no more than six years (DeBano 1981; Dyrness 1976); other studies have documented a much more rapid recovery of one to three years (Huffman et al. 2001). The persistence of a hydrophobic layer will depend on the strength and extent of hydrophobic chemicals after burning and the many physical and biological factors that can aid in breakdown (DeBano 1981).

If a wildfire occurred, consequent resource damage from mechanized suppression activities and burn severity could range from negligible to severe, depending on location, size, severity of burn, and subsequent administrative activities. Primary risks for erosion and mass failure would be from slopes and associated roads, especially at stream crossings in the event of debris flows. These risks are discussed in more detail in the Watershed Hydrology section. Loss of soil productivity could be extended depending on burn severity, location, and post climate characteristics. Following a severe fire, rehabilitation efforts to mitigate the fire's effects on erosion and sediment delivery would likely occur and reduce potential negative effects.

Alternative 1 – No Action

Soil Disturbance

- Does not meet soil quality in 2 units.

Soil Productivity

- There would be no compaction or displacement beyond what currently exists.
- Litter, duff, and fuel loads would continue to accumulate until major disturbance occurs
- Soil nutrient cycling would continue.
- Stands currently at high risk for mortality would not be treated.

If a high severity fire occurs:

- Hydrophobic soils could reduce water infiltration.
- Soil erosion and mass movement could occur, depending on location.
- Reduced soil productivity would be possible through loss of organics (duff, soil wood, coarse woody debris), nutrients, microbial populations, and increases in noxious weeds.

b. Direct and Indirect Effects of Alternative 1 - No Action

Under this alternative, no new management-induced detrimental direct or indirect impacts would occur in the project area. No effects to soils would take place in Alternative 1, as no road construction, road decommissioning, logging, or fuels treatments would take place.

There would be no compaction or displacement beyond what currently exists. No soil restoration or watershed improvement activities would occur. Soil potassium and nitrogen would continue to cycle, build up at current rates, and not be subject to removal due to fuels reduction. Soil nutrient cycling would continue in the soil at low rates from rock weathering, atmospheric deposition (mostly nitrogen), and nitrogen fixation. Soil nutrients would be bound in organic matter complexes and slowly released through decay.

On a landscape scale, the restoring of ponderosa pine, western larch, and white pine would not occur. Timber stands would continue to reflect past management practices that selectively harvested seral species, leaving the more pathogenically prone Douglas-fir and grand fir. Stand conversion to more site-appropriate tree species would be delayed (or may never occur) relative to the Proposed Action Alternative 2.

Under the No Action Alternative, stands currently at high mortality risk would not be treated, which may increase the risk of stand loss due to wildfire, severe burning, erosion concerns, and loss of soil nutrients. Moreover, the introduction of weeds and unwanted flora following a fire could lead to higher competition between less desirable plants and native vegetation.

In the absence of such a hot fire, nutrients would be retained on site. However, stand conversion back to more site-appropriate tree species would be delayed in comparison to the Proposed Action Alternative 2. The continued accumulation of dead and down fuel loads could contribute to an increased potential for locally severe fire effects on soil, including physical alteration of soil structure and development of hydrophobic layers.

On existing roads, no change in use, management, or maintenance would occur on Federal land in the foreseeable future. In the event of a fire or rain-on-snow event, roads can be a major contributor to sediment production (see Aquatics section).

c. Direct and Indirect Effects of Alternative 2 (Proposed Action) and Alternative 5

Direct and Indirect Effects of Vegetation Treatments

Alternative 2 proposes regeneration cutting on 1896 acres and commercial thinning on 190 acres (for 2086 acres total) using a combination of helicopter (54%), cable (20%), and ground-based (26%) yarding systems (Chapter 3, Table 3-20). These vegetation management activities have the potential to cause detrimental soil disturbances, such as compaction and displacement, by removing an estimated 151 acres (7 percent) of the total activity area from a long-term productive growing state (Chapter 3, Table 3-20; and PF SOIL-9). Post-harvest fuel treatments are proposed on 2086 acres and consist of 1022 acres (49%) of grapple piling, 1039 acres (50%) of underburning and 25 acres (1%) of yarding tops (Chapter 3, Table 3-17).

Tops would be yarded in Unit B3 (25 acres) and, to serve as an additional buffer, in activity areas (treatment units) with perimeters adjacent to open roads (Roads 633, 402, 2190) and along private land boundaries (PF Soil-39). The tops would be yarded in areas about 150 feet wide and would create a buffer that would reduce the likelihood of an escaped fire along open road systems, and would provide control during underburning operations. Alternative 2 would have approximately 150 acres of these buffers; Alternative 5 would have approximately 95 acres. (These acres are included in the total acres of underburning and grapple piling shown in descriptive tables.)

Alternative 2 – Proposed Action

- Meets soil quality standards in all units. Includes net improvement in 2 units.
- Exceeds or is at recommended soil quality standards in two units.
- Detrimental disturbance on ~151 acres.
- Reduced nutrients on site but mitigated by overwintering slash in all units except on 25 acres in one activity area (B3) due to whole tree yarding.

Alternative 5

- Meets soil quality standards in all units. Includes net improvement in 2 units.
- Exceeds or is at recommended soil quality standards in two units.
- Detrimental disturbance on ~95 acres.
- Reduced nutrients on site but mitigated by overwintering in all units except on 25 acres in one activity area (B3) due to whole tree yarding.

Soil Productivity

- Coarse woody debris retained at appropriate levels.
- Localized areas of soil sterilization, reduced water infiltration, and lost ground cover below burn piles.
- Short-term reduction in ground cover due to prescribed burns, skid trails, and skyline corridors.
- Removal of live trees may increase risk of local mass failures, especially near roads.

If a low-moderate severity fire occurs:

- Minor soil erosion and mass movement would be possible, depending on location.
- Small and, in most cases, acceptable effects would influence soil health and productivity.
- Chances for high severity fire effects on soils would not be eliminated but likely reduced when compared to the no-action alternative.

Alternative 5 proposes regeneration cutting on 726 acres and commercial thinning on 139 acres (for 865 acres total) using a combination of helicopter (43%), cable (23%), and ground-based (34%) yarding systems (Chapter 3, Table 3-16). These vegetation management activities have the potential to cause detrimental soil disturbances, such as compaction and

displacement by removing an estimated 87 acres (10 percent) of the total activity area from a long-term productive growing state (Chapter 3, Table 3-20, and PF SOIL-8 and 10). Fuel treatments are proposed on 865 acres and consist of 346 acres (40%) of grapple piling and 519 acres (60%) of underburning, (Chapter 3, Table 3-17).

Field monitoring of proposed units with past timber harvest history in the Myrtle and Snow Creek drainages indicates a range of existing soil damage from negligible (such as firewood cutting) to 21 percent (Chapter 3, Table 3-20). The areas proposed for ground-based timber harvest are most vulnerable to exceeding soil quality standards for area extent of disturbance upon completion of activities. Ground-based yarding is currently proposed in 12 units under Alternative 2 and in 6 units under Alternative 5. Unit G1 contains some steeper slopes (>45%) that will be eliminated from proposed ground-based harvest activities (PF SOIL-33).

All proposed ground-based units will be winter logged, especially Units G3 and G10 due to existing conditions. Though Unit G3 is proposed ground-based, there may be an opportunity to tie in with skyline equipment that will be used in neighboring Unit G4. This would be beneficial to reducing potential disturbance.

Timber harvesting would open up tree canopies and logging slash from tree limbs, tops, and un-merchantable pieces would add to existing *short-term* fuel loadings. Canopy removal would allow wind and sunlight to penetrate, heat, and dry the debris, which could increase potential fire intensity and severity until the slash is treated or naturally abated. However, the *long-term* risk for a stand-replacing wildfire would be reduced by creating more open stand structures that would have lower accumulations of large diameter fuels and that would be less likely to support crown fires (see Specialist's Report on Fire and Fuels).

Soil compaction effects can last for decades but are not irreversible. Recovery processes vary greatly with soil texture and clay content and their interaction with climatic processes such as cycles of freezing-thawing and wetting-drying (Dykstra and Curran 2002; Landsberg et al. 2003). Persistence of compacted soil and, presumably, long-term consequences of compaction for tree growth depend on the severity of the initial compaction, the ability of species to cope with compacted soils, and rates of processes that decompact the soil (Cromack and others 1979; Froehlich and McNabb 1983; Froehlich et al. 1985). Soil displacement that mixes or removes the volcanic ash surface layer, however, reduces soil moisture holding capacity and associated productivity, which is essentially irreversible.

Site specific design prior to unit layout required that proposed activities avoided landtypes that are known to pose a potential hazard. Additional local areas of concern were identified during field reviews so that soils and slope stability would further be protected (FEIS Chapter 2). The proposed activities would not adversely impact slope stability.

Direct and Indirect Effects of Roads and Landings

Both alternatives propose temporary road construction to reopen Road 402-C approximately 0.6 miles to move personnel, logs, and/or equipment to complete harvest and fuels treatments (Table 3-18). The proposed temporary road would be constructed on an old roadbed already containing legacy soil compaction, displacement, and effects to site productivity on approximately 2.4 acres assuming an average road width of 35 feet.

Upon treatment completion, approximately 1 mile (~4.2 acres) would be obliterated which includes culvert removal, ripping and re-contouring the road prism, restoring stream channel crossings, seeding, fertilizing, and topping the areas with woody debris and organic matter. All landings and helicopter pads will be located on system roads (Map appendix). A jump-up landing on private land just west of proposed Unit B5 (Alternative 2 only) and one landing in a private parcel adjacent to G1 would be utilized. Additional discussion of road effects can be found in the Specialist's Report on Watershed Hydrology.

Direct and Indirect Effects of Mitigation Measures

Mitigation measures, such as use of existing skid trails, slash mats, and winter logging would keep proposed harvest impacts under 15% for the units that are currently below this level. Design and mitigation measures and their effectiveness to limit harvest impacts are described in Chapter 2.

The two activity areas which currently are close to or exceed soil quality standards (G3 and G10) would be winter logged to further prevent additional impacts. A combination of seasonal restrictions and strict adherence to making use of the existing skid trail corridors and utilizing slash mats whenever possible should provide adequate protection so that current conditions are not increased.

In addition, provision for net improvement on previously impacted activity areas would be achieved through soil restoration activities that would affect old detrimental disturbance in Units G3 and G10. This would be accomplished through decompaction, addition of organic material, revegetation of bare areas, and weed control. Anticipated results would provide for improvements in hydrologic function and would initiate a recovery process that otherwise may be prolonged as soil compaction persists. Post-harvest monitoring is scheduled to assess if mitigation objectives in these units are met.

4.5-B.2 Direct and Indirect Effects of Activities on Soil Productivity

Harvesting removes nutrients that have accumulated in the forest over time. Harvesting the tree bole only would remove about 14 percent of the tree's potassium, potentially causing indirect effects to some plants. Following the management recommendations from the Intermountain Forest Tree Nutrition Cooperative (IFTNC) would minimize any additional loss of potassium and nutrients from treated areas by overwintering slash on 2086 acres in Alternative 2 and 865 acres in Alternative 5, this excludes the area that would be whole tree yarded to create fuel buffers along open roads and private lands. Alternative 2 would have approximately 150 acres of fuel buffers; Alternative 5 about 95 acres. Additional measures include planting western larch, ponderosa pine, and western white pine that require less potassium than species with increased abilities to sequester nutrients, like Douglas-fir or grand fir (Garrison and Moore 1998; Moore et al. 2004b).

Effects of whole tree harvesting on the growth of trees are greatly influenced by rotation cycles and silvicultural prescription. As long as rotations are extended, the depletion of major nutrients needed by plants should not be excessive in relation to total reserves in the soil that replenish between harvests (Marion 1979; Perry 1994). In an effort to keep nutrient reduction to a minimum, logging systems and site preparation options were incorporated to reduce the acreage impacted by whole-tree yarding.

For Alternative 2, whole tree yarding is proposed in unit B3 (25 acres) because of the fuel load if left untreated, slope steepness, sensitivity of surrounding drainages, and that the Unit could not be accessed by a grapple piler. Tops would also be yarded within fuel buffers in Units B1, B4, B5, G1, G3, G4, G5, G6, G7S, G10, G11, E3, and E8 for a total of approximately 150 acres. The fuel buffers utilize the perimeters of the units (PF Soil-39 and 40) that are located along the main access routes (Roads 633 – Alternative 2; Roads 402, and 2190 – Alternatives 2 and 5) and a parcel of private land, and offer a 150 foot buffer that reduces excess slash piles, lessens the likelihood of fire along the travel routes, and provides control during underburning. For Alternative 5 the fuel buffers would total about 95 acres.

Removal of tops and limbs would likely result in about twice as much potassium loss as bole-only yarding, so that Unit B3 (in Alternative 2 only) and the units that contain the 150-foot fuel buffers along the road perimeter may sustain a greater nutrient loss than the remaining activity areas. However, sub-merchantable material (for Unit B3) and broken foliage and limbs would remain on site and contribute to the nutrient pool.

The preferred alternative would remove tops and limbs and would likely result in about twice as much potassium loss as bole-only yarding, so Unit B3 may sustain a greater nutrient loss than the remaining activity areas. However, sub merchantable material and broken foliage and limbs would remain on site and contribute to the nutrient pool. This material would be slashed, left over the winter to leach out nutrients, and treated with an underburn in the spring when soil moisture conditions are at or above 25 percent.

Conventional removal, (lop and scatter) rather than whole-tree yarding would be practiced in all remaining units. Slash would remain on site over-winter so that mobile nutrients, such as potassium, can leach from fine materials back into the soil. Broadcast burns would be "light" in nature and would foster the release of tied up nutrients. These measures would likely reduce the occurrence of nutrient-influenced insect and disease-caused mortality in the future.

Indirect effects of soil nutrient loss include reduced growth and yield and increased susceptibility to pathogens, such as root disease (Garrison and Moore 1998) and insect infestation (Garrison-Johnston et al. 2003). Precipitation (Stark 1979) and weathering of rocks will continue to make additional nutrients available on site. Annual needle, leaf, and twig fall, forbs, and shrub mortality will continue to recycle nutrients as well.

4.5-B.3 Direct and Indirect Effects of Activities on Coarse Woody Debris and Organic Matter

The amount of coarse woody debris present in the project area varies (PF SOIL-1). Many stands, especially those proposed for first entry, contain high amounts of downed wood originating from root disease and beetle infestation. These amounts greatly exceed the recommendations of Graham et al. (1994) and Brown et al. (2003) and contribute to hazardous fuel loading. Historically, fire would have moderated the amount of accumulated coarse woody debris (Smith and Fischer 1997).

Approximately 7 to 14 tons per acre of coarse woody debris (slash and logs) would be left on Douglas-fir/grand fir sites and 17 to 33 tons/acre on hemlock/cedar sites for coarse woody debris recruitment. This would provide a long-term source of nutrients and organic matter as well as protection against soil erosion (Brown et al. 2003; Graham et al. 1994). However, removal of excess woody debris reduces the potential for high-temperature uncontrolled fires that could otherwise sterilize the soil, cause highly erosive hydrophobic soil conditions, and reduce overall soil productivity (Pritchett and Fisher 1987).

Field observations and soil transects show that organic matter varies throughout the activity area (PF SOIL-1) with depth of organic matter generally correlating to habitat type and aspect. Organic matter content is usually high on moist sites and northerly aspects and low to optimum on dry sites. Potential loss or reduction of organic matter can lead to a decline in several key soil and foliar nutrients (Powers 2005).

Indirect effects of soil wood loss include altered processes of forest regeneration and growth, favoring species requiring lower soil moisture, lower nutrient levels, and greater potential for soil erosion. Additional effects could also include loss of habitat for species requiring soil wood as dens or substrate for invertebrates, bacteria and fungi, which affect food availability for small rodents and their predators.

4.5-B.4 Direct and Indirect Effects of Prescribed Burning and Slash Disposal

No measurable negative effects on soils are anticipated from post-harvest underburning if soil moisture content is greater than or equal to 25 percent when the burning occurs (PF-SOIL38, Niehoff, 1985). On the south facing dry site units, the prescribed burns would have limited detrimental effects when executed in the spring. Burning under controlled conditions of high soil moisture reduces potential nutrient losses and the chance of creating hydrophobic soils that can lead to increased erosion, sedimentation, and debris flows (Neary et al. 2005; Robichaud 2000; Swanson 1981).

When burn piles are large, nutrient losses from heat and volatilization could be considerable. Mitigation therefore recommends that burn piles be small (approximately 10 to 18 ft. diameter) and numerous, rather than large and few. In some cases, burning of the slash piles may create localized patches of hydrophobic soils for as much as one to two years, but the areas are generally not large or extensive enough to alter the slope hydrologic response or long-term soil productivity.

However, on an unpredictable site-specific basis, some drier sites may burn at a severity level that removes all of the protecting duff and litter layers, even under managed fire conditions. The duff and litter layer is important in protecting the soil horizons, both as reducing erosion potential and in maintaining soil moisture. Litter prevents the breakdown of soil aggregates and reduces the velocity of any overland flow, thereby decreasing the erosion potential (Beschta 2004). Project design features and mitigation measures are expected to minimize this effect (FEIS Chapter 2).

Design features also require piling machinery to operate on a slash mat whenever enough material is available and on slopes less than 35 percent to prevent soil disturbance in excess of guidelines. These units would be entered from existing roads, skid trails, and firelines below or within the proposed units. Only areas that could be reasonably accessed would be treated and none of the trails would be excavated to facilitate access. The residual logging debris that would be lopped and scattered or that could not be grapple piled and burned would increase potential fire intensity and severity for a few years until snow could compress the debris and the fine organics would decompose. Untreated forest and riparian habitat conservation areas between the grapple piling activity and the stream networks would prevent sediment delivery to stream channels.

4.5-B.5 Direct and Indirect Effects of Reforestation

Planting would be done by hand crews and access would occur from existing system roads. This activity would reduce the amount of time needed to recover vegetation, hydrologic function, and soil productivity after regeneration harvesting. A reduction in potential sediment production and delivery as well as potential slope instability could be expected with establishment of reforested activity areas. Additional benefits from planting western larch, ponderosa pine, and western white pine is their reduced requirement for potassium compared to species with increased abilities to sequester these nutrients, like Douglas-fir or grand fir (Garrison and Moore 1998; Moore et al. 2004b).

4.5-B.6 Direct and Indirect Effects of Noxious Weed Control

Most of the noxious weed control used in Myrtle Creek has been biological. However, herbicides have been applied sparingly and judiciously in Myrtle Creek on noxious weeds in accordance with the requirements of the Bonners Ferry Noxious Weed EIS (USDA 1995b). Noxious weed treatments do kill target vegetation that reduce vegetative ground cover, but do not remove protective organic layers and occur over relatively small treatment areas away from streams. Therefore, this activity is not expected to degrade soils, add to sediment production and delivery, or affect wildfire risk.

4.5-C Cumulative Effects

This section describes the anticipated cumulative impacts of the direct and indirect effects added to other past, present and reasonably foreseeable future activities. Effects can occur in site-specific locations, or across a broader landscape area; thus they have a spatial scale. They can also occur over a period of time; thus having a temporal scale.

> ***Cumulative Effects*** *- The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.*

Spatial Scale - the appropriate scale, or geographic bounds, for cumulative effects analysis relates to an area that would be affected by the proposed action or reasonable alternative. This area is referred to as the cumulative effects analysis area and

may vary between resources. The task of selecting the geographical boundaries involves several factors, including the scope of the project considered and the features of the land. If one acre of land receives soil impacts and a second management activity is planned for that same site, then soil cumulative effects are possible. One exception would be the evaluation of slope stability, which requires a closer look at the adjacent terrain outside activity areas to determine if cumulative effects from past management activities and roads are adverse. However, evaluation of cumulative effects to soil productivity does not require in integrated "watershed-type" assessment since that is not considered an appropriate geographic area. This is because assessment of soil quality within too large an area can mask or "dilute" site specific effects.

At the unit scale, activities that cause soil impacts may have cumulative effects – i.e. soil porosity, water holding capacity, aeration, long-term productivity etc. – with repeated entries. Cumulative effects due to physical, chemical, and biological impacts often increase with the scope of past and proposed activities (Reid 1998).

Temporal Scale - the temporal scale is dependent on the specific issue being addressed with no one scale being appropriate for all issues. The analysis may need to evaluate the effects of proposed management over all seasons for several days, years, decades, or perhaps centuries. This is complicated by data constraints that require monitoring to detect change – though data are often insufficient to identify even trends or trajectories of change until the impact is large enough or has been occurring for some time. Furthermore, there is often a lag between some action and its observed effect. This analysis strives toward an integrated approach to soil processes and function to project future trends in response to proposed management options to the best of abilities. For the purpose of this evaluation, short-term effects are defined as those that occur approximately within one to ten years following management activities. Long-term effects are defined as those that occur approximately within 10 to 20 years following management activities.

Generally, detrimental effects on soils are not permanent and depend primarily on soil texture, parent material, aspect, and level of compaction. Recovery time is on the average 30 to 70 years as second growth timber becomes established around disturbed areas (Dykstra and Curran 2002; and Froehlich et al. 1983 and 1985). However, soil displacement that mixes or moves the volcanic ash surface layer and reduces soil moisture holding capacity and productivity is essentially irreversible.

4.5-C.1 Past Activities

a. Logging

Past actions contribute to the baseline conditions that provide a foundation for the analysis (e.g. previous timber harvesting, road building, and fire suppression actions since the early 1900s). Past activities (such as past timber harvest; Map Appendix) and natural processes (such as mass movement and erosion) are described in the Affected Environment section (see Chapter 3) and provide baseline conditions for soils.

Walkthrough surveys of areas proposed for treatment, communication with district personnel, and timber records indicate that regulated timber harvest started on Forest Service land in the project area in the 1950s and continues to the present day (DEIS Fig. 3-74; Tables 3-74 and 3-75).

There is approximately 4,860 acres of industrial private timber land in the upper portion of Myrtle Creek and parts of Snow Creek drainage. Though timber harvest prior to the 1950s was very limited in scale, logging activities have been ongoing and past harvest activities have occurred on approximately 8000 acres of private and Federal land within the project area. How much of these acres are detrimentally impacted can only be estimated, especially since a large portion of the affected land is private. Effects on soil productivity from these activities are site specific attributes of the land on which they occur.

Intensive mechanized harvest prior to the 1990s was widespread on private and Forest Service land and often highly impacting (Niehoff 2002) with unconstrained tractor skidding, dozer piling or windrowing, and hot burning of slash and burn piles. Skidding was often done on steeper ground and more dispersed than might occur today. No soil restoration occurred and riparian harvest was still the norm until the mid 1990s.

By the mid 1990s, some controls had been imposed on tractor skid trail spacing, season of use, or riparian harvest, but compaction and displacement were still widespread. In general, monitoring over the past two decades (Niehoff 2002; USDA 1998, 1999, 2003, 2004) shows a visible trend in soil impact reduction on the IPNF compared to the logging practices of earlier times. This has been accomplished through winter logging, utilization of slash mats, and a better awareness of the importance of protecting long-term soil productivity (USDA 1998, 1999).

On the unit scale, none of the proposed activity areas have been clearcut in the past. On the watershed scale, clearcutting occurred in the Myrtle Creek drainage and likely removed nutrients on approximately 1284 acres of the project area. These effects have been incorporated into the watershed analysis for this project.

b. Roads

Roads constructed in the past provide access to federal and private land in the Myrtle Creek project area (DEIS Tables 4.2 and 4.3 in Watershed Hydrology section). System roads were removed from productivity when they were constructed and have

little additional effect on the area when they are properly maintained (i.e. functioning culverts, drainage structures, surface etc.). Minimal short-term impacts to soil are anticipated from proposed road maintenance activities, which consist of blading, drainage improvement, and surfacing.

Conversely, unmaintained or improperly maintained roads are identified to be one of the main sources of sediment contribution to streams through erosion, sediment routing, and slumping. See the Watershed Hydrology report for a detailed discussion of road related sediment concerns. Implementation of appropriate BMPs and the mitigation measures defined in Chapter 2 would reduce road related sediment.

c. Wildfire

Records of historic wildfires in the vicinity of Myrtle Creek reinforce the potential probability and risk for future wildfires, especially if a fire ignites in an untreated area under dry weather conditions. Extensive wildfires, such as the Sundance Fire of 1967, burned several surrounding drainages of the Selkirk Mountains to the south. Soils at high elevations, and particularly south-facing aspects, still display reduced productivity to this day.

The more recent Myrtle Creek Fire of 2003 burned approximately 3450 acres (PF SOIL-15) of primarily south-facing slopes and some pockets of the middle- to lower lying north-facing mountain side. A rise in sediment to the municipal water supply of Bonners Ferry forced the City to close its water intake pumps for the duration of one week right after the fire and on two other occasions after heavy summer rains resulted in debris flows upstream (see Specialist's Report on Watershed Hydrology).

The Myrtle Creek Fire is considered a past activity, along with the BAER treatments following the fire, because the watershed is still recovering from the fire and post-fire actions. It was also factored into the existing condition (see Chapter 3). The greatest impacts usually occur during the first one to two years after the fire. Regeneration and revival of groundcover are showing positive trends throughout the burn area. Erosion mitigation studies were conducted as to the effects of different erosion treatments after a fire. This research is still ongoing and thus part of the present actions which have no cumulative effects on the watershed or Myrtle HFRA project.

d. Present Activities

Logging – On National Forest System land, activities occurring within the Big Mack, Salt Lick and Mama Cascade Timber Sales were analyzed in the Myrtle-Cascade FEIS (USDA 2001b). Projects to be completed associated with the Big Mack Timber Sale are the shelterwood harvesting of approximately 60 acres, the underburning of approximately 162 acres, and the grapple piling and burning of approximately 80 acres. Completion of these tasks is open ended based on available burn windows and soil moisture conditions. All other logging, hauling, or site preparation associated with harvest activities on National Forest System land have been completed. No additional effects to watersheds beyond what was analyzed for and disclosed in the Myrtle-Cascade FEIS (USDA 2001b) are expected to occur.

Fire suppression – activities over the last century within the project area have allowed stands to progress towards climax vegetative conditions in much of the cumulative effects area. In stands outside of the 2003 Myrtle Creek Fire area, the current trend is toward more shade tolerant species compositions, which are not as long-lived and are more susceptible to insects, disease, and consequently, fire. Since changes in soil water content are associated with proposed fuel reduction activities, the existing and future trend could have an effect on potential slope stability.

Recreation - The project area is open for recreation with most individuals using motorized access to pass through or hike in the area. The Snow Creek watershed is an area which receives snowmobile use and will likely see an increase in recreational vehicle access due to an improved road surface. This will force additional needs in road and trail maintenance. Illegal motor vehicle use occurs, but is infrequent at this point. The Myrtle Creek watershed area is closed to fishing and hunting as part of the Myrtle Creek Game Preserve. No campgrounds or picnic facilities are available in the project area. (See the Recreation portion of the FEIS for more information.)

e. Reasonably Foreseeable Activities

Logging - Other than the proposed activities, there is no ongoing or reasonably foreseeable timber harvest proposed on Federal land in the project area. Salvage opportunities may take place if a wildfire should burn through the project area, but would not proceed with the appropriate analysis.

On private land (Forest Capital), in lower Snow Creek, a shelterwood cut is proposed on 120 acres in S35 T62N R1W (just east of G1 and G2). There are no plans for harvest or road building anywhere else on private land in the project area in the foreseeable future. Timber harvest on private land must follow the rules and Best Management Practices set by the Idaho Forest Practices Act (Title 38, Chapter 13, Idaho Code). Though most of the activities on private land that detrimentally disturb soils, impair soil productivity, and increase soil water content are site specific, potential contribution to the cumulative condition are possible because slope instability could affect surrounding federal lands..

Prescribed Burning - Prescribed burning and slash disposal in several previously untreated units of the Salt Lick and Big Mack timber sales will take place; respectively in stands 76201076, 76801005, and 76801006 in Sections 26 and 27, T62N, R1W; and Stand 71701078 and Sections 7 and 12, T62N, R2W. Completion of these tasks is open ended based on available burn windows and soil moisture conditions.

Land Exchange - The Grandmother Mountain Land Exchange is between Forest Capital, a privately owned timber management company, and the Forest Service. The exchange is scheduled to be completed in early 2007. The majority of the land involved in the exchange is located on the St. Joe Ranger District outside of the cumulative effects area of this project. However, under this land exchange the Forest Service would obtain approximately 280 acres located in the lower Myrtle Creek drainage, including approximately three quarters of a mile of Myrtle Creek, which includes Myrtle Creek Falls. The acquisition of this parcel would benefit water quality, bull trout and other aquatic species within the cumulative effects area through the long-term protection of lands adjacent to Myrtle Creek and Myrtle Creek Falls.

Weeds - Noxious weed monitoring and treatment would continue and would follow guidelines established in the Bonners Ferry Noxious Weeds Control Project EIS (USDA 1995b). Effects to soil resources were analyzed in the document and its adaptive strategy. No additional effects to soils beyond what was analyzed for and disclosed in the Bonners Ferry Noxious Weeds Control project EIS are expected to occur.

Roads - Future road decommissioning and culvert improvement activities are expected in the Myrtle Creek and Snow Creek watersheds and depend on funding opportunities. Road decommissioning and soil restoration would contribute to a reduction in compaction, thus improving infiltration and reducing surface runoff (Switalski et al. 2004). Removing stream crossings when decommissioning old roads or replacing culverts on open roads is expected to have short term impacts on sediment yield below the crossing sites, but lower the longer term risk of sediment entering the streams and degrading water quality (See watershed analysis).

Forest Products - The gathering of forest products and firewood within the project area will continue. Firewood cutting removes standing dead and down trees that contain little if any fine fuels, usually within 100 feet of open roads. With the minor amount of wood removed and small area impacted, this activity has very little effect on the soil resource.

4.5-C.2 Cumulative Effects of Alternative 1 – No Action

In addition to the direct and indirect effects, Alternative 1 would not add to cumulative soil effects unless severe burns create unwanted hydrophobic soils that could provide a mechanism for overland flow, slumping or road failures. Since there would be no ground-disturbance to cause detrimental soil effects, there would be no activities contributing to cumulative effects.

4.5-C.3 Cumulative Effects of Alternative 2 (Proposed Action) and Alternative 5

a. Cumulative Effects of Vegetation Treatments on Soils

The effects of past activities, including timber harvest, were considered in the establishment of the existing condition in proposed activity areas (see Chapter 3). The anticipated effects of proposed activities were incorporated in the existing condition and evaluated for cumulative effects against the Regional Soil Quality Standards as displayed in Chapter 3, Table 3-20.

Potential cumulative impacts to the soil resource are possible in areas that have been previously harvested (see Map Appendix and Table 3-15) if design features are not implemented. Under Alternative 2, the most relevant impacts originate from recent activities in the Myrtle Creek drainage and affect proposed Unit D2 and portions of D1 that were tractor logged during the Snow-Myrtle timber sale in 1986. For both alternatives, past harvest activity in Snow Creek occurred in proposed Units G2, G3, G4, and G9 that were treated using ground-based and cable equipment with the Snow Creek Timber Sale (1996-97). The Snowplowksi timber sale (1996) affected portions of G7S and all of units G10 and G11 with ground-based logging.

Three activity areas, D1 (Alt 2 only), G2, and G7S were tractor logged in isolated portions of the units but are otherwise untouched. Although there are localized areas that are impacted, these units do not exceed the soil quality standards (Chapter 3, Table 3-20). Proposed aerial logging and site preparation should keep disturbance well below 15 percent.

b. Cumulative Effects of Vegetation Treatments on Slope Stability (Alternative 2 only)

Proposed harvest activities can increase the potential for slope instability from increased soil water content, reduced and decomposing root mass, and decreased canopy cover, when added to already existing past harvest activities within the same vicinity (Megahan et al. 1978; Gray and Megahan 1981). There is a potential for cumulative effects on approximately 271 acres in proposed Units E3, E8, and F1 that are located east of the Curve Creek timber sale (1990), and the more recent (2004)

Salt Lick timber sale (see Map Appendix). However, stable slopes are less than 35 percent and harvest treatments were intermediate so that remnant trees and upcoming regeneration should provide little cause for concern.

Slope stability could be also affected on site, and downslope from proposed Units D1 and D2, as soil water may increase as a result of logging and the cumulative effects from a winding system road and past regeneration harvest (mid 1980s) surrounding the immediate area. Dense reforestation on the productive surrounding slopes, however, reduces instability potentials.

The remaining past harvest activities in the proposed project area that are not spatially associated with any of the proposed harvest units (i.e. downslope or upslope) were identified as stable or not relevant to having a cumulative effect.

c. Cumulative Effects of Roads

The Myrtle HFRA project is expected to have short-term (days) road related impacts from temp road construction (402-C) and obliteration, followed by long-term improvements. The short term impacts would primarily be from increased sediment yield resulting from soil restoration on the entire 402-C spur road totaling one mile of road obliteration, and associated culvert removals. Activities are geared towards an overall net improvement of watershed conditions. A comprehensive evaluation on cumulative effects of the remaining road system can be found in the Specialist's Report on Watershed Hydrology.

d. Cumulative Effects of Activities on Coarse Woody Debris, Organic Matter, and Soil Productivity

The proposed vegetation and fuel treatment activities in Alternative 2 are expected to remove site nutrients with the harvest of tree boles on 2086 acres of the project area. Alternative 5 would affect 865 acres. Certain nutrients, particularly potassium, are known to be critical for tree resistance to insects (Garrison-Johnston et al. 2003) and disease, especially root-rotting organisms (Garrison and Moore 1998). Maintenance of sufficient nutrient capital will be provided by retaining coarse woody debris (Brown et al. 2003; Graham et al. 1994) and overwintering logging slash (Baker et al. 1989; Barber and Van Lear 1984; Edmonds 1987; Garrison and Moore 1998; Laskowski et al. 1995; and Palviainen et al. 2003).

For Alternative 2, whole tree yarding is proposed in unit B3 (25 acres). Tops would also be yarded within 150-foot fuel buffers in Units B1, B4, B5, G1, G3, G4, G5, G6, G7S, G10, G11, E3, and E8 for a total of approximately 150 acres. This could potentially reduce the organic matter and nutrient levels below those of the surrounding areas. In the event of a severe fire, cumulative effects from the already further depleted site are possible, and may negatively influence soil productivity and extend recovery time. Effects on soil productivity from these activities are site specific attributes of the land on which they occur. For Alternative 5 the buffers (Units G1, G3, G4, G5, G6, G7S, G10, G11, E3 and E8) would total about 95 acres.

e. Cumulative Effects of Prescribed Burning and Slash Disposal

When soils have adequate moisture conditions to retain their biological, chemical, and physical integrity, effects from the loss of forest floor can be minimized (Barnett 1989; Frandsen and Ryan 1985; Hungerford et al. 1991; McNabb and Cromack 1990). Direct effects of prescribed underburning and pile burning could potentially remove woody debris that would otherwise provide nutrients to the soil as the decay process occurs (Page-Dumroese et al. 2006). To minimize potential impacts, burning when soil moisture content is ≥25% would help maintain coarse woody debris requirements (Niehoff 1985 and 2002).

Fire would not be eliminated as an ecological process and proper management through fuel reduction and prescribed burning would sustain a future environment where fire is integrated and soil damage is minimal. Mitigation of unwanted potential fire effects through fuel treatments would reduce the chance of detrimental effects to soil productivity and would add little to no additional impact to the project area. There would be minor short-term amounts of soil disturbance from manual fire line construction.

4.5-C.4 Consistency with the Forest Plan and Other Regulatory Direction

a. IPNF Forest Plan Standards

Proposed management practices, *including system roads*, for Alternatives 2 and 5 meet the required 20 percent impact limit <u>except</u> for Unit G3. Decompaction efforts of the existing skid trails and a non-system road are planned and are estimated to reduce detrimental soil disturbance levels in Unit G3 below the current 21 percent. This would be a trend towards a net improvement over currently existing conditions in these units, therefore striving to meet the Forest Plan Standard (PF SOIL-18).

The Regional guidance to follow the coarse woody debris recommendations of Graham et al. (1994) would adhere to the Forest Plan Standard to maintain sufficient microorganism populations to maintain site productivity.

Provisions to maintain sufficient nutrient capital would be made in areas of whole-tree logging by retaining submerchantable material and breakage (such as foliage and limbs during harvest activities) on site to contribute to the nutrient pool.

Management area direction to implement Best Management Practices would be included (see Chapter 2 and Appendix C).

b. Regional Soil Quality Standards

Proposed management practices would not exceed the recommended 15 percent for all individual activity areas except Unit G3. In areas where more than 15 percent detrimental soil condition exists from prior activities (Unit G3), the cumulative detrimental effects from project implementation and restoration would not exceed the conditions prior to the planned activity and would move towards a net improvement in soil quality. This would be achieved through decompacting skid trails to reduce existing soil disturbance level (PF document SOIL-18).

Decompaction efforts are estimated to reduce the existing soil disturbance level in Unit G3 from 21 percent to between 11 and 15 percent (PF SOIL-18).

Organic matter layer thickness would be retained as appropriate for local conditions.

Large woody debris would be maintained at recommended volumes (Graham et al. 1994) in each proposed activity area.

4.6 - Inventoried Roadless Areas

As described in Chapters 2 and 3, portions of the Kootenai Peak and Selkirk Roadless Areas are within the Myrtle Creek HFRA project area. This section of the FEIS describes the analysis of the potential affects on these areas. To aid in the reader's understanding of the effects of the Proposed Action (Alternative 2), which was developed through collaborative meetings of the Myrtle Creek Working Group subcommittee of KVRI, this discussion starts with a description of the management activities, followed by a description of the effects.

Road construction in inventoried roadless areas was one of the items discussed during meetings of the Myrtle Creek Working Group. The discussion included the pros and cons of constructing new roads, weighed against the need to treat fuels in these areas, and the policy and legal framework guiding activities in roadless areas. It was agreed through the KVRI collaboration process, that construction of roads in either the Kootenai Peak or Selkirk Roadless Area would not be given further consideration for this project.

Roadless Area Conservation Rule

Alternatives 1 and 5 would not conduct any activities in Inventoried Roadless Areas, so this discussion focuses on Alternative 2. Activities are proposed in Inventoried Roadless Areas in order to maintain or restore desirable characteristics of ecosystem composition and structure to reduce the risk of uncharacteristic wildfire effects. The project is in keeping with the 2001 Roadless Area Conservation Rule criteria listed below.

As required in the 2001 Roadless Rule, the fuels reduction treatments proposed in the Inventoried Roadless Areas (IRAs) are designed to maintain or restore the characteristics of ecosystem composition and structure (such as to reduce the risk of uncharacteristic wildfire effects) within the range of variability that would be expected to occur under natural disturbance regimes on a landscape scale. Also as required, the timber that would be removed is generally small-diameter material.

4.6-A The Need for Fuels Treatments Within Inventoried Roadless Areas

The drainages in the project area are oriented with the prevailing wind direction – typical winds are light to moderate from the southwest. Late afternoon winds tend to funnel down the drainages. This orientation may aid in fire spread. Steep slopes on the sides of the drainages can contribute to rapid, upslope runs. District fire records show that it is not uncommon for wildfires in the Selkirks to move down drainage and northward from one drainage to the next. (See map of the 1926 fire in Chapter 3.)

Selection of potential treatment areas was based on the following fundamental factors:

- The need to reduce the risk of hydrophobic soils adjacent to Myrtle Creek and its tributaries, as they are the transporting mechanism for post-fire sediments.
- The need to reduce fuels in the path of historic burn patterns (see Figure 3.9 map of the 1926 fire that burned from the south to the north across several watersheds.)
- The need to treat areas at a high risk of crown fire hazard, and areas with poor ecological integrity (described in the Vegetation discussion, also see Figure 3.3 map of the terrestrial integrity in the project area.)

The fuel reduction treatment units, strategically placed on the landscape, are an integral part of the fuels reduction strategy to slow the spread of fire and keep fire out of the tree canopies, to help protect Myrtle Creek and its tributaries. The fuels reduction treatments complement this project's purpose and need (maintaining Myrtle Creek watershed as a source of high

quality drinking water for the City of Bonners Ferry; reducing hazardous fuels in Myrtle Creek watershed and adjacent forests; and, trending vegetation in Myrtle Creek watershed and adjacent forests toward conditions that would be less susceptible to catastrophic fire, while maintaining and restoring habitat for fish and wildlife species) by accomplishing the following:

1) fostering long-term reduction of risks from unwanted or undesirable wildfire, and
2) reducing or avoiding the associated post-fire effects within the municipal watershed for the City of Bonners Ferry, Idaho.

As explained in the Fire and Fuels discussion in Chapter 3, fires are influenced by the available fuels, topography of the area, and weather. The only side of the "fire behavior triangle" that can be changed by land managers is the available fuels. The best general approach for managing wildfire damage seems to be managing tree density and species composition through the use of silvicultural systems that include a mix of thinning, surface fuel treatments, and prescribed fire. All three of these fuels reduction / silvicultural systems would be used to some degree, to manage tree density and treat the surface, ladder and aerial fuels (Fire and Fuels Chapter 4 discussion of Forest Fuels and Fire Behavior and Chapter 2 description of Alternative 2).

Effectiveness of the treatments in reducing the risk of uncharacteristic (and unwanted) wildfire effects was measured by the following factors: crown fire hazard, suppression capabilities based on predicted fire behavior, and improvement in fire condition class (Fire and Fuels, Chapter 4, Methodology discussion).

Analysis disclosed that, overall, the proposed treatments are predicted to have the following results in the treated areas:

- Change from a Fuel Model 10 (timber with heavy timber litter) to a Fuel Model 8 (timber with light timber litter)
- Change the fire type from a Crown fire to a Surface fire (reduced potential for Crown Fire Hazard)
- Improve Suppression Capabilities from a situation with no direct attack capabilities, low production rates, and moderate to high fire severity; to a situation where direct attack is possible, production rates are high, and fire severity would be low.
- Improve the Fire Condition Class. (See Chapters 2 and 4, Tables of Fire/Fuels information.)

The fuels reduction treatments can be divided into three categories,

- even-aged regeneration cuts (irregular shelterwood),
- uneven-aged regeneration cuts (group selection), and
- intermediate/partial cuts (commercial thin)..

Detailed descriptions of the treatments can be found in Chapter 2, Silvicultural and Fuels Treatment Summary.

4.6-A.1 Alternative 2 Proposed Fuel Reduction Treatments

a. Treatments in Moist Forest Types (western red cedar and western hemlock habitat types)

Irregular shelterwood cuts (Units B1, B3, B4, B5, B6, D1**,** D6, D9, and E3). About 656 acres of shelterwood cutting is proposed under Alternative 2 in inventoried roadless areas. The majority of the stands proposed for shelterwood cutting are located in moist cedar hemlock forests. All, or portions, of these stands burned in the 1926 fire (Figure 3-9). This fire burned over 28,000 acres including about 6,000 acres within the project area. Most of the fire burned as a stand replacing event, which in essence, regenerated these stands and created the mostly even-aged conditions that exist in this portion of the project area today (Figure 3-18). Generally, these stands are dominated by trees *smaller* than 10 inches (diameter measured at breast height - DBH) and less than 80 years old. Most of the stands proposed for treatment have thick overcrowded overstories dominated by western larch, lodgepole pine, and Douglas-fir, which are declining in health and are being replaced by nearly impenetrable thickets of shade tolerant species (grand fir, western red cedar and western hemlock). These shade tolerant species tend to be much less resistant to fire, insects and disease than long-lived seral species they have replaced. Stand-replacing fires in these forest types left few large surviving trees (Smith and Fischer 1997, p.103).

Shelterwood cutting would be designed to approximate regeneration processes that occurred through natural disturbances. The large diameter western larch, white pine, and Douglas-fir, in addition to other large-diameter trees of other species, would be retained in the overstory and no future overstory removals would be scheduled. Shelterwood cutting would retain on average about 35 trees per acre (TPA), with some areas retaining fewer and some retaining more than 35 TPA. Stands would be regenerated with a mixture of species, but would feature western larch and white pine (species that are more resistant to insects and disease and fire than the shade tolerant species).

In the long-term, developing these types of stands would restore the desirable characteristics of ecosystem composition and structure, and reduce the risk of uncharacteristic wildfire effects. Ultimately, the structure and composition of these stands would provide the public and land managers with more options to meet fuels management objectives than with untreated stands. Figure 4-13 represents typical stand conditions where irregular shelterwood cutting is proposed. Figure 4-14 represents what an irregular shelterwood cut would like after treatment.

Commercial thinning (Units E8 and G8). About 46 acres of commercial thinning is proposed in inventoried roadless areas. These prescriptions would focus on retention of the biggest and best trees available in the stand, in particular western larch. The number of trees retained would vary from about 60 to 100 TPA. The average-sized tree removed would typically be less

than 9 inches DBH. Figure 4-17 represents typical stand conditions where commercial thinning is proposed. Figure 4-18 represents what a commercial thinning would like after treatment.

Smith and Fischer (1997, p.102) stated that the diverse species and structures of the habitat types indicate that pre-settlement fire regimes were highly variable. Helms (1998), defines silviculture as, *"the art and science of controlling the establishment, growth, composition, health and quality of forests and woodlands to meet the diverse needs and values of landowners and society on a sustainable basis."*

The proposed prescriptions in these forest types are designed to approximate some of the variability that occurred historically in these forest types, while meeting specific fuels management and water quality objectives. Although stand-replacing fire was a part of the natural processes that shaped the project area, this type of fire is not necessarily desirable in a municipal watershed. The proposed prescriptions will not reduce the risk of fire *occurrence* in the watershed, but they will create stand conditions that provide better opportunities for future managers to control structure and composition, which will in turn, reduce the risk in the long-term of that fire becoming a stand-replacing event.

b. Treatments in Dry Forest Types (Douglas-fir habitat types)

Historically, the south aspect of the Snow Creek drainage provided an avenue for wildfires that started south of the area, to enter the Myrtle Creek drainage (a very typical, documented, course of fire behavior on the eastern side of the Selkirk Mountains). The proposed treatments would create fuel buffers in stands that contain overstories of ponderosa pine, Douglas-fir and larch with understories composed of thickets of Douglas-fir that have formed ladder fuels. The objective of the buffers is to slow the spread of fire and help keep the fire out of the tree canopies.

Group Selection Cuts (Units F1 and G9). About 395 acres of group selection cuts are proposed in inventoried roadless areas. These prescriptions would feature the protection and maintenance of large (greater than 21" DBH) old trees (ponderosa pine, larch, and Douglas-fir), culture intermediate size trees (especially ponderosa pine and larch) and create small openings of two to three acres to promote regeneration of these species. There is substantial evidence that these forests burned every 35 to 40 years, and the current fire-free interval is now 80 years. These stands are now dominated mostly by Douglas-fir less than 12" DBH that have flourished in the fire-free environment, at the expense of ponderosa pine and western larch that perform poorly in closed-canopy forests. Treatment would focus primarily on the removal of the smaller diameter trees that have overgrown these forest types during the fire suppression era. Unit G9 includes approximately 83 acres of old growth.

Regarding the appropriateness of harvesting in old growth, Pfister et al (2000) stated:
"There are two conditions where restoration may require harvesting. First, initial restoration cutting treatments appear necessary to restore old-growth stands historically sustained by relatively frequent low to mixed-intensity fire. The most extensive example would be old-growth ponderosa pine and ponderosa pine/Douglas-fir stands. Overstocked stands with sapling pole understories are at high risk to stand replacement fire, and may not have the capacity to regenerate themselves following such fires. The appropriate treatment is to **significantly** *(emphasis added) reduce the density of understory* **and** *(emphasis added) overstory trees established since Euro-American settlement, and remove them from the site. Following cutting, restoration of fire, through prescribed burning, is necessary if such stands are to perpetuate themselves in place, consistent with historic disturbance processes, intervals, and intensities."*

4.6-B Policy and Legal Framework

4.6-B.1 Roadless Area Conservation Rule

As stated in the 2001 Roadless Rule. Circumstances where timber harvest may be authorized at the local level include:

- The timber is generally small-diameter material and the removal of timber is needed for one of the following:
  - To improve habitat for listed or proposed threatened and endangered, or sensitive species (FSM 2670), or
  - To maintain or restore the desirable characteristics of ecosystem composition and structure; for example, to reduce the risk of uncharacteristic wildfire effects.

See Chapter 3 for more information concerning the 2001 Roadless Rule.

4.6-B.2 Forest Plan

Forest Plan direction for Inventoried Roadless Areas is established through Management Areas direction and is primarily reflected in the MA 10 designation for Semi-Primitive recreation. See Chapter 3 section 3.6 for more information on Management Area direction.

4.6-C Analysis Methodologies

The inventoried roadless area discussion for the Myrtle Creek HFRA project was broken into two sub-topics:

1) the potential effects on roadless areas, and
2) the internal Forest Service requirements that would have to be met for timber harvest or the construction of temporary roads within roadless areas.

Analysis and disclosures of the anticipated effects on Inventoried Roadless Areas utilized direction provided by the 2001 Roadless Rule and the 2007 Forest Service Handbook (FSH 1909.12, Chapter 70), and looked at these five attributes.

Natural Undeveloped
Manageability Special Features and Values
Outstanding Opportunities for Solitude or Primitive and Unconfined Recreation

Evaluation of these attributes provided a thorough analysis of the effects of proposed activities on the roadless areas and recreation use, and addressed public concerns. The following table describes the attributes.

Table 4.46 Wilderness Attributes and Roadless Characteristics

Wilderness Attributes (FSH 1909.12)	Roadless Characteristics (RACR)
Natural	- High quality or undisturbed soil, water, and air. - Sources of public drinking water. - Diversity of plant and animal communities - Habitat for threatened, endangered, candidate, proposed, or sensitive species dependent on large areas.
Undeveloped	Natural appearing landscapes with high scenic quality. Reference landscapes
Outstanding Opportunities for Solitude or Primitive and Unconfined Recreation	The following three classes of dispersed recreation: Primitive, Semi-Primitive Non-Motorized, and Semi-Primitive Motorized.
Special Features and Values	Other locally identified unique characteristics. Traditional cultural properties and sacred sites.
Manageability	No criteria

RACR – The Roadless Area Conservation Rule (2001)

4.6-D Management Activities Proposed in Roadless Areas

The following management activities are proposed in the roadless areas. The direct, indirect and cumulative effects are discussed below. There will be no construction of roads in either roadless area.

Table 4.47 Alternative 2 Fuels Reduction Activities Within Roadless Areas

Selkirk Roadless Area – 97,957 acres total size

Unit	Acres in IRA	Silviculture/Fuels Reduction Rx	Slash Treatment	Percent Canopy Closure Before	Percent Canopy Closure After
B1	118	ISW	GP	65	35-45
B3	25	ISW	YT	65	35-45
B4	47	ISW	GP	70	35-45
B5	97	ISW	GP	65	35-45
B6	137	ISW	GP	70	35-45
Total Acres in IRA = approximately 424. Total Percent IRA Impacted = 0.45%					

Kootenai Peak Roadless Area – 4,844 acres total size

D1*	24	ISW	GP	70	35
D6*	52	ISW	GP	70	35-45
D9	32	ISW	GP	70	35-45
G8	11	CT	UB	70	50
G9	283	GS	UB	65	45-55
E3	124	ISW	GP	65	45-55
E8	35	CT	GP	70	50
F1	112	GS	UB	65	45
Total Acres in IRA = approximately 673. Total Percent IRA Impacted =13.9%					

**Note: Units D1 and D6 are partially within the roadless areas (see the following photo/maps)*

ISW – Irregular Shelterwood; CT – Commercial Thin; GP – Grapple Pile; GS – Group Selection; UB – Underburn

4.6-D.1 Alternative 2 – Effects on Inventoried Roadless Areas

Since the Myrtle Creek Working Group recommended the option that did not include construction of temporary roads (project file documents), this discussion focuses on the potential effects of management activities other than construction and use of temporary roads in Inventoried Roadless Areas (IRAs). Since there will be no construction of roads or other facilities such as trails or day use areas, that characteristic will not change in either the Selkirk or Kootenai Peak IRA.

This photo, taken in 1935, shows the area burned by the 1926 wildfire and the resulting mosaic of openings, and areas where the fire moved across the forest floor burning brush and smaller trees but leaving larger trees. It also shows the boundaries of the IRAs (red line) and the location of the proposed fuel reduction treatment units (blue lines).

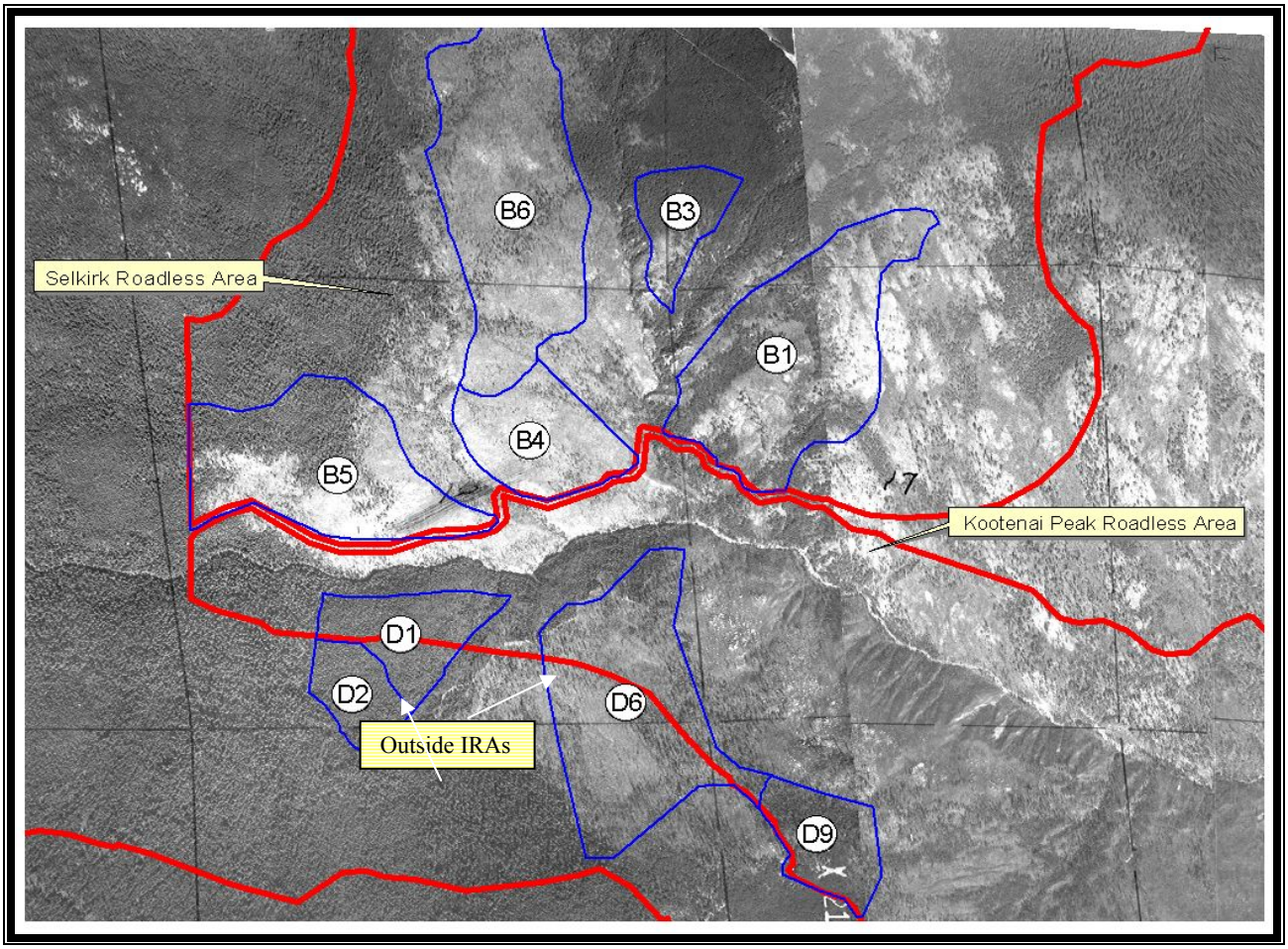

Figure 4.11 1935 Photo, Inventoried Roadless Areas and Proposed Fuels Reduction Units

This photo taken in 2004 shows the same landscape as in the previous photo. Currently, the Myrtle Creek Road #633 is the boundary between the two roadless areas in the center of the photo. It is also important to notice the contrast in vegetative cover and the extent that the fuels have built up since the 1935 photo; in part due to fire suppression policies.

All of the proposed treatment areas have departed from their respective historical stand composition and structure to some degree (refer to Fire Regime Condition Class discussion in Chapter 3 – Fire and Fuels section). Also, the proposed fuel reduction treatments parallel the disturbance regimes found historically in the Myrtle and Snow Creek ecosystems.

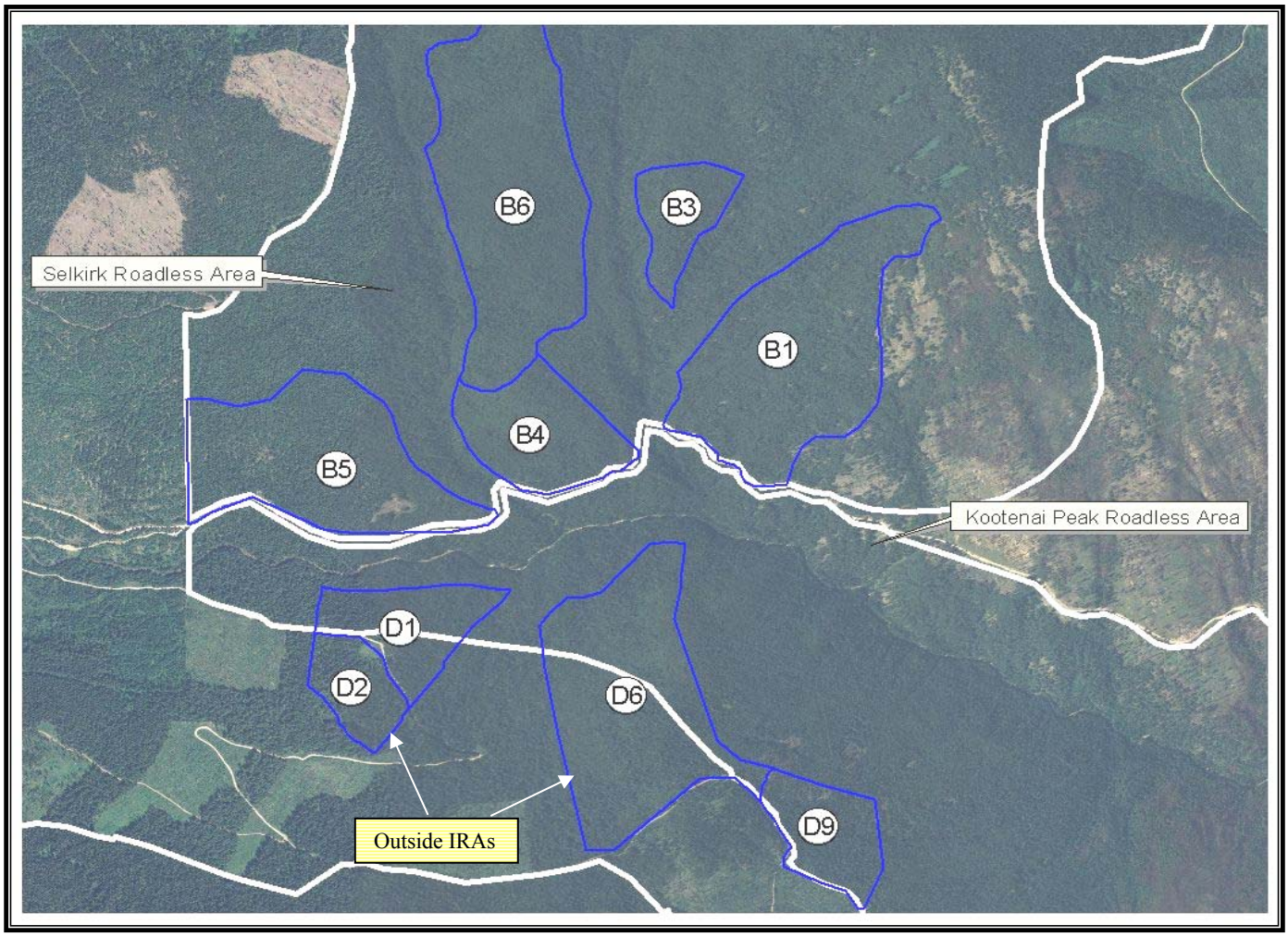

Figure 4.12 2004 Photo, Inventoried Roadless Areas and Fuels Treatment Units

4.6-D.2 Effects on Attributes of the IRAs

a. Natural

All of the proposed treatment areas have departed from their respective historical stand composition and structure to some degree (refer to Fire Regime Condition Class discussion in Chapter 3 – Fire and Fuels section). Therefore, the natural integrity of the vegetation component is declining and at risk from uncharacteristic wildfire. The fuels reduction treatments are designed to protect the larger overstory trees (also future seed sources) from crown fire, restore historical stand structure, and allow areas affected by root disease to be reforested with seral species that are relatively resistant to root disease. Fuels reduction treatments will remove trees that have created the congested understory and indirectly improve the health and vigor of the remaining overstory trees. The proposed treatments will help restore long-lived seral species that will start to lower the risk of large, severe disturbances.

b. Undeveloped

The fuels reduction objectives (discussed in Chapters 1, 2 and 4) include shifting the fuels within the areas proposed for treatment from a Fuel Model 10 (timber with heavy litter) to a Fuel Model 8 (timber with light litter). For the Fuels needs, (also discussed in Chapters 3 and 4) the fuels reduction treatments will include silvicultural prescriptions such as commercial thinning, group selection, and irregular shelterwood (Chapter 2 Table "Alternative 2 Fuels Treatment Summary"). All of the prescriptions call for leaving larger-diameter trees with full live crowns; the poor quality smaller-diameter trees would be targeted for removal. Edges of the treatment units will be "feathered" by marking trees to be left within the treated areas, thus softening the visual break between treated/untreated stands of timber.

The irregular shelterwood treatment areas would be most changed in appearance from the way they look now; however, following the burning to treat fuels and reforesting where appropriate, the areas would look more like they had been part of a wildfire. The previously overcrowded smaller trees and nearly impenetrable thickets of understory will be more open with large trees in a more park-like setting. Blackened stumps will show effects of the burning and over time, the post treatment flush of vegetation and the decomposition of slash (about two to five years) will add to the more-natural appearance similar to that following a fire. Some snags will also be created during slash disposal operations and left for wildlife use, adding to a more natural appearance.

Kootenai Peak Roadless Area

Though subjective, the short term effects would be the time it takes (between 5 and 15 years) for vegetation community differences between areas inside versus outside the treatment units to start blending together visually. In the long term, especially after prescribed fire is complete, the area may appear more similar to a landscape where natural fires were allowed to burn. The linear character of the treatment units (often a result of following the edges of property lines) and the difference in canopy closure to surrounding untreated areas will be lessened by feathering the edges as described above but, will remain distinguishable for up to 30 years or more when the canopies appear to blend visually.

There will be no increase in constructed facilities such as trails or day use areas.

Road #1309 serves as the southern boundary of a portion of Unit D1, cuts across the middle of Unit D6, and serves as the south-western boundary for most of Unit D9. Approximately 27 acres of Treatment Unit D1 would be within the narrow northwest stringer of the roadless area between Road #1309 and Myrtle Creek Road #633. To visitors behind the gate on Road 1309, it will appear as an open park-like area with scattered large trees, which they could hike through before getting closer to Myrtle Creek. Units D6 and D9 are also in the northwest stringer of the roadless area. Only the northernmost part of Unit D6 is in the roadless area and it would have park-like in appearance in the short term.

The majority of the treatment units are along the southern edge of the roadless area (Units G8, G9, E3 and E8). Units G8 and G9 are between Road 2190 and the top of Snow Ridge. Visitors using this stretch of road to access the roadless area would hike through a park-like area with canopy cover that is about 10-20% lighter than it was prior to treatment. From the top of the ridge, the visitor would be looking into the portion of the Myrtle Creek drainage that was burned by the 2003 Myrtle Creek Fire. The view of the recent wildfire might give some visitors a greater feeling that the treated area appears natural.

Units E3, E8 and F1 are on the north side of Snow Ridge, between the ridge and portions of the Myrtle Creek drainage burned by the 2003 Myrtle Creek Fire. Unit E3's entire southern boundary is along Road 2190. This unit will also appear more open and park-like with a canopy that is 20-50% lighter than adjacent untreated areas. Unit E8 will be less open than E3, with a canopy that is about 10% -30% more dense than Unit E3's. Unit F1 is not bordered by Road 2190. Visitors could reach this unit by hiking from Road 2190 through Unit E8, or hiking from the road through untreated areas to the west or south of the unit. Most of the northern boundary of this unit is along an edge of the area burned by the 2003 Myrtle Creek Fire. Again, this area would be more park-like with canopy that is about 10-40% lighter that it was prior to treatment. Along the northern portion of this unit, the area might be perceived as having a more natural appearance because of its closeness to the area burned by the wildfire.

Selkirk Roadless Area

The effect of the proposed treatments will be the same as for the Kootenai Roadless area. In the short term (5-15 years), there will be an obvious impact of human activities. Over time, much of the impact will soften and the landscape will become more natural appearing. The linear character of the treatment units (often a result of following the edges of riparian zones or property lines) and the difference in canopy closure to surrounding untreated areas will be lessened by feathering the edges as described above but will be discernable for 30 or more years. There will be no increase in constructed facilities.

Myrtle Creek Road 633 serves as the southern boundary of treatment Units B1, B4 and B5. Unit B5's western edge is along a private property boundary. Most of the eastern edge of Unit B1 is next to the northern portion of the 2003 Myrtle

Creek Fire. Units B3 and B6 are north of the road (see the previous photos). Visitors hiking into the roadless area would walk through open park-like areas where the larger trees have been retained. Because of its proximity to the 2003 Myrtle Creek wildfire, Unit B1 may appear more natural than other treatment areas.

c. Outstanding Opportunities for Solitude or Primitive Unconfined Recreation

Kootenai Peak and Selkirk Roadless Areas - Proposed activities should not interfere with normal recreational access to trailheads. The proposed activities will not change the character of the recreation opportunities currently available.

d. Solitude:

Kootenai Peak and Selkirk Roadless Areas - The sights and sounds of logging activity will be apparent along portions of the Myrtle Creek/Snow Creek driving loop. However, it will be consistent with activities throughout both drainages and will not be apparent from primitive areas. The proposed activities will not change the character of the recreation opportunities currently available. Effects on recreation are discussed below.

e. Special Features and Values

Kootenai Peak and Selkirk Roadless Areas - The old Forest Service cabins, remnants of a lookout tower, and historic trails within the roadless areas will not be affected by the proposed management activities. Effects to grizzly bear habitat and habitat for other wildlife are described in the wildlife discussions.

f. Manageability

Kootenai Peak and Selkirk Roadless Areas - Because no facility development or road construction is proposed, the proposed activities will not change the manageability or boundaries of these roadless areas.

4.6-E Before and After Photos of Representative Treatments

To help the reader get a feel for the changes after fuels reduction treatments are complete several sets of photos are included. The following photos are representative examples of "before and after" conditions in vegetation.

This photo represents typical amounts and structure of fuels in proposed treatment units.

Figure 4.13 Typical fuels in proposed units

The photo at the right is an example of a shelterwood treatment unit showing the larch regeneration that is taken place. Alternative 2 proposes about 656 acres of irregular shelterwood prescriptions in inventoried roadless areas.

The photo below, left represents typical stand conditions where group selection prescriptions are proposed. Alternative 2 includes about 395 acres of group selection prescriptions in inventoried roadless areas.

The photo below, right is representative of the appearance of a group selection prescription after the ladder fuels have been removed and the stand has been underburned.

Figure 4.14 Example of a regenerated Irregular Shelterwood Treatment Unit (with larch regeneration).

Figure 4.15 Typical ladder fuels in the proposed Group Selection Treatment Units.

Figure 4.16 Example of a recent Group Selection unit following treatment.

The next two photos represent "before and after" conditions that would be found in the stands proposed for commercial thinning prescriptions. Alternative 2 includes about 46 acres of commercial thin prescriptions in roadless areas.

Figure 4.17 Commercial Thin (before)

Figure 4.18 Commercial Thin (after)

4.6-F Forest Plan Consistency

As stated previously, Forest Plan direction for Inventoried Roadless Areas is established through Management Area direction. Forest Plan direction pertaining to the roadless resource is primarily reflected in the MA 10 designation for semi-primitive recreation.

Alternative 1 (No Action) – Current management would continue. See Chapters 1 and 3 discussions of Management Areas for more information on the current conditions.

Alternative 2 – The goals for the Management Areas (described in Chapter 3) would be met to varying degrees depending on the location in the Management Area, and the type of proposed fuels reduction treatments. Treatments would have a short-

term impact on the MA 10 goal to provide semi-primitive recreation while activities were underway. After completion of project activities, all goals would be met.

No activities would occur in MA 11 (proposed wilderness); therefore, this alternative would be consistent with MA 11 direction to manage lands proposed for wilderness to protect their wilderness characteristics.

Alternative 5 – This alternative does not include any activities in Inventoried Roadless Areas; therefore there would be no change in Forest Plan Consistency.

4.6-G Roadless Area Conservation Rule Consistency

Alternative 2 would be consistent with the January 2001Roadless Rule, incorporated at 36 CFR § 294.13(1). The Proposed Action meets the following exception:

> §294.13 Prohibition on timber cutting, sale, or removal in inventoried roadless areas, subsection (b)(1)(ii)
> To maintain or restore the characteristics of ecosystem composition and structure, such as to reduce the risk of uncharacteristic wildfire effects, within the range of variability that would be expected to occur under natural disturbance regimes of the current climatic period;

The Responsible Official has made the following determinations:

- The trees to be removed in this project consist of generally small-diameter timber.

The irregular shelterwood prescriptions are in stands generally dominated by trees smaller than 10 inches DBH. The large diameter western larch, white pine, and Douglas-fir (in addition to large-diameter trees of other species) would be retained in the overstory and no future overstory removals would be scheduled.

The commercial thinning prescriptions would focus on retention of the biggest and best trees available in the stand. The average size of the trees removed would typically be less than 9 inches DBH.

- The treatments are needed to maintain or restore desirable characteristics of ecosystem composition and structure to reduce the risk of uncharacteristic wildfire effects.

The fuels reduction treatments will trend the treated areas toward stand conditions that more closely resemble their natural or historic conditions, which in turn trends the treated areas toward their historic fire regimes and toward a lower, more desirable and sustainable Fire Regime Condition Class. The treated stands will trend toward their historic conditions of less fuel buildup (particularly ladder fuels), stands that are less dense (resulting in more open tree canopies), and stand composition and structure that is more sustainable, adaptable and resilient to fire. After the slash is burned in the treated areas, the predicted fire behavior (such as lower flame lengths, slower rates of spread) and crown fire hazard will be reduced. Where treated, there will be a reduced chance of fire causing uncharacteristic and undesired mortality in the stands, and an increased likelihood that firefighters will be able to safely suppress the fire.

Alternative 1 (No Action) and Alternative 5 do not include activities in Inventoried Roadless Areas, therefore the Roadless Rule would not apply to either of these alternatives.

4.6-H Effects of Proposed Action on Recreation

4.6-H.1 Recreation Opportunity Spectrum

a. Summer:

Activities north of Myrtle Creek Road (Units B1, B3, B4, B5 and B6) will not appear natural and will change the ROS classification Semi-Primitive Non-Motorized to Roaded Modified Non-Motorized. The change is slight, (approximately 600 acres) and the experience is not inconsistent with that provided along the remainder of the Myrtle Creek / Snow Creek driving loop. The off-road experience is also consistent with past National Forest System and private land management practices.

Road 1309 is gated for grizzly bear security in the summer and not accessible to public motorized traffic. Proposed units on this road system (D1, D2, D6 and D9) are screened from most typical vantage points on the main Myrtle Creek Road 633. Vegetation along Myrtle Creek creates a filter from the road, and those areas viewed from Burton cabin, trail, or Cascade ridge, will feel distant and will seem consistent with past activities. The ROS classification for this area will not change.

The treatments planned along the Snow Creek Road adjacent the Kootenai Peak Roadless Area (Units G8, G9, E3 and E8), will generally create openings of various sizes that appear natural. The big trees will remain and the effect will be a park-like setting. The ROS classification will not change.

b. Winter:

There will be no change in the ROS classification for the winter experience.

4.6-H.2 Meeting Management Area Goals for Recreation.

Planned treatments will not change the type of recreation provided or anticipated. There will be no change in opportunities.

4.6-H.3 Effects to Developed or Dispersed Sites.

There will be no direct impact to any developed or dispersed facilities. The proposed resurfacing of the lower Snow Creek Road #402 up to the Snow Falls parking area would create safer driving conditions for visitors.

4.6-H.4 Social Impact to Recreationists.

The sights and sounds of logging activity will be apparent along the lower ends of the Myrtle Creek / Snow Creek driving loop. It will be consistent with activities throughout both drainages. It will not be apparent from primitive areas. Proposed activities would not interfere with normal recreational access to trailheads. Treatment activities may be observable from Burton Cabin, Cooks Peak, or other destinations, but will be generally distant enough to not be noticeable.

Safety concerns for the recreational user vary seasonally. The summer season receives steady traffic on the entire loop with dramatic increases during the huckleberry season. Many visitors are not always knowledgeable concerning logging activities, nor do they all have CB radios. Timber sale contract terms cover most concerns by limiting log hauling to weekdays, proper signing, etc. During the winter season, the Myrtle Creek Road 633 becomes less of a concern. Most snowmobilers or skiers access the mountains via Snow Creek Road 402.

Snow Falls Trail access has an additional safety concern due to its very long use season. People hike to the falls during the winter as well as throughout spring, summer, and fall. The site is widely publicized and due to its proximity to town, it encourages a full range of visitors (many without rural driving experience). The first mile of Snow Creek Road 402 road is steep, rough and winding. Visitors often meet not only logging traffic, but private land owners and other visitors as well. Heavy traffic and a rough road surface create an on-going traffic hazard. Yearly road maintenance cannot keep up with the road surfacing needs. The Myrtle Creek HFRA project proposes to improve the road surface of the first 1.3 miles (approximate) of Road 402 and the parking area for the Snow Falls trailhead.

4.6-I Forest Plan Consistency

As stated previously (Chapter 3), Forest Plan direction for Inventoried Roadless Areas is established through Management Area direction. Forest Plan direction pertaining to the roadless resource is primarily reflected in the MA 10 designation for semi-primitive recreation.

If no action is taken (selection of Alternative 1), the respective MA goals discussed in the Roadless Area section of Chapter 3 would not be met. Goals for MA 10 would still be achieved (see Forest Plan direction in Chapter 3).

If Alternative 2 is implemented, the goals for the MAs (described in Chapter 3) would be met to varying degrees depending on the location on the MA, and the type of proposed fuel reduction treatments.

No activities would occur in MA 11 (proposed wilderness); therefore, both alternatives would be consistent with MA 11 direction to manage lands proposed for wilderness to protect their wilderness characteristics.

If Alternative 5 is implemented, doesn't go into Roadless Area therefore, there is no effect.

4.6-J Forest Manual Consistency

Alternative 2 would be consistent with the January 2001Roadless Policy, incorporated at 36 CFR § 294.13 (1). The trees to be removed in this project consist of generally small-diameter timber, and the treatments are needed to maintain or restore desirable characteristics of ecosystem composition and structure to reduce the risk of uncharacteristic wildfire effects.

This interim directive is not relevant to Alternative 1 (no action).

4.7 - Required Disclosures

4.7-A Potential Conflicts with Plans and Policies of Other Jurisdictions

a. Water Quality

Section 313 of the Clean Water Act requires Federal Agencies to comply with all Federal, State, interstate and local requirements, administrative authority, and process and sanctions with respect to the control and management of water pollution. Executive Order 12088 also requires the Forest Service to meet the requirements of the Act. All action alternatives (Alts 2 and 5) would comply with the Clean Water Act and Idaho State Water Quality Standards. These alternatives would incorporate Soil and Water Conservation Practices and Best Management Practices, avoid channel degradation, and comply with the Forest Plan.

b. Air Quality

The fuels reduction treatments include underburning and pile burning, which has the potential to affect local air quality. This activity would be conducted in accordance with the Montana/Idaho Airshed Group joint operating plan. Daily operations are monitored and coordinated by the monitoring unit in Missoula, Montana.

c. Cultural Resources

The laws and policies that govern cultural resource protection on Federal Lands are coordinated with the State Historic Preservation Office (SHPO) of Idaho, who serves in an advisory capacity. The policies for the US Forest Service and SHPO are consistent. The Forest Service has informed and consulted with the Kootenai Tribe of Idaho on proposed activities, site information and potential impacts.

d. Wildlife

The Forest Service and the Idaho Department of Fish and Game (IDFG) work together to manage wildlife, but the missions of the two agencies are different. The Forest Service manages the land and affects wildlife habitat through implementation of fuels reduction and silvicultural treatments, and through management of the transportation system and access to National Forest System lands. The IDFG manages wildlife and has affects to the wildlife by implementation of hunting regulations (adjusting seasons, harvest and day limits) and enforcing other rules that affect fish and wildlife populations.

It is important to keep in mind that the Myrtle Creek drainage is a designated State of Idaho Game Preserve where no hunting is allowed.

4.7-B Probable Adverse Environmental Effects Which Cannot Be Avoided

Implementation of any alternative (Alternative 1, 2 or 5) would inevitably result in some adverse environmental effects. The severity of the effects of the action alternatives can be minimized by adhering to the features of the alternatives, such as Best Management Practices. If management activities occur, however, some effects cannot be avoided. Even the No Action Alternative has effects.

a. Scenic Resources, Roadless Areas and Recreation

The fuels reductions treatments would add a variety of line, form, color and texture to the landscape. Proposed activities would have a short-term adverse affect on specific roadless area characteristics and recreation activities while activities are occurring and until the in-growth of vegetation begins to mask the evidence of management activities. Removing the understory and intermediate size trees would create stumps, which could remain on the landscape for five to 20 years or more depending on the rate of decomposition, burning consumption during the underburning, and the tree species. This evidence of active management could be perceived as an adverse effect to the portion of the roadless areas treated with the Myrtle HFRA project.

b. Cultural Resources

There is no assurance that every cultural resource site would be located in advance of all planned management activities. Some ground-disturbing activity may affect an undiscovered historic or pre-historic site. Sites discovered in this manner would be immediately protected from further disturbance.

c. Wildlife

The availability of various elements of wildlife habitat (such as stand structure, composition, and species-specific habitat elements) are dynamic and change over time. Consequently, wildlife populations associated with specific habitat conditions

also change with time. Alternatives 2 and 5 would trend habitat conditions within or toward historic ranges. Such changes can result in changes in local populations of specific species. See Appendix B for information concerning the potential effects.

d. Air Quality

Temporary seasonal effects on air quality are not completely avoidable under any of the alternatives, including the No Action Alternative. Fuels reduction treatments include underburning and pile burning as an integral part of management activities that would fulfill the purpose and need for this project. These activities would be conducted when air dispersion meets the Montana/Idaho Airshed Group requirements and effects would be monitored by the Missoula, Montana monitoring unit. See Chapter 4 Fire/Fuels discussion for additional information.

4.7-C Relationship Between Short-Term Use and Long-Term Productivity

Short-term uses are those that generally occur annually. Long-term productivity, in this sense, refers to the ability of the land to produce a continuous supply of a resource. Refer to the individual resource discussions in Chapters 3 and 4, and the Appendices for resource-specific definitions of short-term and long-term.

a. Water Quality

The duration of effects of fuels reduction and silvicultural treatments on the water resource is highly variable and dependent on site-specific characteristics and features. Under the action alternatives, road construction, culvert replacement, and decommissioning may temporarily introduce a small amount of sediment into streams. The long-term benefits of culvert replacement and road decommissioning would reduce the amount of sediment reaching streams; over time increasing water quality and improving habitat conditions for fish. See the watershed/hydrology discussions throughout the FEIS and Appendices for information.

b. Vegetation

The capability of the land to produce timber, high quality water, and forage would not be impaired by any of the action alternatives. Silvicultural treatments would reduce competition and improve growth of individual trees, and maintain the health and vigor of timber stands, thus enhancing long-term productivity of the area. In the short-term, harvesting stands at high risk of mortality would utilize commercially valuable wood products that would otherwise not be used as forest products. Reforestation would contribute to maintaining these lands in a productive state.

Silvicultural treatments that trend toward desired species composition and stocking levels, planting of genetically improved trees, management of stocking levels to reduce competition and improve vigor of trees, and intermediate treatments to maintain the health and vigor of stands are all means of trending toward and maintaining sustainable conditions. Thus, managed stands produce a greater rate of growth over time than unmanaged stands – maintaining the long-term yield of forest stands.

In the short-term, harvesting stands that are at a high risk of mortality captures the economic value that would otherwise be lost. Reforestation (natural or planted) keeps the land back in a productive growing condition.

Silvicultural and fuels reduction treatments can affect the levels of organic matter within an activity area, which could reduce long-term site productivity. These management activities include measures designed to maintain varying levels of organic matter and to maintain or improve soil characteristics that affect site productivity (see discussion of the Soil Resource throughout the FEIS). Reforestation of treatment areas could change plant succession, stand development, and species composition.

c. Wildlife

As explained above, the availability of various elements of wildlife habitat (such as stand structure, composition, and species-specific habitat elements) are dynamic and change over time. Appropriate scheduling of fuels reduction/silvicultural treatments and road improvement activities, as well as ongoing access management, can provide for and help sustain a mosaic of habitat conditions. The number of snags to be left for wildlife and other benefits is determined by a protocol based on the best available information on the appropriate size, species, and numbers of snags needed for wildlife, and the snags that can be protected during harvest activities. The short-term need to protect snags from wildfire through reduction of wildfire risk has been addressed by the fuel treatment features of the alternatives. Disturbance to wildlife during project implementation would be minor and short-term due to restrictions on public use of designated roads. See Appendix B for more information.

d. Air Quality

The temporary impacts of smoke from underburning and pile burning, and road dust from vehicles associated with the proposed activities would have minor short-term effects on visual quality and recreation use as described in the FEIS. The short-term impacts are traded for by minimizing the risks to the municipal watershed from wildfire and meeting the other goals and objectives for this project. Wildfires generally produce significantly more air pollution, sometimes such affects occur when the air quality is already being impacted by other wildfires within the airshed.

The Forest Service would voluntarily cease prescribed burning activities when necessary to avoid violation of Airshed agreements and State air quality standards. Prescribed burning of fuels and logging slash would take place primarily in early spring when air quality and weather patterns are more conducive to better air quality. During other times of the year activities such as agricultural field burning, slash burning on private forest lands, use of wood stoves, and dust from the Palouse and Columbia Basins can compete for use of monitored airshed.

4.7-C.2 Irreversible and Irretrievable Commitment of Resources

An *irreversible* commitment of resources refers to the loss of production, or use of a non-renewable resource, due to a land use decision that, once executed, cannot be changed. An *irretrievable* commitment applies to loss of production or use of renewable resources for a period to time.

a. Water Quality

Best Management Practices and other design criteria and mitigation items would be effective in avoiding irreversible and irretrievable effects on water quality and aquatic habitats.

b. Soil Productivity

Best Management Practices and other design features described in Chapter 2 would be used to avoid soil productivity losses from Alternatives 2 and 5. The No Action Alternative (Alternative 1) could have losses as an indirect effect of wildfire. See the Soil Resource discussions in the FEIS for information concerning effects.

c. Scenic Resources, Roadless Areas and Recreation

Active management would cause an irretrievable, but not irreversible, effect to the forest stands since the specific trees and biomass removed cannot be replaced, and the future maintenance of fuels and fuel buffers would prevent the proposed treatment areas from returning to the existing condition. However, the effects are not irreversible, since trees and vegetation always grow back over time. Evidence of management activities such as stumps, would reduce the natural integrity of the area until regrowth of vegetation and decomposition of stumps improve the apparent naturalness in five to 20 years depending on decomposition rates.

d. Potential For Future Wilderness Designation

Effects of the proposed activities to the IRA's potential for future wilderness designation are neither irretrievable nor irreversible, as Congress can (and has) designated previously managed and developed areas as wilderness.

Kootenai Peak – None of the Kootenai Peak IRA was designated as either MA10 or MA11 by the Forest Plan and its size (4,844 acres) is less than the 5,000 acres required for designation by Congress.

Selkirk – Although management activities and the potential need to continue managing the lower slopes of the project area could affect consideration for future wilderness designation on those portions of the project area where treatments are proposed, it would not likely affect future wilderness consideration of the rest of the Selkirk Roadless Area, which is not adjacent to the wildland urban interface.

e. Air Quality

The impact of pile burning and underburning would have temporary seasonal impacts on the air quality in Alternatives 2 and 5.

f. Heritage Resources

Any activity that would disturb a cultural resources is an irreversible commitment.

g. Wildlife

Loss or modification of habitat for certain wildlife species is an irretrievable (time-related) commitment of resources. See Appendix B for more information concerning wildlife.

h. Vegetation

The harvest of trees is an irreversible commitment of resources since the individual trees cannot be replaced; however trees are a renewable resource that will grow back, thus it is not an irretrievable commitment. Acres not proposed for vegetation treatments that are at high risk of insect and disease or fire would experience adverse effects if tree mortality or a wildfire occurs.

i. Noxious Weeds

Any activity carries the risks of introducing or spreading weeds. Mitigation measures such as washing logging and construction equipment, closing temporary roads, and seeding disturbed areas would help reduce but not totally eliminate the risk of

spreading weeds. Weed infestations are, and will continue to be, treated under the direction of the Bonners Ferry Noxious Weed Control Final EIS and Record of Decision.

4.7-C.3 Specifically Required Disclosures

a. Administration of the Forest Development Transportation System

A roads analysis has been prepared for the Myrtle Creek HFRA Project (see Transportation files) in accordance with the Roads Policy at 36 CFR Part 212, published in the Federal Register on January 12, 2001.

b. Effects of Alternatives on Social Groups

Executive Order 12898 (issued in 1995) required federal agencies to identify and address the issue of environmental justice (i.e. adverse human health and environmental effects of agency programs that disproportionately impact minority and low income populations). At this time, no minority or low-income populations have been identified in the Myrtle Creek HFRA project analysis area.

Based on past experience with similar projects on the Bonners Ferry Ranger District, none of the action alternatives would substantially affect minority or low-income individuals, women, or civil rights. The implementation of this project is expected to provide job opportunities in communities such as Bonners Ferry, Moyie Springs, and Naples, Idaho. Some of these communities include minority populations that may benefit from the economic effects. Small or minority-owned businesses would have an opportunity to compete for some of the work.

Data for Boundary County as of the 2000 census year shows the population is 93.2 percent white, not of Hispanic/Latino origin; 3.4 percent persons of Hispanic or Latino origin; 2.0 percent persons of American Indian and Alaska Native origin. Black or African American, Asian, Native Hawaiian and Other Pacific Islanders each represent less than 1 percent of the population.

c. American Indian Religious Freedom Act

Consultation with the Kootenai Tribe of Idaho was ongoing throughout project development to determine if there were anticipated effects to their social, economic or subsistence rights.

d. Effects on Floodplains and Wetlands

The Inland Native Fish Strategy (INFS) standards and guidelines implemented with this project would protect floodplains and wetlands.

e. Effects on Threatened and Endangered Species

Threatened and endangered wildlife, fish, and plant species may be affected by the proposed action and alternatives (including No Action). See Appendices A and B for more information. A biological assessment was prepared and submitted to the US Fish and Wildlife Service for concurrence according to the Endangered Species Act to insure protection of these species.

f. Energy Requirements and Conservation Potential of Alternatives

The energy required to implement the action alternatives, in terms of petroleum products, would be insignificant when viewed in light of the production costs and effects of the national and worldwide petroleum production and reserves.

g. Effects on Prime Rangeland, Forest Land, and Farm Land

There are no rangelands or grazing permits on National Forest System lands within the project area. The definition of prime forest land does not apply to lands within the National Forests. Lands administered by the Forest Service within the project area do not include prime range lands or farm lands. Under Alternatives 2 and 5, National Forest System lands would be managed with the appropriate consideration to the effects on adjacent lands.

h. Migratory Bird Treaty Act

On January 10, 2001, President Clinton signed an Executive Order outlining responsibilities of federal agencies to protect migratory birds. There would be no significant loss of migratory bird habitat from implementation of Alternative 2 or 5. These alternatives would move stand structure, composition, patch size, and specific wildlife habitat elements within/towards historic ranges. Proposed actions are expected to maintain sufficient amounts and types of habitats to allow migratory birds to inhabit and reproduce within the Myrtle Creek HFRA project area.

The action alternatives contain certain practices that avoid or minimize, to the maximum extent practicable, adverse impacts on species of migratory birds. See Appendix B for more information.

i. Incomplete or Unavailable Information

There are some incomplete or unavailable portions of records of past timber harvest and road construction activities on National Forest System lands and private lands within the project area - as stated in the discussions of past activities. The relevance of the incomplete or missing data depends on what is lacking. For instance, the name of a particular sale would be of little value in evaluating the environmental effects of the harvest. For many elements of past activities, knowledge is gained through field visits, interpretation of aerial photos, or both. Note that past actions are reflected in the current condition of the project area to the extent that they are still affecting the particular resource being analyzed; thus, the effects of past actions are accounted for in the assessment and description of the existing conditions.

Literature Citations

Literature is listed by resource.

Aquatics, Watershed/Hydrology

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The following persons, agencies, and organizations received copies of the EIS. Those with an asterisk beside their name participated in the KVRI Working Group. See Chapter 2 for information about the public involvement activities for the Myrtle Creek Healthy Forests Restoration project.

This list is not all inclusive due to the fact that other persons can request copies following this initial release to the public.

* Boundary County Commissioners
* Darrell Kerby, Mayor of Bonners Ferry, Idaho
* City of Bonners Ferry water department
* Kootenai Tribe of Idaho
* City Council, Bonners Ferry, Idaho
* US Senator Larry Craig – Coeur d'Alene staff
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* Boundary County Economic Development Committee
* Idaho Dept of Lands
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The following persons, agencies, and organizations (in addition to those listed above) received copies of the EIS. .

US Environmental Protection Agency – Seattle and Washington, DC
USDI Office of Environmental Affairs – Washington, DC
USDA National Agricultural Library, Beltsville, MD
USDA, Forest Service - Ecosystem System Management – Washington, DC