Watershed Specialist Report for the Flagtail Fire Recovery Project FEIS

Blue Mountain Ranger District,
Malheur National Forest

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Watershed

Regulatory Framework

Malheur Forest Plan

The Malheur National Forest Plan (USDA 1990) as amended, provides direction to protect and manage resources. Only direction pertaining to the water resources portion of the Burned Area Recovery project is included here.

The Forest Plan Goals for water resources include:

- Provide a favorable flow of water (quantity, quality, and timing) for off-Forest users by improving or maintaining all watersheds in a stable condition. (Goal 27, p. IV-2)
- Maintain or enhance water quality to meet State of Oregon standards, considering downstream uses and protection of other riparian and floodplain values. (Goal 28, p. IV-2)

The Forest Plan Objectives state how resources will be managed under the Forest Plan. They are discussed by Riparian Area and for Soil and Water (only objectives pertaining to water are listed):

Riparian Area:

- All riparian areas will be managed to protect or enhance their value for water quality, fish habitat and wildlife.
- All new or updated management plans will include a strategy for managing riparian areas for a mix of resource uses. A measurable desired future riparian condition will be established based on existing and potential vegetative conditions. When the current riparian condition is less than that desired, objectives will include a schedule for improvement. (NOTE: Access and Travel Management Plans are proposed under alternatives 2, 3, 4 and 5).

Water:

- Manage soil and water resources to maintain or enhance the long-term productivity of the Forest.
- Much of the management activity under this Plan will be directed toward improving those riparian areas which are in undesirable condition. A combination of watershed improvements in or adjacent to riparian areas will be the major soil and water improvement activities on the Forest. Any one method or a combination of methods may be incorporated to treat a less than desirable riparian area.
- Integrate mitigation into management activities. Examples of mitigation for soil and water protection include waterbarring skid trails, seeding disturbed soil along riparian areas and size and distribution of harvest units.

Forest-wide Standards provide further guidance:

Protection of Water Quality:

- Comply with State requirements in accordance with the Clean Water Act for protection of waters of the State of Oregon (Oregon Administrative Rules, Chapter 34041) through planning, application, and monitoring of best management practices (BMPs) in conformance with the Clean Water Act, regulations, and federal guidance issued thereto. (Standard 117)

- In cooperation with the State of Oregon, the Malheur National Forest will use the following process:
  - (a) Select and design BMPs based on site-specific conditions
  - (b) Implement and enforce BMPs.
  - (c) Monitor to ensure that practices are correctly applied as designed
  - (d) Monitor to determine the effectiveness of practices in meeting design expectations and in attaining water quality standards.
  - (e) Evaluate monitoring results and mitigate where necessary to minimize impacts from activities where BMPs do not perform as expected.
  - (f) Adjust BMP design standards and application when beneficial uses are not being protected and water quality standards are not being achieved. Evaluate the appropriateness of water quality criteria for reasonably assuring protection of beneficial uses. Consider recommending adjustment of water quality standards. (Standard 118)

- Implement the State Water Quality Management Plan, described in Memoranda of Understanding between the Oregon Department of Environmental Quality and US. Department of Agriculture, Forest Service (February 2, 1979 and December 2,1982), and 'Attachments A and B' referred to in this Memoranda of Understanding (Implementation Plan for Water Quality Planning on National Forest Lands in the Pacific Northwest, December 1978, and Best Management Practices for Range and Grazing Activities on Federal Lands, respectively).

  Site-specific BMPs will be identified and documented during environmental analysis, along with evaluations of ability to implement and estimated effectiveness. BMPs are described in General Water Quality Best Management Practices, Pacific Northwest Region, November 1988. (Standard 119)

- Evaluate site-specific water quality effects as part of project planning. Design control measures to ensure that projects will meet Oregon water quality standards. Projects that will not meet Oregon water quality standards shall be redesigned, rescheduled, or dropped. (Standard 120)

- Conduct a watershed cumulative effects analysis in watersheds where project scoping identifies cumulative effects of activities on water quality or stream channels as an issue. This will include land in all ownerships in the watershed. Disperse activities in time and space to the extent practicable, and at least to the extent necessary to meet management requirements., On intermingled ownerships, coordinate scheduling efforts to the extent practicable. (Standard 121)

- Rehabilitate disturbed areas that could contribute sediment to perennial streams. (Standard 122)

Updates to Standards 117 and 119: "Complying with State Requirements in accordance with the Clean Water Act…and federal guidance issued thereto." and "Implement the State Water Quality Management Plan….."

Since the Forest Plan was signed, how the Forest Service complies with State Requirement in accordance with the Clean Water Act and how the Forest Service implements the State Water Quality Management Plan has been renegotiated with the State and modified, partly in response to changes in how the US Environmental Protection Agency (EPA) administers the Clean Water Act with the State of Oregon. A new Memorandum of Understanding Between USDA Forest Service and Oregon Department of Environmental Quality to Meet State and Federal Water Quality Rules and Regulations was signed in May 2002. (USDA Forest Service, May 2002) and additional federal guidance and protocols have been issued (Furnish and McDougle, 1999; Hildago-Soltero, 2000; Jensen, undated; USDA Forest Service, Pacific Northwest Region, Regional Office, 1999; USDA Forest Service, undated, "Appendix A"; USDA Forest Service, undated, "Appendix C"). Appendix K, Part 1, presents a summary of the direction, guidance, and protocols in the above documents and provides some references to the Flagtail project and Part 2 shows how this information was applied to the Flagtail Fire Recovery Project.

Management Areas and Amendments to the Forest Plan

The Forest Plan, as amended, establishes Management Areas and Standards that pertain to water resources. (Forest-wide Goals and Standards apply to all.) On the Malheur National Forest, the relationship of these Management Areas and the Standards defined for them is confusing and described below.

The original Forest Plan established Management Area MA 3A – Non-Anadromous Riparian Areas. This Management Area, including Description, Goals, and Standards, is described on pages IV-55 to IV-61 of the Forest Plan.

The Forest Plan was amended with Amendment 29 for Management Area 3A in 1994. It established a Desired Future Condition for MA 3A and modified two MA3 Standards for the Resource Element of Fish, Water Quality and Wildlife. The description of the Desired Future Condition and the modified Standards are found in Amendment 29 to the Malheur Forest Plan.

The Inland Native Fish Strategy (INFISH), as Corrected, amended the Malheur Forest Plan in 1995. INFISH provides interim direction to protect habitat and populations of resident native fish outside of anadromous fish habitat in parts of five states, including eastern Oregon. INFISH establishes Riparian Management Objectives and Standards and Guides to provide protection of fish and fish habitat. INFISH also identifies areas, defined by standard distances from streams and wetlands, in which these Standards and

Guides would apply. These areas are called Riparian Habitat Conservation Areas (RHCAs) and are applied across all Forest Plan Management Areas.

Standard Riparian Habitat Conservation Area (RHCA), and the additional INFISH Riparian Goals, Riparian Management Objectives (RMOs) and Forest-wide aquatic standards apply except when watershed analysis or site specific analysis has occurred or when current Forest Plan direction provides more protection for inland native resident fish habitat as described in the Decision Notice Correction for the Inland Native Fish Strategy. The RMOs and standards contained in Malheur Forest Plan Amendment 29 are considered more protective than those in INFISH, supercede comparable ones in INFISH, and apply to the Flagtail project area. The criteria for defining standard RHCAs and the additional Riparian Goals, RMOs and Forest-wide aquatic standards established by INFISH which apply to the Flagtail project area are found in Appendix A of the INFISH Decision Notice (USDA Forest Service, 1995).

INFISH provides standard widths for RHCAs as well as direction on defining site-specific widths that varied from the standard. The standard RHCA widths, based on slope distances as described in Chapter 1 and the Fisheries Report, were adopted for this project.

INFISH definitions of Riparian Habitat Conservation Areas do not correspond exactly with the definition of Forest Plan Management Area 3A – Non-anadromous Riparian Area. Three primary differences that apply to the Flagtail Project Areas are:

- Standard widths of RHCAs are generally wider than the corresponding widths of MA 3A buffers. The standard RHCA widths apply in the Flagtail project area along fish bearing, perennial, and intermittent streams and wetlands. Consequently, at least two Management Areas usually comprise each RHCA; RHCAs are composed of an inner core of MA 3A, defined by the Forest Plan, and an outer portion which is allocated to another Management Area.
- MA 3A, but not RHCA, includes "those Class IV streams and upland areas, . . . which have high water table conditions during some parts of the growing season. Class IV channels will be recognized as the important link between uplands and the downslope perennial streams. They will be managed to ensure bank and channel stability" (Forest Plan, p. IV-55). The direction to recognize the link between uplands and downslope perennial streams is interpreted in the Flagtail project area to include ephemeral draws, which, if not managed properly, will erode into channels. "These Class IV and other riparian areas will have a variable width, depending on site specific needs for all riparian dependent species" (Forest Plan, p. IV-55).
- MA 3A, but not RHCA, includes "dry" quaking aspen stands.

Ephemeral draws of various lengths shown on Figure 16 were assigned buffers of 10-50 feet depending on draw condition and adjacent, proposed activities (see Mitigation).

Aspen mapping and protection with 100 ft. buffers, under the Unique Habitat Wildlife Forest Plan Standard, is ongoing.

The two, modified, Standards included in Amendment 29 address several of the same resource elements described as RMOs in INFISH, effectively establishing a set of RMOs that is both specific to the Malheur National Forest and more protective of inland resident fish habitat, which is permitted under INFISH. Thus, INFISH applies to the Malheur National Forest except for the RMOs which are superceded by Amendment 29 Standards. Both the Water Temperature RMO of INFISH and the Water Temperature Standard described in Amendment 29 are superceded by revisions to the State of Oregon Water Quality Standard for Temperature established under the Clean Water Act referenced above. RMOs are discussed in the Fisheries Report.

Analysis Methods

Tools to Estimate Existing Condition

Summary of Information Sources: Information sources used to describe the existing condition of the Flagtail area include the Malheur National Forest (MNF) Geographic Information System, the Upper Silvies Ecosystem Analysis at the Watershed Scale (Upper Silvies WA) (1997), the MNF Soil Resource Inventory, post-fire surveys of detrimental soil conditions, USGS stream gauge records, stream surveys based on the Region 6 Stream Survey Protocol (1994, 1996), riparian surveys based on the MNF riparian survey protocol (adopted from managing Riparian Ecosystems (Zones) for Fish and Wildlife in Eastern Oregon and Eastern Washington, 1979), ocular surveys developed by former district aquatic personnel, post-fire channel cross-section and longitudinal transects, Burned Area Emergency Rehabilitation (BAER) report, post-fire (site-specific) reconnaissance and informal stream/ephemeral draw evaluations conducted by district personnel (including the fish biologist, hydrologist, and soil scientist), field surveys and monitoring of rehabilitation of fire suppression activities, results of WEPP modeling, and the soils and other specialists' reports prepared for this project (including soils, fuels, and vegetation). The results of post-fire reconnaissance and informal stream/ephemeral draw evaluations are documented in a table of existing conditions by stream segment. The MNF Geographic Information System was used to evaluate and analyze data available in spatial formats. The BAER report included results of modeling of potential runoff from a selected design storm event. It also included results of the Watershed Erosion Prediction Program (WEPP) modeling of post-fire hillslope erosion and sediment transport to streams. The results of additional WEPP modeling conducted by the project soil scientist between the DEIS and the FEIS were also incorporated. Information described above was integrated using local and regional knowledge and professional judgement.

Effects Analysis Methods

The actions proposed in the action alternatives and in the No Action Alternative were evaluated qualitatively, based on the principles of applied watershed science and professional judgment and knowledge of the area. Consideration was given to post-fire condition, desired post-activity condition, and the application of site-specific Best Management Practices (BMPs). The analysis built on the Environmental Consequences for Soils Report and incorporated information from other specialists' reports such as Fuels and Vegetation. Effects were identified and discussed based on site-specific conditions and expected outcomes, including those described in the Existing Condition and those used as measures for the Water Issue. Comparison of alternatives also incorporated the results of additonal WEPP modeling as described above.

Unknown and Unavailable Information: Stream conditions on private land within and downstream of the burn area are generally unavailable. Conditions on a short segment of the Silvies River visible from County Road 63 and along triburary streams where they leave the Forest boundary can be estimated visually. Also, assumptions about some conditions which are generally controlled by topography can be derived from publicly available sources such as USGS maps (available to the District as the GIS Primary Base Series cover). Details of past management history on private land, including harvest, especially prior to the fire, is unknown, although general conclusions about past stand management may be made based on observations from public lands and travelways and principles of stand growth.

Routine stream flow data are unavailable because the nearest stream gauging station is located at least 30 miles down the Silvies River in a portion of the basin that differs substantially hydrologically from the Upper Silvies Watershed. Data from a temporary peak flow gauge located below the Wickiup Creek confluence with the Silvies River apply to the area located above most of the burn; only the small, Hog Subwatershed portion of the burn (ephemeral draws) drains into the formerly gauged area.

Wetlands are not mapped in GIS but the District locates and protects them during implementation and may map them as determinations are made. Protection is consistent with the Standards and Guidelines of the Forest Plan, as amended. The locations of wetlands were noted generally and included in the description of the Existing Condition.

The research and the state of knowledge for many of the water quality parameters, watershed processes, and watershed functions in most of the United States, including the Malheur National Forest, have not advanced enough so that definitive quantitative data are commonly available (USDA Forest Service, undated, “Policy and Framework….”).

Recent research demonstrates that some watershed and water quality parameters are highly variable. For instance a recent study (1998, Bunte and MacDonald), “using good scientific methods for making sediment measurements, in a specific watershed, for ten years resulted in measured sediment at *plus or minus 100 percent of the actual value (precision) at the 95 percent confidence interval (reliability).* Modeling would be expected to be more variable. The soil scientist used Disturbed WEPP to model erosion in selected areas within Flagtail. The results of this modeling were extrapolated to the project area based on local knowledge and landscape characterstics.

Because watershed science is not exact and few data are available, the common practice for watershed specialists, like other earth scientists, is to integrate available information with knowledge of basic principles of watershed science and with the physical and biological characteristics of the landscape. Integrating these factors results in a reasoned understanding of watershed conditons, functions, and processes. This understanding can be used to evaluate effects of proposed activities. For the Flagtail project area, this understanding is laid out in the Existing Condition which forms the basis for the comparison of alternatives. This process of integration of available information with basic principles is consistent with 40 CFR 1502.22 (Unknown and Unavailable Information).

***Other Issues*:**

Three concerns, some of which relate to the Beschta Report (Beschta, 1995), are considered qualitatively in the effects analysis. These are legacy conditions, the effectiveness of Best Management Practices, and watershed cumulative effects. These concerns are addressed qualitatively as described below.

Legacy Conditions: Legacy conditions have been identified as a concern (other issues considered). Legacy conditions are described in the Existing Condition section and considered in Cumulative Effects. Site-specific legacy conditions were considered in the selection and design of BMP systems and other watershed mitigation and would be considered in the site- specific implementation of BMPs and mitigation in order to protect water quality.

Rehabilitation of some legacy conditions is proposed in the action alternatives. Examples include decommissioning of classified and unclassified roads under all four action alternatives and waterbarring of old skid trails which would be re-used in alternatives 2, 3 and 5. Projects proposed outside this EIS for the Flagtail area address rehabilitation of other legacy conditions as described in Chapter 1, Actions Outside of this EIS to Address Recovery Needs and Watershed Cumulative Effects sections. Legacy conditions for which treatment is on-going include riparian hardwood planting along the Silvies River and other streams and placement of coarse woody material in ephemeral draws and the Silvies River. Other conditions, such as erosion in the Bald Hills would be treated by foreseeable actions.

BMP Effectiveness: The effectiveness of BMPs has been identified as a concern (other issues considered). Evaluations at national and regional scales indicate that BMPs are effective within the design specifications. For instance, evaluations of BMP implementation and effectiveness in the Pacific Southwest Region (Forest Service, 1998; Forest Service, 2001) indicate that BMPs are implemented as prescribed 80%-95% of the time, depending on the practice. Effectiveness of implemented practices was rated at about 78% to 95%, depending on the practice. Local experience, based on informal and formal monitoring on the District, while not compiled into formal databases similar to these national and regional evaluations, indicates that the conclusions from these evaluations apply on the Blue Mountain Ranger District.

In addition EPA has recently provided guidance on incorporating BMPs into silvicultural activities (Note: EPA’s definition of silvicultural activities includes actions associated with silvicultural treatments including but not limited to road building, burning, etc.) EPA has identified ten management measures which establish the goals to be achieved, guidelines for operations, or steps to be taken to be achieved for protecting water quality during silvicultural activities. Numerous management practices, both managerial and structural, are recommended by measure by EPA. EPA also advocates approaching control of nonpoint source pollution by using systems of BMPs since single practices cannot address the full range and extent of control needed at the variety of sites where silvicultural activities occur (US EPA, 2001).

This guidance was used to develop the BMPs and other watershed and soils mitigations described in chapter 2, especially in areas where legacy or other site-specific conditions are a concern. An example of a BMP system would be controlling erosion in some units by the retention of slash, waterbarring of skid trails and incorporation of ephemeral draw buffers. Potential systems of BMPs may be identified by comparing objectives for BMPs that are described in Chapter 2.

Cumulative Watershed Effects:

Cumulative watershed effects are discussed, by alternative, under each of the three major sub-titles of the Watershed Environmental Consequences Section. The area considered for cumulative watershed effects is the entire Silvies drainage including the lower river segment (River Mile 0 to 20) which is the next downstream river segment included on the State of Oregon Section 303(d) List of Water Quality Limited Waterbodies. The time period considered for cumulative effects begins with the initial operations and continues until watershed effects from the proposed actions are considered to be recovered, generally up to 50 years. Synergistic effects potentially developing from interactions between proposed activities and legacy or other local conditions are considered.

Allotment Interactions

The Malheur National Forest has adopted guidelines for grazing after prescribed or wild fire. They recommend rest for at least two years following a wild fire, recognizing increased watershed sensitivity to cumulative effects from grazing and other management activities. It is assumed that the burn area would be rested from grazing for two or more years, consistent with these guidelines. Grazing, when re-initiated, would be in compliance with applicable standards. Decisions about re-initiating grazing are not part of this EIS and would be made under the authority of the Grazing Permit.

Analysis File

Additional analysis and supporting data are found in the Analysis File; these are incorporated into this analysis by reference. Chapter references are to chapters in the FEIS. Maps and appendices referenced by figure number and “map section” or by appendix title refer to maps or appendices finalized for the FEIS and included in that document’s map or appendix section. Data for these maps and appendices were provided separately from this report or are commonly available, for instance, in the MNF GIS.

Background Information

Overview of Project Area

The project area lies at the northern end of the Great Basin in the Basin and Range physiographic province), just south of Aldrich Range of the Blue Mountains. Elevation ranges in elevation from approximately 4800 feet along Swamp Creek near the Forest Boundary on the north side of the fire to above 6000 feet on the narrow plateau which is the divide between Jack and Hog subwatersheds. Figure 3, Map Section displays the hydrologic setting of the project area.

The Flagtail Fire area is drained by the Silvies River and its tributaries, which drain into Malheur Lake. A 4.5 mile interfluvial segment of the Silvies River flows within the

Flagtail Fire boundary in the Snow Creek subwatershed. Ephemeral tributaries to the Silvies River in Hog Creek subwatershed burned although the river is outside the fire boundary in this subwatershed.

The project area is within the Flagtail Burn Area in the Upper Silvies Watershed (5th field Hydrologic Unit Code (HUC)) in the Silvies Subbasin (4th field HUC) of the "Oregon Closed Basins" Basin (3rd field HUC). Portions of four subwatersheds (6th field Hydrologic Unit Code) lie within the project boundary; less than one acre is mapped in GIS within a fifth subwatershed (Wickiup) where no activities are proposed. Flagtail Fire also burned on private land in three of these subwatersheds (Snow, Keller, and Jack) and in West Bear Valley subwatershed where there is no national forest land.

The climate in the Flagtail area is considered sub-humid continental. Most of the precipitation occurs as snow. Intense, short-duration thunderstorms occur during summer. Isolated summer thunderstorms produce localized, erosive peak flows in small watersheds (generally, less than 10 square miles). Thunderstorms are usually not large enough to produce erosive peak flows in watersheds larger than about 10 square miles. Temperatures vary widely, both seasonally and by elevation. Annual temperatures normally range from –30 degrees F during the winter to above 90 degrees F in summer; colder temperatures have been recorded in Bear Valley. Freezing temperatures can occur at any time of the year, especially at the higher elevations. The majority of annual runoff occurs as snowmelt in April through June; low flows occur in August and September.

Snow Creek (Figures 3 and 16, Map Section) is included on the Oregon Department of Environmental Quality's 2002 Clean Water Act Section 303(d) List of Water Quality Limited Waterbodies (303(d) List) for summer rearing temperature for salmonids (trout). The lower 20 miles of the Silvies River (Figure 3, Map Section), which are about 68 river miles below the project area, are also included on the 2002 list for summer rearing temperature for salmonids, dissolved oxygen, and temperature March 1 – June 30 (spawning). Scotty Creek, south of the project area is the only other stream in the Upper Silvies Watershed included on the 303(d) List (Figure 3, Map Section).

No emergency situations or recommendations for emergency treatment for watershed or fisheries resources were identified in the Burned Area Emergency Rehabilitation (BAER) report. Team members recognized a non-emergency concern with soil erosion in some ephemeral draws and stream channels due to pre-existing conditions and changes in vegetation and ground cover caused by the fire. These areas are included in the discussion below.

Existing Condition and Effects

This section is organized by three major topics: 1) Stream Channels, Riparian Habitat Conservation Areas, Management Area 3A, and Uplands; 2) Water Quantity; and 3) Water Quality.

Stream Channels, Riparian Habitat Conservation Areas (RHCA's), and Management Area 3A (Non-anadromous

Riparian Area), and Uplands

Figure 16, in the Map Section, shows stream and mapped ephemeral draws. Table WS-1 displays the subwatersheds and stream distances within the project area. Project area by subwatershed is displayed in Table WS-9. Most ephemeral draws, intermittent streams, aspen stands, wetlands, and perennial streams are confined in narrower valleys at mid and higher elevations. Relatively long ephemeral draws transition into short segments of intermittent or perennial streams or into less confined wetlands above tributary confluences. Low elevation, perennial and fish-bearing streams are usually found in wide, flat valleys although portions of Snow Creek lie in narrow valleys. Wetlands vary in size from less than 1 ac. (INFISH Category 4 wetlands) to greater than one acre (INFISH Category 3 wetlands).

Table WS-1: Lengths of Streams by Category/Class* and Subwatershed Within the Project Area

Subwatershed	Fish Bearing (Miles)	Perennial (Miles)	Intermittent (Miles)	Ephemeral Draws (Miles)
Hog Creek	0	0	0	2.7
Snow Creek	5.7	2.5	5.3	16.5
Keller Creek	0	.2	0	1.7
Jack Creek	.9	1.5	4.2	15.1
Total	6.6	4.2	9.5	36.0

* Categories and class defined in Chapter 1. Estimates differ from BAER report due to updating of GIS in March 2003 following field work in fall 2002.

The primary erosion process is widening, deepening, and upslope extension of channels and creation and similar extension of erosion paths in draw bottoms (Upper Silvies WA), both of which increase the efficiency of runoff and produce sediment. The fire reduced ground cover, which increases the potential for surface runoff to reach draws or channels. The project soil scientist estimated that ground cover would approach near pre-fire levels in 2007. Channel stability is not expected to change as a result of direct or indirect effects of the fire according to the BAER evaluation. The BAER evaluation used a design storm typical of a two year event which has a probability of occurring at a given time of 50%.

Visual estimates were made of soil burn severity along streams using BAER maps. Table WS-2 through WS-5 display distance (estimated) of stream burned by soil burn severity, stream category or class, and subwatershed. The soil severity evaluation is based on conditions along the stream bank and within 10-15 feet of the bank. These are not always typical of the adjacent RHCAs. Within RHCAs soil burn severity varied by vegetation type with most forested areas burning and most meadows not burning as described below. Figures 2 and 6, Map Section, display soil burn severity and vegetation mortality.

Table WS-2: Summary of Burn Soil Severity along Mapped Ephemeral Draws by Subwatershed (distances rounded to nearest .05 mi.)*.

Subwatershed	Within Project Boundary (Miles)	High Soil Severity Burn (Miles)	Moderate Soil Severity Burn (Miles)	Low Soil Severity Burn (Miles)	Unburned (Miles)
Hog Creek	2.70	0.05	0.20	1.50	0.95

Snow Creek	16.50	7.45	4.00	3.85	1.20
Keller Creek	1.70	0.20	0	1.50	0
Jack Creek	15.10	4.90	3.30	4.50	2.40
Total	36.00	12.60	7.50	11.35	4.55

Figures are based on ocular estimates from maps.

Table WS-3: Summary of Burn Severity along Intermittent Streams by Subwatershed (distances rounded to nearest .05 mi.).*

Subwatershed	Within Project Boundary (Miles)	High Soil Severity (Miles)	Moderate Soil Severity (Miles)	Low Soil Severity (Miles)	No Burn (Miles)
Hog Creek	.0	0	0	0	0
Snow Creek	5.30	.0.35	0.35	4.05	0.55
Keller Creek	0	0	0	0	0
Jack Creek	4.20	0.35	0.40	1.45	2.00
Total	9.5	.70	.75	5.50	2.55

*Figures are based on ocular estimates from maps.

Table WS-4: Summary of Burn Severity along Perennial Non-fish-bearing Steams by Subwatershed (distances rounded to nearest .05 mi.).*

Subwatershed	Within Project Boundary (Miles)	High Soil Severity (Miles)	Moderate Soil Severity (Miles)	Low Soil Severity (Miles)	No Burn (Miles)
Hog Creek	0	0	0	0	0
Snow Creek	2.50	0.10	.65	.95	0.80
Keller Creek	.20	0	0	.20	0
Jack Creek	1.50	0	0	0.70	0.80
Total	4.20	0.10	0.65	1.85	1.60

*Figures are based on ocular estimates.

Table WS-5: Summary of Burn Severity along Fish-bearing Streams by Subwatershed (distances rounded to nearest .05 mi.).*

Subwatershed	Within Project Boundary (Miles)	High Soil Severity (Miles)	Moderate Soil Severity (Miles)	Low Soil Severity (Miles)	No Burn (Miles)
Hog Creek	0	N/A	N/A	N/A	N/A
Snow Creek	5.7	0.7/4.8	0.3/0.3	0/0	4.7/0.6
Keller Creek	0	N/A	N/A	N/A	N/A
Jack Creek	0.9	0.1/0.1	0.7/0.7	0/0	0.1/0.1
Total	6.6				

* Figures are based on ocular estimates.

RHCAs in the wide valley bottoms and in small or narrow (“stringer”) meadows associated with intermittent, perennial, and fish bearing streams are vegetated with grasses and grass-like plants such as sedges and with sparse shrubs (see Botany section). These meadows generally did not burn or only burned with spot fires.. They continue to buffer runoff and filter sediment, similarly to before the fire. WEPP modeling conducted between the DEIS and FEIS indicated that the narrower meadows typical of Snow Creek drainage would trap only about 20% of the surface runoff produced in a five year or greater event. The probability of such an event occurring at any time is 20%. The wider meadows found in Jack and Keller subwatersheds and along the Silvies River in Snow and Hog subwatersheds would be expected to trap proportionately more sediment.

Conifers typical of the adjacent uplands are found in the outer, drier ("upland") portions of most RHCAs associated with perennial and fish bearing streams and wetlands and along the non-meadow portions of intermittent streams. Exceptions to this pattern of vegetation are found along Snow Creek where much of the valley is narrower and forested and fewer meadows occur. Over 60% of the trees were killed on about 80% of the forested areas within RHCAs. Vegetation along ephemeral draws is typical of the adjacent uplands. Soil burn severities and vegetation mortality of conifers in RHCAs and draws are usually similar to the adjacent uplands.

Snow Creek drainage burned in a different pattern because much of the streamside was forested. Hardwoods present on the streambanks within forested areas burned similarly to the adjacent forest. About one-half mile (forested) along Snow Creek (fish-bearing and perennial segments) and a perennial tributary burned with moderate or high soil severity, killing conifers and riparian hardwoods and reducing ground cover and filtering capacity. Felling of hazard trees along road 2400133 restored some filtering capacity although more recovery is expected as ground vegetation and litter recover over the next five years and as more snags come into contact with the ground.

Conifers and riparian hardwoods planted in spring 2003 are expected to accelerate recovery of shade in 7-10 years for the hardwoods and 40 years for the conifers. Roots from these plantings will contribute to accelerated recovery of bank instability in about three years. Roots from fire-killed vegetation are expected to provide soil holding capability for up to nine years after the fire, with capability gradually declining as the roots decompse during this period.

MA3A, not included in RHCAs, is vegetated with either aspen or, in ephemeral draws, conifer stands or other plants that are similar to those on the adjacent uplands. There are minor inclusions of aspen at scattered locations in the draws. The soil burn severity in these areas is similar to that on the adjacent hillslopes. One aspen area, located near the end of road 2400056, would be included in the area considered for treatment under the Proposed Action. A detailed description of the existing condition of this stand is found in the Botany section. Legacy conditions are present as described below.

Conditions of the drainage system, including uplands, in the project area are variable. Anthropogenic disturbance is present as described below in the Legacy Conditions section. Large seep systems are found in the headwaters of Jack and Snow creeks and their tributaries and in portions of the valley bottoms of the Silvies River and Jack, Snow, Cold and several unnamed creeks. Flows often infiltrate and decrease going downstream. In other portions of the same valley bottoms, seep systems and wet meadows have dried out when channels down cut; consequently soil water from these areas is assumed to drain rapidly into the downcut channels and run off faster and earlier as described in Legacy Conditions Section below.

A segment of the Silvies River below Snow Creek and ephemeral draws in lower Jack Creek subwatershed meet or nearly meet minimum Forest Plan standards for large wood following the initial implementation of the Flagtail Placement of Coarse Woody Material CE between the DEIS and the FEIS. Forest Plan standards for large wood which are not met currently, would be met along fish bearing streams and along approximately 60% of other streams and draws as the CE continues to be implemented in the next three years. Placement of coarse wood reduces sediment mobilization, disperses concentrated flows, and improves other impaired watershed functions resulting from legacy conditions. Forest Plan standards may be exceeded as fire-killed trees fall in increasing numbers over the next 15-30 years. Commercial sized hazard trees along some open roads were removed from ephemeral draws and from the outer portions of some RHCAs in fall 2002 under a Categorical Exclusion. Non-commercial sized hazard trees were felled and left. Hazard trees within the inner portions of RHCAs were felled and left in place. Dead trees removed from the outer portions of RHCAs would generally not reach stream channels or, if they did, the dimensions of the portions of the trees reaching channels would be likely to be less than Forest Plan standards. Conceptually, down wood increases filtering capacity; however, as the WEPP modeling (conducted between DEIS and FEIS) shows (see Water Quality section), the most common run off events are unlikely to detach and move soil that would reach streams.

The condition of the Silvies River on private land adjacent to County Road 63 in Snow Subwatershed appears to be similar to that on Forest Service land. Its gradient continues to flatten gradually as it transitions from the narrower intermoutain valleys on the Forest Service lands to Bear Valley. Bear Valley is a typical Great Basin valley which is over ten miles wide. Similarly maps indicate that the tributaries to the Silvies River on private land are also flat gradient streams typical of the Great Basin. The condition of tributaries of the Silvies River visible from public land or travelways is variable with entrenchment estimated to vary from less than a foot to several feet, variable amounts of bank cutting, widening that is estimated to vary from less than 20% to over 100%, and loss of riparian hardwoods and beaver. Sedges and other riparian herbaceous species appear to be present along many of the drainages. Greater amounts of disturbance are found lower in the subwatersheds, several miles from the Forest Boundary. Ponds have been constructed on streams in Keller and Jack subwatersheds, based on map and field observations.

About 1080 ac. of private land is within the burn boundary. Like nearby Forest Service land, it is a mosaic of forested and non-forested areas. According to the BAER map (Figure 2, Map Section), about one-half appears to have burned with high or moderate soil severity and about half with low soil severity or no burn. Observations from public lands and travelways and anecdotal knowledge of historical forest management indicates that forest stands are commonly ponderosa pine which has been precommercially or commercially thinned.

For the purposes of this document, the portions of Jack Creek which drain the Bald Hills and lie generally north of the 2400 road will be called lower Jack Creek. The area to the south of the 2400 road will be called upper Jack Creek.

Fire Suppression and Suppression Rehabilitation: About 23 miles of fireline (dozer, including re-opening of about four miles of previously closed road by dozer) were built during Flagtail Fire. Fireline was placed in areas of concern including a crossing of a perennial tributary to upper Jack Creek, an ephemeral draw and seep tributary to the Silvies River in Hog Subwatershed, and on steep slopes and near a seep above Tributary

7 to the Silvies River (confluence at T.16S., R.29E., S.13, NW, SW). These areas, along with the rest of the fireline were rehabilitated in fall 2002. Fire suppression rehabilitation, (waterbarring and slash placement) was considered effective by December 2002. These three areas were selected for monitoring in July 2003. Rehabilitation was effective along the perennial tributary to Jack Creek and on the steep slopes and near the seep above Tributary 7 to the Silvies River. Evidence of slight concentrations of overland flow and associated sediment movement was noted along the ephemeral draw tributary to the Silvies River in Hog Subwatershed. Generally sediment was accumulating behind downed material (<3 in . d.b.h.) which was not frequently distributed. Erosion paths varied in length from two to ten feet. Erosion seeding has been recommended for this area and is scheduled for implementation in spring 2004. Numerous off-road tracks were made by vehicles used during suppression, generally on the uplands; these areas are not connected to the drainage network. Fire retardant was used throughout the fire area with no observable consequences. No retardant use was observed in RHCAs or in ephemeral draws.

Legacy, Road, and Pre-fire Conditions: Anthropogenic causes of erosion and other disturbance are evident, primarily along stream channels and valley bottoms and in ephemeral draws with less than 45% gradient, but also in non-forested areas, and on previously harvested hillslopes where tractor yarding occurred. These conditions occur within both the areas without roads identified during public comments and in and around existing and proposed DOGs and ROGs. These conditions affect water quantity and water quality as described in the following sections and may interact with effects of the fire. Table WS-6 displays miles of mapped ephemeral draws by degree of pre-fire impacts by subwatershed.

Table WS-6: Degree of Impact* in Ephemeral Draws in Project Area by Subwatershed (lengths in miles)**

Subwatershed	Total Ephemeral Draws in Fire Boundary (Miles)	Highly Impacted Draws (Miles)	Moderately Impacted Draws (Miles)	Low Impacted Draws (Miles)	Natural-Appearing Draws (Miles)
Hog Creek	2.70	1.90	.20	.60	0
Snow Creek	16.50	2.25	5.80	7.90	.55
Keller Creek	1.70	.15	0	1.55	0
Jack Creek	15.10	2.35	2.85	9.40	.50
Total	36.00	6.65	8.85	19.45	1.05

***Highly** impacted draws are gullied, have eroding ruts, or are actively rilling. **Moderately** impacted draws have relatively wider areas of detrimental or non-detrimental disturbance (for instance skid trails are greater than 11 ft. wide) and evidence of little ground cover or tree recovery pre-fire. **Low** impacted draws have narrower areas of impact (for instance less than 10 ft wide), and evidence of some ground cover and tree recovery before the fire, or evidence of sediment moving through culverts and depositing locally. **Natural-Appearing** draws appeared to have ground cover and tree vegetation similar to the adjacent hillslope plant community and no visual signs of ground disturbance; these were commonly found on steeper ground.
**Figures are based on ocular estimates from maps.

The Upper Silvies WA (2001) states that some riparian zones and valley bottoms have been drained as a result of stream channel downcutting. Examples are found along segments and some tributaries of the Silvies River, Snow Creek, Jack Creek, and Cold Creek. As a result, these areas store less water, dry out earlier, and are less resilient to disturbance, because of the loss of deep rooted plant species, than before the downcutting. Buffering capacity for upslope inputs is retained, generally due to the valley widths, although it is reduced due to downcutting of the channels. Soil water from these areas is assumed to rapidly drain into the downcut channels and to run off faster and earlier. Stream channel conditions are described in more detail in the Fisheries Section. Similar conditions exist in ephemeral draw tributaries to lower Jack Creek (north of the 2400 road). More rapid runoff and dewatering of shallow fills in ephemeral draws appears to be occurring.

Overall these processes contribute to an extended drainage network that is considered more efficient at transporting water to the outlets of subwatersheds. Peak and near peak flows tend to occur earlier, to be slightly higher, and to last longer than in less disturbed and less efficient networks. Consequently, less water is retained and stored in the soil for gradual release. Meadows dry out sooner than under undisturbed conditions. The Upper Silvies WA (2001) also suggests that past flow increases may have been large enough to cause channel erosion, especially in previously disturbed channels, partially because of the fine fill materials found in the valley bottoms.

Riparian water tables, which have dropped as the result of channel entrenchment, supply less water to streams in late summer. It is suspected that fewer beaver ponds are present to supplement summer low flows, although at least one colony of beaver has been observed along the Silvies River.

Movement of soil water and sediment has also been modified by the construction of roads and by unclassified extensions of roads, especially by those within 100 feet of channels and draws, as shown in Table WS-7 for the project area and for entire subwatersheds. Table WS-7 does not include unclassified extensions of roads which have similar effects. These extensions are estimated to total less than two miles and are located primarily in the Bald Hills area of Jack subwatershed, which is included in one of the areas without roads that was identified by public comment. Among others, roads 2400092, 2400196 and 2400133 capture water from tributaries or deliver sediment and concentrated flows to Jack or Snow creeks. Road 2400133 also has a culvert fill which is failing and delivering sediment to Snow Creek.

On most roads, the roadway surface is either rutted or has rill erosion, or both, which is caused by water running down the roadway or rutting (Note: definition of rutting here is consistent with its use in describing road surface conditions by travel managers, not with its use in evaluating general soil conditions by soil specialists) made by the passage of a vehicle. This lengthens flow paths, potentially increasing sediment detachment and water concentration and delivering potentially increased amounts of sediment and water into adjacent streams. Project engineers identified roads where previously constructed drainage structures, such as drainage dips, grade sags, cross-ditches and waterbars, that are not routing water and sediment off roads efficiently or in a timely manner (see Transportation secction) or where these structures are lacking. Replacing and reshaping these structures would route water and sediment off roads before reaching streams.

Table WS-8 displays stream crossings in the Flagtail Burn Area by subwatershed.

Table WS-7: Roads within 100 feet of Stream Channels and Draws in Flagtail Project Area by Subwatershed and Total Roads and Road Densities for Subwatersheds in the Flagtail Burn Area by Subwatershed.

Subwatershed	Flagtail Project Area - Roads Within 100 ft. of Channel (mi.)	Total Roads Within 100 ft. of Channel (mi.)	Total Roads in Flagtail Project Area -	Total Roads* (mi.)	Subwatershed Road Densities* (mi./sq. mi.)
Hog Creek	.1	8.3	1.2	55.0	5.8
Snow Creek	5.9	7.4	25.0	35.1	3.5
Keller Creek	.1	6.7	2.4	44.4	3.8
Jack Creek	2.9	7.4	23.0	49.3	3.1
Total	9.0	27.5	51.6	183.8	

*includes public and private ownership

Table WS-8: Stream and Draw Crossings within Flagtail Project Area by Stream Type and Subwatershed (Number)

Subwatershed	Total	Fish bearing	Perennial, Non-Fish Bearing	Intermittent	Ephemeral Draws
Hog Creek	6	0	0	0	6
Snow Creek	45	7	6	9	23
Keller Creek	5	0	1	0	4
Jack Creek	32	1	3	15	13
Total	88	8	10	24	46

Shade, along the Silvies River and portions of Snow, Jack and other perennial and fish bearing streams, was reduced pre-fire due to the loss of hardwood shrubs due to legacy activities. Riparian vegetation conditions are described in more detail in the Botany and Wildlife Sections.

The 2003 RHCA plantings would accelerate the recovery of shade in 7-10 years for the hardwoods and in about 40 years for the conifers. They would maintain or improve stream bank conditions beginning in about 3 years due to root growth. Coarse woody material placement, erosion control, and riparian fuels treatments, would contribute to a gradual improvement in legacy and on-going conditions beginning at the time of implementation.

Between the DEIS and FEIS the project soil scientist modeled potential hillslope erosion in 2004 using the Disturbed WEPP model (see Soils Section). The use and results of WEPP modeling are summarized below and discussed in more detail in the Water Quality – General Water Quality – Sediment section. WEPP does not address sediment transport within draws or stream channels.

WEPP modeling conducted between the DEIS and FEIS indicates that only about 20% of sediment eroding from hillslopes during five year or greater events (which occur about 20% of the time) would be trapped within 50 ft. of ephemeral draws or in the narrower valleys typical of these areas or the Snow Creek drainage.

WEPP does not model erosion in ephemeral draws or stream channels. Although the fire has exacerbated pre-fire conditions in some ephemeral draws, primarily by removing ground cover and increasing erosion potential, as described below, many of these areas lie upslope of wide valley bottoms. Erosion during less than five year precipitation events would likely occur in the upper portions of the tributaries and sediment transported down these draws would likely be deposited lower down, within the draws or intermittent channels, or on wide valley bottoms before reaching perennial or fish bearing streams (for example, near the 2400011 or 2400017 roads). Exceptions are Snow Creek and tributaries 6 and 8 to the Silvies River (confluences at T.16S., R.29E., S.13, NW, NE and T.16S., R.29E., S.26, NE, NE, respectively). These streams are either downcut through meadows above the confluence with the Silvies River or flow directly, without going through meadows, into the Silvies River. A greater proportion of sediment is likely to be caught where valley bottoms are wider along Jack Creek, Swamp Creek, and the Silvies River or where drainages transition into Bear Valley. Vulnerability to accelerated erosion is greatest in the previously gullied and skidded draws that drain the Bald Hills in either Snow or lower Jack subwatersheds (see Figure 16, Map Section), some of which lie within one of the areas without roads identified by public comment. Most gullies were stable prior to the fire, due to deep accumulations of needle litter. The increased vulnerability resulted from moderate or high soil severity burn (see Figure 2, Map Section), which removed ground cover, exposed mineral soil, and increased local runoff. In addition, due to deep litter accumulation in these draws, sustained heat may have killed roots of forbs and grasses, delaying ground cover recovery.

Conditions which contribute to increased risk of surface erosion are also found in other draws in Snow, Jack and Hog subwatersheds and, to a much lesser extent, in Keller subwatershed. Some of these areas lie with the two areas without roads identified by public comment. Most draws which have been skidded down appear to have lacked ground cover and tree regeneration before the fire. Active erosion, related to past, pre-fire management activities implemented before the application of Best Management Practices (BMPs), was observed in several places in fall 2002. Tributary 8 to the Silvies River (confluence at T.16S., R.29E., S.26, NE, NE) is particularly at risk due to the current, potentially active headcut at the lower end of a former landing at the end of road 2400058. The landing was apparently formed by filling a gully at the head of an eroded, intermittent channel. Headcutting or other erosion was also observed in lower Jack Creek tributaries (Dipping Vat Creek and its tributaries and Tributary 2 of Tributary 1 (confluence at T.16S., R.29E., S.24, SE, NE)) below the gullied ephemeral draws previously described. An actively eroding, non-forested area (3-5 acres) of the Bald Hills also funnels water to ephemeral draws at the head of Tributary 2 of Tributary 1 of lower Jack Creek and is transitioning to erosion pavement. Rilling was observed on skidded areas the ephemeral draw portion of Tributary 11 (confluence at T.16S., R.29E., S.23, NE, NE) to the Silvies River. Recruitment of woody material to trap sediment may not be timely or adequate in areas of active erosion.

Steep ephemeral draws below road crossings, with or without culverts, burned, exposing mineral soil and reducing ground cover. These draws are located primarily in Snow Creek subwatershed where they are direct tributaries to the Silvies River (for instance, draw tributaries to Tributary 6 of the Silvies River (confluence at T.16S., R.29E., S.13, NW, NE)). Other culverts, found in less steep draws that had been previously skidded down (generally with impacts classed as low, such as those along the 2195 road in Snow Subwatershed) in areas which also burned either with moderate or high intensity, showed evidence of sediment movement through the culverts in fall 2002. Deposition and/or scour is occurring downslope (generally less than 1 cu. ft. of material was disturbed). Soil disturbance in previously harvested areas and effects of the Flagtail Fire on soil, such as hydrophobicity and ground cover, are described in the Soils Section.

During the period when ground cover is recovering, the interactions between conditions created by the fire and legacy conditions which resulted in increased vulnerability to erosion are expected to be reduced by the implementation of on-going and foreseeable activities. Placement of coarse wood in these areas under the CE reduces vulnerability to legacy conditions; it is not intended to mitigate fire effects on ground cover. Both monitoring in Summit Fire (McNeil, 2001) and monitoring of sedimentation related to culverts (McNeil, 1999) demonstrated the potential for interactions between current disturbance and legacy conditions.

Erosion patterns resulting from legacy conditions would continue to develop in response to precipitation events, to natural recovery of ground cover and other vegetation, and to implementation of on-going and foreseeable activities. Vulnerability is greatest in the previously gullied draws that drain the Bald Hills in either Snow or Jack subwatershed or which have rilled near other ridge tops. Vulnerability to erosion was greatest in 2003 and is declining as ground cover continues to recover and watershed improvement projects become effective. Ongoing activities include plantings in RHCAs, previously described, and the placement of coarse woody material in some stream channels and ephemeral draws, both of which occurred in 2003. Foreseeable acitivities that would ameliorate additional legacy conditions include Bald Hills erosion control and aspen protection and restoration. These activities supplement natural recruitment of hardwoods, conifers and coarse wood, improving riparian vegetation recovery, infiltration, and sediment trapping.

Full recovery of ground cover is expected to occur by about 2007 at which time vulnerability to accelerated erosion would be similar to pre-fire levels. However, due to the implementation of improvement projects such as the placement of coarse woody material, vulnerability would be reduced below pre-fire levels. As Bald Hills Erosion Control CE is implemented, vulnerability in that area would be further reduced.

Sediment trapping and water holding capacity within draws and intermittent channels is expected to improve gradually: first, over the next five years as ground vegetation and litter recovers from the fire and ongoing and foreseeable actions continue to be implemented; second, over the next 5-15 years as ground cover becomes re-established and legacy effects diminish in response to ongoing and foreseeable actions; and third, as trees fall in increasing numbers over the next 15-30 years.

Beaver are present within the project area (in the Silvies River) but are probably at much reduced numbers based on local anecdotal history which is consistent with the trend for beaver populations across the West. Also, beaver may be transistory within the project area due to reduced numbers of riparian hardwoods.

No Action (Alternative 1)

Direct and Indirect Effects

No activities are proposed under this Alternative. Since no activities are proposed, there are no direct or indirect effects from management activities on stream channels, RHCAs, MA 3A, or uplands under the No Action Alternative. Fire and fire line recovery would continue based on climate and natural processes operating on the existing condition including legacy conditions.

Burned trees are expected to fall on hillslopes and in stream channels and draws in increasing numbers over the next 15 – 30 years. Trees which fall in channels and draws would increase sediment trapping compared to the Existing Condition. Reestablishment of effective ground cover on hillslopes, ephemeral swales, and ephemeral draws which burned with moderate or high soil severity, would take up to five years. Ground cover in other areas would recover sooner (see Soils Section). During the recovery period, exposed mineral soil would increase vulnerability to accelerated erosion. Soil conditions and erosion in upland non-forested areas would not improve. Forest stands would recover as described in the Forest Vegetation Section.

Numerous problems with road (classified or unclassified) drainage and old skid trails on hillslopes would not be treated, including those within the two areas without roads that were identified by public comment. Road sediment would continue to be generated, at a rate inversely proportional to the rate of maintenance. Examples include roads 2400092, 2400196, 2400, and roads accessing the Bald Hills. Runoff and sediment would continue to be routed to stream channels and ephemeral draws from roads, primarily from classified and unclassified roads within 100 feet of draws and streams as described for the Existing Condition. On-going road maintenance is not expected to remedy chronic and acute sources of sediment in a timely manner, partly due to funding levels.

Since no timber hauling would occur, no road dust would be released during haul and enter streams. Temporary roads would not be built (which increases potential for erosion and decreases infiltration locally for a short window of time during operation) and decommissioned. Old skid trails and landings in the dry aspen stand (MA 3A) in Unit 62 would not be used and would not be improved over the next two years. Wood would gradually fall on old skid trails, over the next 15-30 years, decreasing overland flow and soil movement. No new skid trails or landings would be created. Ground disturbance associated with harvest activities or, for 1-2 years, with road construction, reconstruction, and decommissioning would not occur. Since small fuels in the visual corridor would not be treated, the risk of ditch lines failure due to an accumulation of small material would be postponed until the material fell naturally, probably in the next five to fifteen years. No effects are expected from the felling of hazard trees which are left on-site.

Stream bank stability is expected to remain about the same, both in burned and unburned areas. In riparian areas that burned with high or moderate soil severity, where hardwood shrubs died, naturally occurring shrubs would become re-established and provide bank stability in about 7-10 years. Existing roots from dead shrubs and trees would continue to provide stability for about 7-9 years, until they decompose.

Channel stability would remain vulnerable due to sediment loading from road impacts and other legacy activities but is not expected to change as a result of the fire, under the most common precipitation events, based on the WEPP and peak flow modeling by the BAER team and by the project soil scientist between the DEIS and FEIS. Five year and greater storm events are likely to result in observable erosion as described in the Water Quality – General Water Quality – Sediment Section.

Fuels would accumulate as described in the Fuels Section increasing the soil, watershed, and stream channel hazard from future fires. It is likely, in the event of a future wildfire (in 10-30 years) that, in addition to loss of ground cover and increased hazard for erosion, stream side vegetation would likely be killed and set back along more streams than occurred in the Flagtail fire. Death of stream side vegetation would reduce shade and set back temperature recovery. The likely accumulation of fuels would also preclude using fire as a tool in future management activities to move the uplands and RHCAs toward the Desired Condition.

Summary

Since no activities would occur under this Alternative, the overall effect would be to maintain pre-fire degraded watershed and stream channel conditions for up to 15-30 years, until burned trees fall in sufficient numbers to provide sediment trapping in ephemeral draws and streams. This Alternative does not improve road conditions which are impacting streams, as recommended in the Upper Silvies WA (2001).

Cumulative Effects

Since there are no direct or indirect effects under this Alternative, there would be no cumulative effects resulting from management activities. Cumulatively, effects of the Flagtail Burn Area on downstream conditions would remain similar to the Existing Condition, including on-going activities, for about 15-30 years until trees fall. On-going and foreseeable activities would further improve watershed conditions. Downstream conditions may then improve in proportion to the additional recruitment of wood. Other conditions such as those of most hillslopes and roads would remain unchanged. Opportunities for interactions among legacy conditions would be present which local monitoring indicates may result in erosion or concentration of flows.

In review of Appendix J (Cumulative Effects), ongoing and reasonably foreseeable actions that could affect watershed function of the landscape would be fuels treatments, other harvest, and reforestation on private land and, on Forest lands, recreation and trail use, livestock grazing and management, conifer and riparian hardwood planting, addition of coarse woody material to streams and draws, spring development, timber harvest and other silvicultural treatments in the Upper Silvies Watershed (including post and pole or personal use firewood sales and hazard tree removal (either alive or dead)), Bald Hills erosion control, aspen protection (fencing), riparian fuel treatment, and fireline seeding.

Based on the Disturbed WEPP modeling conducted between the DEIS and FEIS, it is expected that because silvicultural treatments, on either private or federal land, are required to be implemented with BMPs, no measurable effects on overall watershed function would be observed under the most probable runoff events (< 5 year frequency); see also Cumulative Effects for the No Action Alternative in the other two major sections of this report. As discussed in more detail in the Water Quality – Sediment section, effects of five year and greater events are not expected to be measurable due to the "noise" (variability) associated with erosion and sediment monitoring.

The effects of re-initiation of grazing would be similar to those before the fire as the same standards and guidelines would apply. Recreation and related uses appear to be isolated with respect to watershed function. Use may result in local degradation but is unlikely to affect overall trends in watershed recovery. Riparian and conifer planting in RHCAs and aspen protection would provide shade and bank stability, improving both post-fire and legacy conditions. More discussion of shade effects is found in the Water Quality – General Water Quality - Temperature section. Placement of coarse woody material in draws and channels, aspen protection, and Bald Hills erosion control would all improve watershed function impacted by legacy conditions, primarily channel morphology and function and sediment control.

Other fire and fireline recovery would progress based on climatic conditions, legacy conditions and ongoing and foreseeable activities (described in Chapter 1) and interactions among these. Some legacy conditions in the two areas without roads, identified by public comment, would be ameliorated, moving watershed conditions toward those typical of areas without roads.

The overall effect of this Alternative combined with on-going and foreseeable activities would be slightly improved cumulative watershed condition with the same potential for watershed damage from wild fire as previously described.

Alternatives 2, 3 and 5

Direct and Indirect Effects

A variety of activities would occur on this post-fire landscape. Site-specific BMPs, combined into systems, and other mitigation (see Chapter 2), which have been generally shown to be effective on the Malheur National Forest, would be applied; see discusson in the BMP section near the beginning of this report. Potential systems of BMPs may be identified by the BMP objective described in Chapter 2. Site-specific legacy conditions were considered in the selection and design of BMPs and other watershed mitigation and would be considered in the implementation of BMPs and mitigation in order to protect water quality.

Alternatives 2, 3 and 5 differ in the amount of harvest and fuel treatments and also in the amounts of various yarding systems and subsoiling as shown in Table 2-1 in Chapter 2. There are about 500 fewer acres of tractor yarding, about 170 fewer acres of skyline and about 315 fewer acres of helicopter yarding in Alternative 3 when compared to Alternative 2. There are about 200 fewer acres of tractor yarding, about 260 fewer acres of skyline and about 140 fewer acres of helicopter yarding in Alternative 5. Harvest, fuel treatments, and reforestation proposed under Alternatives 2, 3 and 5 would move the landscape toward the Desired Condition, allowing fire to burn within its historical range and reducing the potential for adverse watershed effects.

Site-specific design and implementation of BMPs are expected to retain disturbed soil within the activity unit (see Chapter 2 and Soils Section) under the most common precipitation or runoff events (≤ 2 yr events) as determined by the project soil scientist using WEPP (see Watershed – Water Quality – Sedimentation Section and Soils Specialist Report). Implementation of these BMPS would also disperse concentrations of water caused by activities and meet Forest Plan standards for detrimental soil conditions. Controlling these effects would reduce the potential for extending the drainage network, the primary erosion mechanism in the Flagtail Burn Area. Consequently, although more activities are proposed under Alternatives 2 and 5 than under Alternative 3, the effects of the alternatives on the drainage network in the project area are expected to be the same, under the most common precipitation events, as discussed in the Water Quality – General Water Quality – Sediment section.

Excluding equipment from ephemeral draw buffers except at designated crossings would eliminate uncontrolled disturbance which may transport erosion products into the stream network. Because it is recognized that BMPs may not be 100% effective, depending on weather and microsite conditions, standard INFISH RHCAs and variable width, no cut buffers on selected ephemeral draws (see Figure 16, Map Section) or other multiple mitigation measures, as described below, would also be applied to control erosion and concentrated overland flow. Ephemeral draw buffers are based on ephemeral draw impact ratings (see Table WS-7):

- 10 ft. each side, generally, where the ephemeral draw impact rating is low or not apparent if either skyline or helicopter yarding is proposed,
- 25 ft. each side, generally, where impacts are rated low or where impacts are rated moderate if skyline or helicopter yarding is proposed,
- 50 ft. each side where impacts are rated moderate if tractor yarding is proposed or where impacts are rated high.

These buffers would allow for future recruitment of coarse and large woody material (12 inch diameter at the small end) at the minimum Forest Plan Standard (20 pieces of wood per mile) which would maintain or improve water holding capacity in draws. The 25 ft. and 50 ft. buffers also provide filter strips which are expected to be adequate to trap most sediment moving due to either legacy disturbances or in case sediment generated by proposed activities moves off-site (McNeil, 2001a, McNeil 2000b) or for precipitation events that occur more frequently than five years except as described below. Buffer strips would also prevent further degradation of sediment trapping and water holding capacities of previously impacted draws, given post-fire conditions.9see Water Quality – General Water Quality – Sediment)

Harvest activities near RHCAs or ephemeral draws, that burned with either moderate or high severity and where filtering capacity may be reduced as a result of the burn and slower recovery of ground cover, would be mitigated with additional measures. These areas include RHCAs along Snow Creek and along unnamed intermittent streams and ephemeral draws in areas of Jack and Snow subwatershed that burned with moderate or high soil severity. Yarding by skyline or helicopter, installing sediment fencing, increasing waterbar frequency, seeding of less steep slopes, and restricting operations to dry or frozen conditions are mitigation measures that are expected to prevent disturbed soil from entering or crossing RHCAs with reduced filtering capacity.

By limiting skidding across ephemeral draws to designated crossings, the water holding and sediment trapping capacity of the draws would be maintained. Placement of slash in skid trails and landings in the dry aspen (MA3) portion of Unit 62 would provide erosion control, sediment trapping, and microsite protection for aspen sprouts. Drainage, such as water bars, would be installed on about old skid trails that are reused (about 10-60% of old skid trails would be reused, depending on unit).

Mitigation also includes no timber harvest in RHCAs. Wetlands would be protected within RHCAs and would be avoided. Additional wetlands discovered during layout or other activities would have RHCAs applied for protection and would then be avoided and mapped as determinations are made.

Under these alternatives, the remaining hazard trees along open roads and closed roads used for haul would be felled and removed except that hazard trees within RHCAs would be felled and left with effects as described in Cumulative Effects for Alternative 1. Because only minimal soil disturbance would be associated with removing hazard trees outside RHCAs, as described in Soils Section, there would be no effect on the drainage network. Similarly treatment of non-commercial material in riparian areas within the visual corridor of County Road 63 would be treated by hand which is not expected to result in soil disturbance or sedimentation. Removing this material where it may impede the function of road ditches would protect against possible ditch or road failure due to the plugging of a ditch.

The application of site-specific BMPs to the replacement or removal of culverts during reconstruction and decommissioning of stream crossings would limit additional sedimentation to streams to up to about one cubic yard of sediment per culvert treated, during implementation and for up to two years following implementation. Maintenance is not expected to add to stream sediment due to the application of BMPs.

Maintenance (including dust abatement), reconstruction and decommissioning of roads, as shown in Table 2-1, Chapter 2 or in the Management Requirements/Mitigation Measures table in Chapter 2, would reduce road-related disturbance to RHCAs, stream channels, and ephemeral draws during and after operations and after year 2, depending on the practice. Reducing this anthropomorphic disturbance would reduce potential for channel widening, downcutting or extension upslope or similar effects in ephemeral draws. Decommissioning of temporary roads would reduce associated disturbance by controlling opportunities for sediment production or concentration of surface flows. Details of the effects of these proposed activities are discussed in the Water Quality Section (also, see Tables WS-11 through 13, and WS-15 through 17). Decommissioning of roads in each of these alternatives reduces road-related disturbance to stream channels after year 2 and would likely improve channel conditions at rates possibly measurable over 10-20 years, particularly in Snow Creek (see Fisheries Section). One new segment of road (.3 mi.) would be constructed in the uplands of Snow Creek to allow streamside roads 2400133 and 2400203 and one crossing of Snow Creek to be decommissioned while providing access into the upper part of Snow Creek Subwatershed. The application of BMPs and road design criteria would limit soil disturbance during and following road construction and decommissioning and would prevent the extension of the drainage network. Additional effects of proposed road treatments are discussed in the Water

Quantity and Water Quality sections. Treating these roads addresses recommendations in the Upper Silvies WA (2001).

The application of site-specific BMPs, INFISH RHCAs, and ephemeral draw buffers is expected to keep soil within an activity area, or in the cases of road decommissioning, construction, reconstruction or maintenance, reduce road-related disturbance reaching streams under the most common precipitation events (< 5 year frequency), except as noted previously for culvert replacement or removal.

Consistent with guidance for the design and implementation of BMPs, BMPs selected to prevent erosion and concentrated runoff from leaving activity units were re-evaluated when WEPP modeling by the project soil scientist indicated that 5 year and greater precipitation events, which occur in about 20% of the years, would result in about .07 cu. Yd./ac, of eroding soil reaching activity unit boundaries. Only about 20% of this soil would be trapped in ephemeral draws or RHCAs where valley bottoms are relatively narrow. This amount represents an increase of about 25-30% over the Existing Condition. Three and four year events which are slightly more common would result in trace (≤ .01 cu. Yd./ac.) amounts of erosion moving beyond unit boundaries steeper slopes.

Re-evaluation of BMPs resulted in the proposal of additional BMPs to control the additional erosion. Two additional BMPs which prescribe leaving slash scattered in the units and scattering slash on skid trails to reduce the amount of erosion reaching unit boundaries were incorporated. Scattering slash on skid trails would be prescribed only in units (see Mitigation, Chapter 2) where the transport of additonal sediment may adversely impact stream function. The combination of the two additional BMPs would reduce the amount of erosion likely to reach unit boundaries during a five year or greater event by about 28-44% to .04-.05 cu. Yd./ac. or by 14- 28% to 0.05 -0.06 cu. Yd./ac. where only the BMP for leaving slash in units was implemented. While these reductions in potential soil movement may not be measurable because of the natural variability associated with erosion processes and the variability associated with sediment measurements (see Water Quality – General Water Quality – General Water Quality – Sediment section), increasing ground cover is expected to result in increased soil trapping.

No additional, economically feasible BMPs were identified to control erosion resulting from tractor yarding. (U. S. EPA, February 2001). The effect of eroded soil reaching unit boundaries on stream sedimentation is discussed in the Water Quality – Sedimentation section.

The results of the modeling indicated that under the most common precipitation events (1 and 2 year storms), BMPs included in the FEIS would function so that soil disturbed by ground-based yarding would remain within units and would not be transported to unit boundaries. With 3 and 4 year events, under the BMPs included in the FEIS, trace amounts of soil would be moved to lower unit boundaries, where they would be vulnerable to entering RHCAs or ephemeral draws. Ephemeral draw buffers (10-50 ft. on both sides) were prescribed based on the condition of the draws so that greater sediment trapping capacity would be available where conditions are most sensitive (e.g. the “highly disturbed” draws) to interactions between moving sediment and local draw conditions. Trace amounts of sediment would be expected to be captured in the filter strips or behind wood placed under the Flagtail Coarse Wood Placement CE or naturally recruited downfall in the drainage network. These results were consistent with monitoring from Summit Fire Restoration EIS and local observations. Disturbed WEPP indicated that run off expected with five year or larger storms, which have a probability of occurring 20% of the time, would move at least 04 cu. yd./ac. of sediment to the lower boundaries of units, where most of the area burned with moderate to high severity. The amount of soil transported is likely to be proportional to the storm size and the amount of run off produced inside the units. This amount of sediment would move on slopes generally greater than 10%; less would move to the lower unit boundaries on flatter slopes and in units with less severe burning.

Since the most rigorous sediment research has indicated wide variability in sediment production and transportation (plus or minus 100%) and modeling is recognized as being more variable (USDA Forest Service, undated, “Forest Service Policy…”), it is possible that no or only trace amounts of sediment would be produced by five year storms. Also the fact that an effect cannot be measured because of natural variability does not mean no effect exists. The model, professional judgment and experience, and common sense all indicate that more disturbance would result in the potential for more sediment to be mobilized. Given the application of additional BMPs to control soil movement and sedimentation, the Forest Service may rely on monitoring during and following infrequent run off events and modifying BMPs in accordance with results in order to control sediment. Vulnerability is greatest in the relatively narrow window of time, generally less than one year for each activity area (unit), during operations before all BMPs, such as waterbarring and slash scattering, are in place. Once BMPs are in place vulnerability is expected to be reduced to that described above and would gradually decrease over about two to five years as ground cover develops post-fire on both skidded and non-skidded areas. Faster recovery is expected on the more erosive soils where seeding is required (see Chapter 2, Management Requirements and Mitigation Measures). When ground cover has fully developed, vulnerability to soil movement approaches that of pre-fire conditions.

Overall these Alternatives would improve watershed and stream channel condition more than Alternative 4 when both road and harvest activities are considered, although there would be a narrow window of vulnerability, generally less than one year for each activity area (unit) when harvest-related disturbance would be occurring or had recently been completed and post-activity BMPs had not yet been installed. Since the effects of harvest activities are expected to remain within units under the most common precipitation events (< 5 year), the effects of the four action alternatives on soil movement into the drainage network are considered to be the same. The three harvest alternatives include greater amounts of road maintenance, reconstruction and decommissioning, compared to Alternative 4, and would result in greater improvements to watershed conditions. Road maintenance and reconstruction would begin during the first year of implementation with decommissioning/obliteration beginning at year 1 or 2 after implementation of the timber sale. Road conditions which adversely affect watershed condition would be improved as recommended in the Upper Silvies WA (2001).

Most areas currently identified as DOGs or ROGs or proposed for replacment DOGs or ROGs contain pre-fire legacy disturbance typical of the Flagtail area, as described in the Existing Condition. This is also true for the areas designated Unroaded Areas 1 and 2 in the Roadless Area section. Consequently, effects of activities in these areas are expected to be similar to those already described. Since watershed characteristics typical of unroaded areas are not present and BMPs are expected to control sediment and concentrated flows within unit boundaries for the most frequent events, it is expected that watershed–related unroaded values and values related to designated/replacement old growth would neither improve nor worsen as a result of the proposed activities.

Replacing and reshaping these road drainage structures would route water and sediment off roads before reaching streams

Cumulative Effects

Cumulative effects of activities described in Appendix J are similar to those described for the No Action Alternative.

By keeping effects within activity areas or by reducing road-related disturbance, the proposed activities would not add cumulatively to legacy conditions such as channel or draw degradation. Legacy conditions would not be aggravated under any action alternative. Design and placement of site-specific BMPs during the implementation of the action alternatives would control effects of proposed activities and would prevent the aggravation of legacy conditions. Areas of active erosion and areas that are vulnerable to erosion would be buffered. For instance, with the application of BMPs such as waterbars and buffers, it is unlikely that water flow would be concentrated from new skid trails onto old skid trails into vulnerable ephemeral draws.

Road treatments in these alternatives cumulatively reduce disturbance to stream channels and draws and would likely improve channel conditions at rates possibly measurable over 10-20 years.

Potential watershed damage from a future, wild fire is at least equal to what occurred with the Flagtail Fire due to the accumulation of fuels as described in the Fuels Section. In adddition to causing more severe effects on soils, more severe wild fire would be likely to set back the recovery of planted vegetation and natural regeneration in RHCAs and on uplands.

Other fire and fireline recovery would progress based on climatic conditions and the effectiveness of the 2003 RHCA plantings and ongoing and foreseeable activities as discussed for the No Action Alternative.

The overall effect of the activities proposed under this Alternative and of on-going and foreseeable activities, as described for the No Action Alternative, would be improved watershed cumulative condition, proportional to the amount of roads decommissioned and amount of improvements in road drainage.

Overall these Alternatives combined with on-going and foreseeable activities would improve cumulative watershed condition more than the other two alternatives.

Alternative 4

Direct and Indirect Effects

Effects of Alternative 4 would be similar to Alternatives 2, 3, and 5 except that some legacy conditions such as drainage problems on old upland skid trails would not be remedied as no skidding is proposed. Drainage on proposed open and closed roads would not be improved as no road maintenance is proposed. Effects of not implementing road maintenance would be the same as those described for Alternative 1. About 1.3 mi. of road would continue to deliver sediment to Snow Creek since no reconstruction (0.3 mi.) is proposed and about 1 mile less of decommissioning, including a stream crossing, is proposed. Correspondingly, about 0.3 mi. of road in the Snow Creek subwatershed would not be constructed; however, since the construction of this road in Alternatives 2 and 3 was not expected to extend the drainage network, Alternative 4 does not differ substantially from Alternatives 2 and 3 in the effects of new road construction on watershed conditions. Decommissioning about 12 miles of road would address recommendations in the Upper Silvies WA (2001) to ameliorate road impacts on streams but to a lesser extent than Alternatives 2 and 3. Due to reduced road treatments, improvements in channel condition, particularly in Snow Creek, would not be measurable as soon as under the Alternatives 2 and 3.

Proposed fuel treatments and reforestation would move the landscape toward the Desired Condition, allowing fire to burn within its historical range and reducing the potential for adverse watershed effects. The use of low psi equipment and application of other site-specific BMPs for fuels treatments would prevent extension of the drainage network.

The application of site-specific BMPs, INFISH RHCAs, and ephemeral draw buffers is expected to keep soil within an activity area, or to reduce the amount of sediment or concentrated flows reaching streams during fuels treatment and road decommissioning as described for Alternatives 2, 3 and 5.

Effects of activities in DOGs, ROGs, proposed DOGs and ROGs and similar areas are expected to be similar to those already described because of the existing condition of these areas as described for the harvest alternatives. Since watershed characteristics typical of unroaded areas are not present and BMPs are expected to control sediment and concentrated flows within unit boundaries for the most frequent events, it is expected that unroaded values would neither improve nor worsen as a result of the proposed activities.

Summary

Overall this Alternative would improve watershed and stream channel condition beginning at year 1 or 2, but to a lesser extent than Alternatives 2, 3 and 5 since less maintenance, reconstruction and decommissioning are proposed (see discussion in Water Quality – General Water Quality – Sediment).. Road conditions which adversely affect watershed condition would be improved as recommended in the Upper Silvies WA (2001).

Cumulative Effects

Cumulative effects of activities described in Appendix J are similar to those described for the No Action Alternative.

By keeping effects within activity areas or by reducing road-related disturbance, the proposed activities would not add cumulatively to legacy conditions such as channel or draw degradation.

Alternative 4 is similar to Alternatives 2. 3 and 5 in that it cumulatively reduces disturbance to stream channels and draws and would likely improve channel conditions at rates possibly measurable over 10-20 years. It differs in the magnitude of improvement, in that legacy and road conditions would not be improved as much. The potential for upland erosion from old skid trails would remain. The delivery of sediment and concentrated flows from roads to streams would not be reduced as much because of deferring maintenance and because of reduced road reconstruction and decommissioning along Snow Creek.

Other fire and fireline recovery would progress based on climatic conditions and the effectiveness of the 2003 RHCA plantings and ongoing and foreseeable activities as discussed for the No Action Alternative.

Overall this Alternative combined with on-going and foreseeable activities would improve cumulative watershed condition to a lesser extent, proportional to the amount of activities, than Alternatives 2, 3 and 5.

Water Quantity

The water quantity discussion includes annual water yield, peak flows, and minimum flows. Normal spring runoff occurs from March through June, and peak flows occur from late February to late May. Summer thunderstorms typically occur over areas that are less than 10 square miles in size and are not as common as in other parts of the Forest (Upper Silvies WA).

Annual Water Yield: Few data are available for water quantity parameters in the Flagtail Burn Area or in the Blue Mountains of northeastern Oregon. Those that are available, from the Barometer Watershed Program on the Umatilla National Forest, suggest that trends for annual water yield may differ from those expected elsewhere (Helvey and Fowler, 1995). Information from Helvey and Fowler (1995) forms the basis for much of the following discussion.

Annual water yield in areas with high amounts of hydrologic openings may not follow general, commonly accepted trends because of climate and geology. Hydrologic openings are usually defined as forested areas where most trees are less than 30 years old.

Helvey and Fowler (1995) found that a larger change in vegetation may be required than that found by Troendle and Leaf (1980) before changes in annual yield are detected in mixed conifer stands in northeastern Oregon, at least in drainages smaller than 300 ac. The research indicates that a change of at least 60% in hydrologic openings is required before changes in yield may be observed.

While mixed conifer stands typically grow on wetter sites than are found in most of the Flagtail Burn Area, the mixed conifer stands included in the study grew over a range of soil moistures. Helvey and Fowler (1995) suggest that changes may not be detectable, particularly in the relatively dryer areas sampled, until nearly all the forest vegetation is removed. Changes may also be smaller than expected and more difficult to detect when sample plots are located on highly fractured volcanic geologies. Similar trends are believed to hold for the dryer vegetation, for the moderately fractured sedimentary rocks, and for the sizes of drainage areas found in the Flagtail Burn area. The ability to detect changes in annual water yield in eastern Oregon may also be dependent on weather and may be easier to detect in wetter years (Helvey and Fowler, 1995). These trends are consistent with observations by the project hydrologist.

Table WS-9 displays subwatershed area on the Malheur National Forest and percent of subwatershed in hydrologic openings including timber harvest outside the burn boundary, timber harvest within the burn boundary in low severity and no burn areas, and tree mortality caused by Flagtail Fire, based on data in the MNF GIS. Hydrologic openings created by the fire are defined as areas where greater than 60% of the trees were killed or are expected to die or where stands are less than 30 years old. Stands which were less than 30 years old and burned with high or moderate severity were classified as hydrologic openings created by the fire. Since low severity burns resulted in higher percentages of mortality than expected (see Silviculture section), lower rates of mortality over extensive areas were converted into hydrologic openings by considering both mortality rate and area affected. Trees classified as "likely to die" were counted as dead for the purposes of determining hydrologic openings; consequently, if these trees die, hydrologic openings would not need to be adjusted. If these trees live, hydrological openings may have been overestimated and consequently potential changes in yield, overestimated. However, since no changes in yield were expected based on Helvey and Fowler (1995), the effect of green trees surviving, that were expected to die, would result in no change in the estimate of yield.

Prior to the fire, more than 30% of Keller subwatershed had trees less than 30 years old. Jack and Hog subwatersheds had over 20% of the forested areas in this age class. It is estimated that relatively few openings had been created on private timber land within the four subwatersheds or within West Bear Valley subwatershed (contains no Forest Service land); an unknown amount of commercial thinning, which does not create hydrologic openings, has occurred.

Table WS-9: Pre- and Post-fire Area in Hydrologic Openings by Subwatershed, Forest Service lands only (rounded to nearest whole percent).

Subwatershed	Total Acres (Sq. mi.)	Hydrological Openings Created by Timber Harvest in Forested Areas Outside Flagtail Burn Area (Acres (% of Sub-watershed))	Flagtail Burn Area with Moderate or High Mortality* (Acres (% of Sub-watershed))	Flagtail Burn Area with Low Mortality** (Acres (% of Sub-watershed))/	Conversion of Areas with Low Mortality to Equivalent Area of Moderate or High Mortality*** (Acres(% of Sub-watershed))	Hydrological Openings Created by Timber Harvest in Unburned or Low Severity Burn Forested Areas Inside Flagtail Burn Area (Acres-Estimated (% of Sub-watershed))@	Total area in Hydrologic Openings, Post-fire (Acres/ Percent of Subwatershed in Hydrologic Openings

Hog Creek	10,183 (15.9)	2209 (22%)	500 (5%)	0	0	0	2709/27%
Snow Creek	6,137 (9.6)	947 (15%)	3000 (49%)	0	0	25 (0%)	3972/65%****
Keller Creek	6,431 (10.0)	2358 (37%)	200 (3%)	0	0	25 (0%)	2583/40%
Jack Creek	7,519 (11.8)	1710 (23%)	2050 (27%)	425 (6%)	213 (3%)	40 (0%)	4463/59%

*The assumption is made that most areas with moderate or high mortality were not regeneration units with only a few snags left.

**Does not include areas shown as unburned in BAER flight of July 31, 2002 which later burned.

***Assumed that with forest tree mortality of 30-60%, midpoint is 45% which is equivalent to 90% mortality on one half the acres; in response to a public comment numbers were modified to show hydrologic openings created pre-fire (25 ac) separate from fire-created openings. The column immediately to the left was also modified for this reason. 238= 425/2 + 25

@Added for FEIS and acres of harvest created hydrologic opening were excluded from low severity burn estimate as opening was created by harvest prior to fire.

****cumulative change of 1% compared to DEIS, due to additonal acres (harvest created hydrologic openings in low severity or no burn areas) and rounding

Post-fire hydrologic openings increase to over 55% for Jack and Snow subwatersheds and by about 5% or less for the other two subwatersheds, as shown in Table WS-9.

The total area in hydrologic openings post-fire on Forest Service lands in Hog Subwatershed is about 27%, including the increase of about 5% of the subwatershed area due to the fire. The total area in hydrologic openings post-fire in Keller Subwatershed is about 40%, including the increase of about 3% due to the fire.The total area in hydrologic openings post-fire in Jack Subwatershed is just under 60%, including the increase of about 27% due to the fire. The total area in hydrologic openings post-fire in Snow Subwatershed is about 65%, including the increase of about 49% attributed to the fire. These values establish the post-fire baseline for hydrologic openings with in the project area.

Although total hydrologic openings in Snow Creek subwatershed within the project area are greater than 60%, Helvey and Fowler (1995) suggest that in dryer areas, similar to the that of the Flagtail Fire area, changes in yield may not be detectable until nearly all the trees are removed. Consequently no detectable increase in yield is expected in Snow Creek or from Forest Service lands in any of the other subwatersheds within the project area.

Evaluation of hydrologic openings on private land was based on the BAER report which included GIS evaluation of fire severity on private lands. An additional 2%-5% of Jack and Keller and 8-10% of Snow Creek subwatersheds were classifed as hydrologic openings. Again, although these increases put over 60% of Jack subwatershed in hydrologic openings and increase the amount of Snow Creek in hydrologic openings further, because Flagtail area is dryer than most of the area studied by Helvey and Fowler (1995), it is expected that no change in yield would be detectable.

It is also uncertain what annual yield may be in the years immediately after the fire because, in the Flagtail geology, this may be determined more by weather than other factors (Helvey and Fowler, 1995). It is expected that recovery to pre-fire yields would occur more rapidly than is typical elsewhere in Oregon, once trees are established and growing vigorously (Helvey and Fowler, 1995), because water is the limiting factor for tree growth in the Flagtail burn.

These results are in contrast to Troendle and Leaf (1980) who noted, generally, for an area that differs in ecology from the Flagtail area, that after 20 to 30 percent of a watershed is harvested, a substantial change in yield can be detected. They are also in contrast to commonly accepted observations that severe fires appear to increase annual water yield because of the increase in peak flows and due to the loss of forest vegetation and corresponding reduction in yearlong evapotranspiration. Generally, annual yields would decline as forest cover becomes established.

The drainage network is considered to be more efficient because of downcutting and related conditions, previously described.

Changes in annual yield and peak and minimum flows to the Silvies River from the Flagtail Fire would also be difficult to detect because of the dispersion of the burn in five subwatersheds and because about one half of the Upper Silvies Watershed lies above the Jack Creek confluence with the Silvies; consequently, water yield from the Flagtail burn area (about 13 sq. mi.) is intermingled with yield from about 80 sq. mi. of unburned watershed, diminishing the effects of any increase in yield or peak flow on the Silvies River from the fire area.

Based on the above discussion, it is assumed for this analysis that measurable changes in yield to the Silvies River would not be detectable following the fire. It is also assumed that the post-fire conditions combined with effects of past harvest would not have measurable effects on annual water yield.

Peak and Minimum Flows: The Upper Silvies WA (2001) states that, pre-fire, the net effect of past management activities is likely a slight increase in peak flows and that this change is likely small compared to the natural peak flows. Severe fires are often assumed to increase peak flows. However, during BAER analysis, the post-fire increase in runoff for a 2 year event (6 hour duration, 1 inch rainfall total, typical of fall rains) occurring in 2003 was calculated. The predicted increase was 5 percent for soil burn severity conditions shown on Figure 2, Map Section. Helvey and Fowler (1995) also found that peak flows resulting from snowmelt do not increase following the creation of 60% of an area in hydrologic openings from timber harvest. Results for the creation of openings, in which more than 90% of trees have been removed, are mixed, depending on the method of analysis. They also found that peak flows from snowmelt occurred earlier when openings were created.

The slight, post-fire increase in runoff under “design storm” conditions would be expected to decrease over time as ground cover and other soil conditions recovered, reaching pre-fire range as early as 2007. Interaction of post-fire conditions with legacy disturbance is expected to result in little change to the predicted design runoff because most areas of disturbance do not connect directly to perennial or fish bearing streams or they can likely transport a 5% increase in flow without further eroding. Most wide valley bottoms still provide buffering and sediment filtering capacity although legacy conditions have created areas of vulnerability such as where downcutting has occurred (see Stream

Channels…Uplands section). Peak flows, like annual yield, from the Flagtail Burn would also be intermingled with runoff from about 80 unburned square miles.

Minimum flows are considered to be lower and of longer duration due to legacy conditions than before pre-European-American settlement.

No Action Alternative

Direct and Indirect Effects

No activities are proposed under this Alternative. Since no activities are proposed, there are no direct or indirect effects to total water yield, peak flows, or minimum flows under the No Action Alternative.

Fire and fire line recovery would continue based on climate and natural processes. Total water yield, peak flows, and minimum flows are expected to remain about the same as described for the existing condition, based on climate and geology of the area, for about 15-30 years (Helvey and Fowler, 1995). By about 15-30 years, sufficient trees are expected to fall to modify some legacy conditions, such as gullying and elevated sedimentation. Consequently, water storage capacity in ephemeral draws and stream channels would be enhanced and concentrated flows from old skid trails and unclassified roads would be slowed. Local peak and minimum flows would be expected to move toward the Desired Condition, improving late season flows. Amelioration would occur over a relatively small area of the Silvies watershed (about 13 out of 98 sq. miles) and would be widely distributed among the subwatersheds, likely making these effect non-measurable.

The accumulation of downed logs would also likely increase the potential for watershed damage, including further alteration of peak and minimum flows, in the event of a wild fire.

Other legacy conditions, such as road drainage problems and roads within 100 ft. of stream channels and draws, which contribute to increased drainage efficiency and to increased peak flows and decreased minimum flows (Upper Silvies WA, 1997) would not be remedied.

The potential change in runoff from the post-fire design storm (BAER, two year event) was estimated to be about 5%; no further increases would occur under this Alternative.

The overall trend for about 15-30 years, although not measurable, would be to maintain the existing, modified peak and minimum flows, which are the result of legacy and post-fire conditions (up to about 5 years), particularly reduction in ground cover, because no activities are proposed. After that time, peak and minimum flows would remain modified but to a lesser extent due to the recruitment of coarse wood into draws and channels which would provide water storage for late season flows.

Cumulative Effects

Cumulative effects of activities described in Appendix J are similar to those described for the No Action Alternative in the previous “Stream Channels…Uplands” section.

Since there are no direct or indirect quantifiable effects to total water yield, peak flows, or minimum flows from this Alternative, there would be no quantifiable cumulative effects under Alternative 1.

Other fire and fireline recovery would progress based on climatic conditions and on ongoing and foreseeable activities such as the placement of coarse woody material in stream channels and ephemeral draws. The placement of coarse wood would enhance water storage capacity upon placement in year 1. Routine road maintenance would not remedy road drainage problems, which extend the drainage network and contribute to increase drainage efficiency.

Overall this Alternative combined with on-going and foreseeable activities would provide some water storage for late season flows beginning at year 1 due to the placement of coarse woody material; storage capacity would increase at about years 15-30 with the subsequent recruitment of dead trees. Road impacts on peak and minimum flows would remain. Foreseeable actions include cutting of green trees for hazard tree and other silvicultural management. Relatively few trees on relatively few acres are expected to be proposed for removal in either Hog, Wickiup or other subwatersheds in Upper Silvies Watershed (see Appendix J); consequently, the effects of removing these trees is not expected to be detectable at the outlets of these subwatersheds and there would be no cumulative effect with the Flagtail project area. Cutting of additional, dead hazard trees or of dead trees for post and pole or personal used firewood sales in the Flagtail project area would also have no cumulative effect since the dead trees were included in the initial estimate of fire effects on water yield and cutting would have no additional effect on transpiration.

Alternatives 2, 3, 4 and 5

Direct and Indirect Effects

Although proposed activities differ in magnitude and type under alternatives 2, 3, 4 and 5, none of the alternatives would have measurable effects on total water yield, peak flows, or minimum flows. While the effects of the proposed activities would not be measurable, some activities are expected to improve legacy or post-fire conditions, moving the project area toward the Desired Condition for water quantity. Other proposed activities neither improve nor detrimentally impact water quantity and would not move the area measurably toward the Desired Condition. Activities with both types of effects are discussed below.

Activities included in all four action alternatives, which would move the area toward the Desired Condition of reduced drainage network and drainage efficiency, include the decommissioning of roads, especially roads within 100 ft. of streams and draws, as shown in Tables WS-11 through 13, and WS-15 through 17 by alternative. Additional activities included in Alternatives 2, 3, and 5 which would move the area toward the Desired Condition include the installation of drainage dips or other drainage structures during road maintenance, reconstruction of 0.3 mi. of road along Snow Creek, decommissioning of an additional 1.0 mi. of road along Snow Creek, and waterbarring of old skid trails following harvest activities.

Activities included in Alternatives 2, 3 and 5, which would neither improve nor detrimentally impact water quantity, include:

- the removal of dead and dying trees (because potential effects on water quantity are associated with the change from live to dead trees caused by the fire and dead trees do not transpire. Also the loss of transpiration and other functions from dying trees was assumed in the Existing Condition and, thus, has already been considered),
- the removal of incidental green trees in proposed landings, skid trails, new or temporary roads because the number of trees expected to be removed is so small that the changes in transpiration, interception, run-off, etc. would not be detectable at the outlets of the substantially larger subwatersheds,
- the site-specific application of BMPs to harvest and fuel treatments (which would retain concentrated flows within the activity units),
- the site-specific application of BMPs to the construction and decommissioning of temporary roads (BMPs are designed to control effects),
- the construction of 0.3 mi. of new road on the hillslope, with the application of BMPs, to allow 1.0 mile of road in Snow Creek to be decommissioned while continuing to provide access to the upper portion of Snow Creek Subwatershed because the road is located in the uplands without hydrological connections to the drainage network;
- construction of temporary roads because BMPs designed to control sediment, run off, and other potential effects would be implemented (see Chapter 2 of EIS) and
- haul along roads because mitigations and BMPs control damange to road surface.

The difference between Alternatives 2, 3 and 5 is that there are the same amounts of activities that move the area toward the Desired Condition but fewer of the activities that neither improve nor detrimentally impact water quantity in Alternative 3 and, to a lesser extent, in Alternative 5.

Activities included in Alternative 4, which would neither improve nor detrimentally impact water quantity, include the removal of dead and dying trees in fuel treatments and the site-specific application of BMPs to these treatments to retain concentrated flows within the activity units. Also several road-related activities would not occur so that degraded conditions which extend the drainage network and increase drainage efficiency would remain as they would under the No Action Alternative. These activities include road maintenance, reconstruction of road 2400133 along Snow Creek, and reduced decommissioning along roads 2400133 and 2400203 (including a crossing) near Snow Creek.

Road density, another indicator of drainage efficiency, would decrease as described under the Water Quality section with the largest changes in Snow and Jack subwatersheds under all action alternatives and with minimal change between action alternatives (see Tables WS-11 and WS-18). Again, the decrease in peak flows due to decreased road densities is not expected to be measurable.

Overall these Alternatives would improve peak and minimum flows beginning at year 1 or 2, in proportion to road treatments, and again at about years 15-30 as more trees fall down within RHCAs and ephemeral buffers and provide water storage capacity.

Cumulative Effects

Cumulative effects of activities described in Appendix J are similar to those described for the No Action Alternative.

Since none of the action alternatives would have a quantifiable change in total water yield, peak flows, or minimum flows, there would be no quantifiable, cumulative effects on water quantity. Since there would be no cumulative effects on water quantity, there would be no interactions with effects from other activities downstream such as fire salvage and other harvesting from private land below the Forest in the Upper Silvies Watershed, with effects from activities in the Middle Silvies Watershed, with effects from the Silvies Canyon Restoration Project or other activities in the Lower Silvies Watershed, or with conditions in the lower 20 miles of the Silvies River which are included on the Section 303(d) list.

Other fire and fireline recovery would progress based on climatic conditions and ongoing and foreseeable activities as discussed for the No Action Alternative except that routine road maintenance, similar to that proposed under Alternatives 2, 3 and 5, would maintain drainage improvements on the 24 and 2195.

Overall these Alternatives cumulatively combined with on-going and foreseeable activities would improve peak and minimum flows, in proportion to road treatments combined with the placement of coarse woody debris.

Water Quality

Introduction

Streams on the MNF meet many water quality standards (Oregon, 2004) established by the Oregon Department of Environmental Quality under the Clean Water Act (CWA) (Quigley, 1989). Land uses on the Malheur National Forest are defined by the Forest Plan and, consequently, limited opportunities for exposure to pollutants occur. Applicable water quality parameters which could potentially be affected by the proposed activities were reviewed and are addressed in one of two ways. The discussion of general water quality parameters is separated from discussion of streams included on the CWA Section 303 (d) List of Water Quality Impaired Waterbodies (303(d) List). The general water quality discussion is organized by parameter and is based on applicable State standards and/or other concerns. General water quality concerns are discussed in sections titled "General Water Quality – (specific parameter)" below. Discussion of turbidity, for which there is a separate water quality rule, is incorporated in to the discussion of sediment Sediment is described under the water quality rule for Statewide Narrative Criteria.

The sediment discussion also includes discussion of sediment transport from hillslopes into channels and draws based on application of the Disturbed WEPP model (see Soils Section). These sections are followed by a discussion of water quality in 303(d) listed streams and the parameters for which they are listed (see Clean Water Act Section 303(d) List of Water Quality Impaired Waterbodies section below)

As shown in Table WS-1 and Figures 3 and 16 (Map Section), there are numerous stream sources of perennial water. There are also numerous springs, seeps, moist and wet meadows, and other aquatic ecosystems. Figure 3 (Map Section) shows locations of 303(d) listed streams in the Upper Silvies Watershed in which the Flagtail project area is located; it also references listed segments of the Silvies River.

Beneficial Uses of Water - Beneficial uses of water within the project area are fisheries (redband rainbow trout (MIS and Sensitive) and Malheur mottled sculpin (Sensitive) and other species), terrestrial wildlife, livestock, and road watering. Downstream uses are similar but also include agricultural irrigation.

General Water Quality - Temperature

The Upper Silvies WA describes stream temperatures in the watershed and discusses reasons for stream temperature elevation in some detail. Conditions in the Flagtail project area are consistent with these descriptions. Instantaneous stream temperatures measured in or adjacent to the project area during stream and riparian surveys (1994) and continuously recording thermographs (1993-98) indicate that temperatures are elevated in fishbearing and non-fishbearing perennial streams (Upper Silvies WA). The Silvies River within the project boundary is warmer than Snow Creek, likely due to upstream conditions, entrenchment, and direct exposure to the sun. Lack of shade and reduction in interflow contribute to elevation of temperatures in tributary streams. Prior to the fire, Region 6 Stream and related surveys indicated that shade on most streams did not meet Forest Plan standards due to the lack of streamside vegetation (see Botany and Fisheries sections) and due to stream channel condition as described in the Fisheries Section. Most conifers within RHCAs were killed by the fire, as described previously. Riparian hardwood shrubs were scarce prior to the fire due to past management activities. Generally the above ground portion of shrubs was killed if fire occurred in riparian areas with the roots and root collar surviving to sprout. The primary exception is along Snow Creek where the streamside burned with high severity, killing shrub roots and eliminating the potential for hardwood sprouting. Roads within 100 ft. of perennial streams (Table WS-7) probably contribute to reduced available shade and reduced interflow.

General Water Quality - Sediment and Turbidity

Post-fire hillslope erosion and sediment delivery to streams were modeled by the BAER team using the Disturbed Watershed Erosion Prediction (WEPP) model. WEPP predicts sediment transport to the drainage immediately downslope but not through the drainage network; it also does not incorporate the presence of wide valley bottom filter strips.The design storm modeled was a two year runoff event (one inch of rain over six hours), most likely occurring during a summer thunderstorm, and occurring on the average "worst case" post-fire (2003) soil conditions (based on 10 post-fire sample sites). The average post-fire erosion potential under this scenario (which is about the same as for the five year storm) was predicted to be 1 ton/ac. with the average sediment delivery to streams predicted to be 0.88 tons per acre (564 cu. yd. per square mile), indicating that about 88% of the soil detached would reach a stream as sediment under the design storm. This yield would be expected to be measurably different from the sediment yield from an unburned, undisturbed condition, since the yield from a five year event is estimated to be less than .01 cu. yd./ac., based on examination of WEPP parameters. The BAER estimate is based on "the worst case" information which is applied across the entire fire area; a similar comparison between selected areas in the Snow Creek drainage, not necessarily the worst areas, displayed an elevenfold increase between pre- and post-fire conditions. Sediment yield would be expected to return to pre-fire levels as ground cover becomes re-established and hydrophobicity breaks down as described in the Soils Section.

The Upper Silvies WA summarizes other information sources that indicate that water quality may be less than desirable. These include macroinvertebrate studies and observations about turbidity and sediment. Turbidity is included in discussions about sediment; macroinvertebrate conditions are discussed in the Fisheries Section. The Upper Silvies WA indicates that background sediment levels of the perennial and fish bearing streams are naturally high due to the fine, valley bottom, colluvial soils (sands and silts) and the low stream gradients and discharges. Due to these conditions, these stream channels are sensitive to local disturbance and increased sediment inputs (see Fisheries Section). The Upper Silvies WA indicates that legacy activities, implemented without the application of BMPs, combined with natural conditions have likely contributed to less than desirable water quality. Past management activities including grazing, roading, timber yarding, and railroading have resulted in widening, deepening, and upslope extension of ephemeral draws and stream channels and the production of sediment. This summary from the WA is consistent with information provided by the Disturbed WEPP modeling since these natural conditions would contribute to effects predicted by WEPP and because 5 year, or greater, events have probably occurred since historic activities were implemented and legacy conditions developed.

Classified and unclassified roads are inadequately drained and flow directly into ephemeral, intermittent and perennial streams. The roads and other legacy disturbance extend the drainage network and connect to the stream system.

Observations made by district employees during field reviews in the mid-1990s and following the fire identified erosion from roads as a source of sediment to streams. Roads within 100 feet of stream channels have the greatest potential to contribute sediment (Burrows and King, 1989). This potential has been substantiated by local monitoring information from some of these subwatersheds which shows that in an unburned forest, at the 96th percentile, sediment is trapped within 65 feet from road disturbance by ground cover or locally flat topography (McNeil, 1997). Sediment trapping along roads in flat areas, which burned with low soil severity, is likely to approach pre-fire levels after spring 2003. Recovery in other areas would be deferred as described in the Soils Section.

For this analysis, roads within 100 ft. of the stream system, as shown in Table WS-7, were considered the most likely to contribute sediment . Road densities, especially greater than 3 mi./sq mi. are also considered an indicator of declining watershed health and of increased risk of stream sedimentation. Table WS-10 displays road densities and road status by miles (open/closed) for the subwatersheds in the Flagtail Burn Area.

Table WS-10: Current Road Status for Subwatersheds in Flagtail Project Area (Includes Private and Public Ownership) by Subwatershed.

Subwatershed	Open Roads (Miles)	Closed Road (Miles)	Open + Closed Road (Miles)	Road Density (Mi/ Mi^{2})
Hog	35.93	19.11	55.04	5.79
Jack	45.78	3.56	49.34	3.10
Keller	23.08	21.32	44.4	3.79
Snow	32.85	2.23	35.08	3.47
Total	137.58	46.22	183.8	

Between the DEIS and FEIS the project soil scientist modeled potential erosion in 2004 using the Disturbed WEPP model (see Soils Section). WEPP results are not statistically valid due to the low number of areas sampled but may be used to indicate general conditions. WEPP indicated that erosion was proportional to precipitation events and slope with no erosion occurring with one to two year events and trace amounts occurring on steeper slopes with three to four year events. These calculations represent a substantial reduction in erosion potential compared to that described in the BAER report. WEPP was used to estimate relative amounts of erosion associated with the Existing Condition and incorporated the presence of legacy conditions. WEPP was used to evaluate erosion conditions in two areas.

Ten flowpaths randomly located in the Snow Creek subdrainage were used to characterize erosion conditons across the landscape under a variety of slope and burn conditions. The Snow Creek subdrainage was chosen because it was the only substantial drainage in which the majority of the area burned. The distribution of slopes and burn severity appeared to be typical of the Flagtail area. The drainage is not typical of the Flagtail area in that valley bottoms are generally narrower and more confined and provide less filtering capacity than those throughout the rest of the project area. This application of WEPP modeled sediment delivery to either streams or ephemeral draws.

WEPP analysis for Snow Creek subdrainage indicated that the average yield was 0.12 cu. yd./ac. or about 152 cu. yds. total for the subdrainage post-fire (2004); average yield also approximates the sediment yield for a five year event. This is at least a eleven fold increase over the expected sediment yield (less than 12.7 cu. yds.) under a similar runoff event on unburned conditions. Based on examination of WEPP parameters, the sediment yield from an unburned, undisturbed condition was estimated to be less than .01 cu. yd./ac. for a five year event.

Disturbed WEPP was also run on two local areas representing the two steepest classes of ground on which tractor yarding could potentially be proposed, to characterize conditions on slopes that average between about 22% and 28% or 28% and 35%. Also these areas were selected because large portions of them burned with moderate or high intensity. Modeling indicated that areas burned with low intensity produced little erosion. Due to the way WEPP was implemented for this evaluation, erosion yields are estimated at hillslope locations above stream channels and draws, corresponding to upper boundaries of RHCAs and ephemeral draw buffers. However, WEPP also indicated that about 20% of measurable sediment is trapped, on average, by filter strips such as RHCAs and ephemeral draws.

Estimates from WEPP for erosion occurring on the two areas representing the steepest ground that could be tractor yarded and that burned with moderate to high severity under were 0.24 cu. yd./ac. for slopes averaging from about 22% and 28% and 0.31 cu. yd./ac.on slopes averaging from about 28% to 35%, five year runoff events. These values were consistent with values generated by WEPP for similar ground in Snow Creek The amount of sediment reaching streams or draws would be about 20% less.

On slopes of about 22-28% about 0.24 cu. yd./ac of eroded soil would reach these points. Proportionally greater amounts would be moved on steeper slopes and lesser amounts on less steep slopes. The model also indicated that only about 20% of the erosion would be trapped within 50 ft. of ephemeral draws or on the narrower valley bottoms which indicates that there is a reasonable probability that sediment would reach streams.

Results of the WEPP modeling in the two cases described above indicate that none to trace or very small amounts (probably averaging less than 0.01 cu. yd./ac.) of erosion would occur on areas that burned with moderate to high severity with the most probable weather events (< 5 year frequency); most probable events are those expected to occur about 80% of the time and are designated "less than five year events." No erosion was indicated for either one or two year runoff events. Trace amounts of erosion developed on the steepest slopes with three year events and trace amounts of erosion developed over more of the area and slightly increased on the steepest ground with four year events. Erosion on areas that either burned with low severity or are flatter would be less.

When five year or greater events were considered (probability of occurrence is 20%), WEPP modeling indicated that upland erosion and sedimenation of streams that would be measurable on the average across the landscape would occur, although erosion would not be measurable in some local, less severely burned areas. Erosion associated with the five year event also approximates the average amount of erosion that would occur under all events ranging from 1 to 100 years.

It was estimated that about one third to one-half of sediment entering draw bottoms or stream channels, during a five year or greater event, would be trapped by the placement of coarse wood under the Flagtail Placement of Coarse Woody Material CE and natural recruitment. The remainder is expected to be transported into and though the stream system. The flat gradient streams in the lower parts of the Flagtail project area are efficient transporters of fine sediments. Sediment entering these streams would be expected to be transported downstream or deposited on floodplains.

The amount of sediment predicted to enter streams with a five year event in 2004, even if coarse wood were not present, is about 25-35% of the amount predicted for 2003 by the BAER team for a two year event. This change **is probably not measurably** different from the BAER estimate **due to the variability associated with sediment research** (Bunte and MacDonald, 1999)**,** the small quantities predicted, and the background levels of sediment. A similar pattern would be expected for turbidity although theoretically a change of this magnitude would be detectable, given the occurrence of appropriate storm events. No threats to human life or property or degradation of natural resources related to sediment were identified by the BAER team for sediment loads three to four times as large with less associated flow. Additional sediment inputs of this size may result in the deposition of point or other bars locally in streams identified in the Exisiting Conditions for Stream Channels….Uplands section; however, the amount of sediment is still expected to be within the capability of streams to move because of channel conditions (see Fisheries section).

Large precipitation events are likely to produce larger amounts of sediment; which may become a concern with the Forest and downstream. However, due to the high variability and cost associated with sediment research and the lack of flow and other data for the Flagtail area, it is not possible to determine the impacts of such events except to note that the drainage outlets for the approximately 13 square miles of the Flagtail burn are distributed across about 80 square miles of the upper Silvies sub-basin. Changes in sediment production due to the Flagtail fire would occur on about 16% of the land base and would probably not be measurable given the variability associated with the best sediment research. Sediment with the potential to reach the drainage network would gradually decline to pre-fire levels by about 2007 as ground cover recovered according to the soil science report.The placement and gradual natural recruitment of wood that would occur in the first 10-15 years after the fire would further reduce the amount of sediment moving through the system.

The results of the WEPP modeling appear to be consistent with the administrative studies of erosion associated with road culverts (McNeil,1999) in an unburned landscape and of sediment yields in harvest units of Summit Fire (McNeil, 2001) and with professional experience and knowledge of the Blue Mountain Ranger District.

The influence of sediment on stream channel morphology, function or related parameters is further discussed in the Fisheries Section.

General Water Quality – Chemical Pollutants:

The discussion of chemical pollutants, such as petroleum products, is found in the Fisheries Section.

Clean Water Act Section 303(d) List of Water Quality Impaired Waterbodies

Snow Creek (Figures 3 and 16, Map Section) is the only stream within the Flagtail project area included on the Oregon Department of Environmental Quality's 2002 Clean Water Act Section 303(d) List of Water Quality Limited Waterbodies (303(d) list). It is listed for summer rearing temperature for salmonids (trout). Scotty Creek, located south of the project area, is the only other stream in the Upper Silvies Watershed on the 303(d) list (see Figure 3, Map Section). It is also listed for summer rearing temperature. Neither on-going watershed processes nor activities in the project area have the potential to affect Scotty Creek as its catchement is not connected to the project area. The lower 20 miles of the Silvies River, which are located about 68 river miles below the project area, are also included on the 2002 list for summer rearing temperature for salmonids, dissolved oxygen, and temperature March 1 – June 30 (spawning).

Summer rearing temperatures do not meet State standards when the maximum 7-day temperature average exceeds 64 degrees F. ODEQ has established standards for dissoloved oxygen and temperature March 1 – June 30 (spawning) which are available on the ODEQ web site (Oregon, 2004).

No Action Alternative

Direct and Indirect Effects

General Water Quality -Temperature:

Higher peak and near peak flows resulting from increased drainage efficiency due to legacy conditions would continue. These conditions maintain risk that stream channels may degrade further by widening the stream and increasing solar radiation to and subsequent heating of streams throughout the year. Streamside shade and stream temperatures would not recover fully from the effects of the fire for over 50 years when both naturally regenerated, mature conifers and riparian hardwoods would provide effective stream shade.

***General Water Quality - Sediment*:**

Since no activities are proposed, no new, potential sources of sediment or turbidity would be developed and state water quality standards would be met. The no action alternative also does not decrease sediment and leaves the existing sediment in the stream system Sediment delivery to streams and draws from roads and legacy sources would continue because this alternative would not improve cross drainage of roads and skid trails and because road maintenance, reconstruction and decommissioning would not occur, as shown in Tables WS-7, 8, and 10. Adequate filter strips would not be present along about one mile along Snow Creek and several unnamed intermittent stream segments that burned with moderate and high soil severity until ground cover became reestablished. Under high runoff events ($\geq$ 5year frequency), sediment transport would be similar to that described for Existing Condition. WEPP modeling for this alternative in 2004 indicated that an index value of 79 cu. yd. would be produced from that part of the Snow Creek subdrainage in which units are proposed under Alternative 2. Unit area was chosen in order to make comparisons between the No Action and the Action Alternatives. This yield represents an estimated eleven fold increase over the sediment transported to the drainage network under pre-fire conditions.

Legacy conditions would also increase the likelihood that sediment would be produced due to drainage network extension. By about 15-30 years, sufficient trees are expected to have fallen to reduce or capture soil eroding from some legacy conditions, such as gullying, old skid trails, and unclassified roads. Coarse wood in draws and channels would also capture sediment. Consequently, sediment storage on hillslopes and ephemeral draws and stream channels would be enhanced

The likely fuels accumulation and potential for future wild fire after 15-30 years would increase the potential for additional sediment to reach stream channels, due to a greater reduction in ground cover, than was experienced with the Flagtail fire. Potential is greater where valley bottom meadows do not provide buffering capacity.

***General Water Quality – Chemical Pollutants*:**

Effects of chemical pollutants are discussed in the Fisheries Section.

Clean Water Act Section 303(d) List of Water Quality Limited Waterbodies

No changes to the Section 303(d) List of Water Quality Limited Waterbodies would be made under this alternative. Effects on 303(d) listed streams (e.g. Snow Creek) would be similar to those described above in the General Water Quality - Temperature section above. No effects on Scotty Creek are expected because none of the proposed activities would occur in the Scotty Creek drainage.

Recognizing that a WQRP will be required for the Silvies Sub-basin in 2007, the Flagtail IDT has identified the elements of a WQRP incorporated into the Flagtail Fire Recovery Project in Appendix L.

Summary

No activities are proposed under this Alternative. There are no Direct and Indirect Effects. Fire and fire line recovery would continue based on climate and natural processes.

The No Action Alternative does not reduce or increase sediment delivery or improve temperature. Since no activities would occur under this Alternative, the overall effect would be to maintain degraded watershed and stream channel conditions for up to 15-30 years (sediment), until burned trees fall in sufficient numbers to provide sediment trapping in ephemeral draws and streams or for up to 40 years until conifers and riparian hardwoods grow large enough to provide stream shade.

Cumulative Effects

General Water Quality

Activities described in Appendix J were reviewed for cumulative effects on water quality.

Since there are no direct or indirect effects from this alternative, there would be no cumulative effects. Since there would be no cumulative effects on water quality, there would be no interactions with effects from other activities downstream such as fire salvage and other harvesting from private land below the Forest in the Upper Silvies Watershed or from silvicultural activities on National Forest land in the Upper Silvies Watershed except as described below; with effects from activities in the Middle Silvies Watershed; with effects from the Silvies Canyon Restoration Project; other activities in the Lower Silvies Watershed; or or on the lower 20 miles of the Silvies River.

Other fire and fireline recovery would progress based on climatic conditions and on ongoing and foreseeable activities such as the felling of hazard trees and other silviculturral management in the project area or in nearby subwatersheds (see Appendix J), planting of conifers and riparian hardwoods in RHCAs, and placement of coarse woody material in stream channels and ephemeral draws. The effects of re-initiation of grazing would be similar to those before the fire as the same standards and guidelines, which allow for gradual recovery of riparian vegetation in degraded areas, would apply; grazing would not be expected to have measurable effects on stream temperature for two, somewhat opposing reasons. First utilization of shade-providing vegetation is limited under current standards. Second, although riparian vegetation recovery is expected under the current standards and guidelines, it may be slow due to legacy conditions and correlated changes in temperature would be difficult to measure against the natural variation of stream temperatures.

Felling the remaining hazard trees in the Flagtail project area would remove up to 3% of site-potential shade that is provided by tree stems; removing this amount of shade would not have measurable effects on stream temperature. Felling hazard trees in RHCAs along about five miles of the 31 road in Hog subwatershed would have similar effects on Hog Creek above the project area. Similarly, felling hazard trees in RHCAs in other locations in the Upper Silvies Watershed would have similar effects. Since the felling of hazard trees is scattered across the watershed, there would be no cumulative effect. Planted riparian hardwoods would likely maintain cooler water temperature when shrubs reach maturity in approximately 7-10 years; but, due to the wide spacing of planting, this effect may not be measurable. Additional shade from planted conifers would develop in about 30-40 years; again, due to the distribution of these planting, reductions in temperature may not be measurable due to the maturing of conifers alone. However, it is expected that the shade provided by a combination of riparian hardwoods and conifers would maintain cooler temperatures that would be measurable. The placement of coarse wood would enhance water storage capacity upon placement in year 1 which would also contribute to cooler water temperatures. Grazing to Forest Plan standards would not be expected to decrease shade or to contribute to sedimentation.

Placement of coarse wood in draws and channels would enhance sediment trapping from roads and legacy conditions, beginning in year 1 and would be likely to capture one third to one half of sediment exported under a five year runoff event. Natural recruitment would increase storage capacity over time. Sediment yields are expected to approach pre-fire amounts in about 2007 when nearly full recovery of ground cover is expected (see Soils Section). The remainder of sediment exported from hillslopes would be transported downstream with effects as described in the fisheries section. Routine road maintenance would not remedy road sediment problems, which would continue to contribute to elevated sediment levels.

Consequently there would be no detectable cumulative effects on water quality that would interact with effects from other activities downstream in the Middle Silvies Watershed, with effects from the Silvies Canyon Restoration Project or other activities in the Lower Silvies Watershed, or with conditions in the lower 20 miles of the Silvies River which are included on the Section 303(d) list.

One exception would be the Silvies River reach immediately below the Forest Boundary, in the lower part of Snow Subwatershed, where water temperatures may be detectably cooler in the long term (after 20 years) and where sediment reduction on the Forest may result in improved channel conditions.

The overall effect of this Alternative and of on-going and foreseeable activities would be a slightly improved watershed cumulative condition but road and other legacy conditions and on-going activities, including Off Road Vehicle use, which produce sediment would continue.

Clean Water Act Section 303(d) List of Water Quality Limited Waterbodies

Since there are no direct or indirect effects from this alternative, there would be no cumulative effects on Snow Creek or on the lower 20 miles of the Silvies River. There would be no cumulative effects on Scotty Creek because it does not drain the project area and because there are no direct or indirect effects from this alternative. As described for

General Water Quality, Appendix J was reviewed. Similarly, planting conifers and riparian hardwoods and placing coarse woody material in Snow Creek would maintain or reduce stream temperatures. Felling hazard trees in RHCAs would not have a measurable effect on stream temperatures due to the small amount of shade removed..The cumulative effects of re-initiation of grazing would be similar for those described in the General Water Quality section.

Alternatives 2, 3, and 5

Direct and Indirect Effects

General Water Quality - Temperature:

Road decommissioning within 100 ft. of perennial and fish bearing streams (see Table WS-11) would improve shade to variable degrees, depending on site-specific distances between decommissioned roads and streams, after about 40-50 years. Following decommissioning, about 80% of the road area treated would support forest vegetation with potential to shade the streams. Establishing additional shade on about 3.0 mi. of roads near streams moves the area towards meeting Forest Plan standards for stream shade and reduced heating of streams. The remaining 20% of roads within 100 ft. of perennial streams would likely revegetate with meadow species including sedges; generally these stream segments are located too far away from stream water for meadow vegetation to provide effective shade. Although culvert removal on perennial and fishbearing streams would expose stream water to solar radiation, no measurable effect on stream temperature is expected due to the short distance that would be exposed and the rate of stream flow. Expansion of riparian plant communities adjacent to culvert locations is expected to provide shade within three to five years.

Subsurface flow, currently interrupted by roads within 100 ft. of perennial streams, would be reestablished over 20 to 30 years. Subsurface flow generally contributes colder water to stream channels; effects may not be measurable except where long segments of road which parallel streams and riparian meadows are treated. Improved cross drainage would reduce the risk of channel erosion and widening and exposure to solar radiation. Exposure of stream water to solar radiation during culvert removal would not be expected to effect stream temperatures measurably.

Although increasing shade and subsurface flows together would move stream temperatures toward the Desired Condition, changes in stream temperature may not be detectable against the natural variability of stream temperatures for at least 20-30 years. The road decommissioning activities proposed under the FEIS and watershed improvements in the CEs are typical of activities that may be included in Water Quality Restoration Plans to improve water quality.

General Water Quality - Sediment: The application of site-specific BMPs (see Chapter 2 and Appendix BMP), INFISH RHCAs, and ephemeral draw buffers is expected to prevent sediment and concentrations of water from developing and leaving activity units, including those where subsoiling is proposed, under the more common precipitation events (less than five year events). Mitigations to drain roads and reduce sediment identified in the Flagtail Roads Analysis were incorporated into Chapter 2 Mitigations of the FEIS.

About 10%-60% (on average, about 30%) of existing skid trails are expected to be reused, depending on their locations within particular units. The application of site-specific BMPs, including installation of cross drainage, to these skid trails would improve legacy conditions and keep disturbed soil and concentrated surface flows within activity units. Similarly, the application of BMPs, including cross drainage, to new skid trails would also keep disturbed soil and concentrated surface flows within activity units. BMPs include building water bars or similar drainage structures or placing downed wood to create cross drainage. Additional drainage mitigations would be applied to tractor yarded units (over 300 acres) below the Bald Hills. In addition, units with inclusions of shallower or rocky soils would have seasonal operating restrictions or protective buffers applied. Seeding of skid trails, as described in Mitigations, Chapter 2, would also contribute to decreased drainage efficiency and sediment trapping.

Installation of cross drainage in the form of rolling dips or water bars would be included as part of maintenance of open and closed roads. These drainage structures would be placed at frequent intervals to drain water away from the road (see Mitigations, Chapter 2 for approximate spacing). Water and sediment would be redistributed from road surfaces to adjacent uplands and valley bottoms where water would be absorbed into the ground and sediment trapped by re-established ground vegetation and litter or microtopography. These treatments would reduce hydrological connections between roads or skid trails and streams. They would also reduce the risk that additional connections would develop. Decreasing drainage spacing, outsloping of road surfaces, and retarding flows and sediment at drainage outlets are the most common techniques for reducing or eliminating hydrologic connectivity (Furniss et al. 2001). These treatments which "disconnect" roads and skid trails from streams are usually simple, inexpensive, and effective in reducing effects and risks to water quality and aquatic habitats.

Roads and skid trails acting as conduits for water and sediment to streams would be decreased. Proposed treatments and mitigations would rehabilitate some legacy activities, reduce drainage efficiency and sediment transport, and help move peak and near peak flows toward the Desired Condition. Macroinvertebrates in the stream system would improve with decreased erosion and sedimentation as described in the Fisheries Section.

The possible transport of sediment into other streams with five year or greater events was evaluated. Additional mitigation was not recommended on units where the destination stream flowed through flat, wide valley bottoms because the wider valley bottoms would be more likely to trap sediment as would flatter gradient streams typical of flatter valleys. Additional mitigation (scattering slash on skid trails) in units where resources were more vulnerable reduced sediment export from tractor harvest units by 0.1 cu.yd./ac. The combination of scattering slash on skid trails and in the units reduced sediment production by about one third.

Under five year or greater runoff events WEPP indicated that Alternatives 2, 3 and 5 would produce 33%, 15%, and 28% more sediment, respectively, than under the No Action Alternative. However, because variation for sediment sampling is plus or minus

100% under the best conditions (Bunte and MacDonald, 1999) and the variation for sediment modeling is greater, these three harvest alternatives do not appear to differ from the No Action Alternative.

One of the results of Disturbed WEPP modeling is that either increased disturbance or increased run off, or both, indicate greater soil movement and potential sedimentation. The model provides an estimate of the magnitude of these effects. Due to the variability inherent to erosion processes, the magnitude of the change must be large in order to characterize effects objectively (Bunte and MacDonald, 1998). When effects are small (less than 100% change in either direction), they are not measurable. However, the fact that an effect cannot be measured because of natural variability does not mean that no effect exists. The model, professional experience and judgment, and common sense all indicate that more disturbance would generally cause more soil movement and potential sedimentation, given the same run off event. This conclusion is the basis for the selection of additional BMPs, such as slash placement, in selected units.

Reconstruction of 0.3 mi. of the 2400133 road along Snow Creek would reduce sediment entering the stream by about year 2. BMPs applied during reconstruction would limit sediment entering the stream during and in the first two years following reconstruction to about one cubic yard.

Roads within 100 feet of streams would be reduced by nearly 6 miles (see Table WS-11). BMPs described in Chapter 2 would be applied to road decommissioning and would activity-related sediment to about one-half cubic yard during decommissioning and in the first year immediately following treatment limit (see Tables WS-12 and WS-13). Sediment input would not be persistent or chronic and would disburse with the next high flow. Decommissioning the 2400133, 2400203, 2400092 and 2400196 roads in Snow and Jack subwatersheds, respectively, and roads along Tributary 8 to the Silvies River and other draws that drain the Bald Hills are expected to reduce sediment delivery the most. Effects of decommissioning up to two miles of unclassified extensions of roads, primarily in the Bald Hills area, would be similar to those described for classified roads. Since segments of Snow Creek burned with high and moderate soil severity, a sediment fence would be placed along parts of Road 2400133 to supplement the post-fire filtering capacity of the RHCA until either ground cover recovers sufficiently or until the road is decommissioned. The fence would be placed where there is less than a 100 ft. band of suitable ground cover between the creek and the road.

Table WS-11: Alternatives 2, 3 and 5 - Proposed Road Decommissioning in Flagtail Burn – Total and Within 100 ft. of Stream Channels and Ephemeral Draws -- by Stream Type and Subwatershed (Miles*)

Sub-watershed	Total Road Miles Proposed for Decomm-issioning	Total Subwatershed Roads within 100 Ft. of Channels and Draws (Miles)	Road Miles Within 100 ft. of Streams or Draws	Proposed Decommiss-ioning — Roads Within 100 Ft. of Fish-bearing Channel (Miles)	Proposed Decommiss-ioning– Roads Within 100 Ft. of Perennial Channels (Miles)	Proposed Decommiss-ioning– Roads Within 100 Ft. of Intermittent Channels (Miles)	Proposed-Decommiss-ioning– Ephemeral Draws and Uplands (Miles)

Hog	0.1	8.3	.1	0	0	0	0.2
Jack	7.1	3.6	5.9	.8	.0	.7	5.6
Keller	0	6.7	.1	0	0	0	0
Snow	5.9	4.6	2.9	2.0	.1	.7	3.0
Total	13.1	23.2	9.0	2.8	0.1	1.4	8.8

***Based on ocular estimate.**

Table WS-12: Alternatives 2, 3 and 5 - Fish-bearing and Perennial Stream Crossings (number)

Sub-watershed	Fish-bearing			Perennial		
	Existing Condition	Proposed Decommissioning	Post-Activity	Existing Condition	Proposed Decommissioning	Post-Activity
Hog	0	N/A	N/A	0	N/A	N/A
Jack	1	1	0	3	1	2
Keller	0	N/A	N/A	1	0	1
Snow	7	2	5	6	4	2
Total	9	3	5	10	5	5

Table WS-13: Alternatives 2, 3 and 5 - Intermittent Stream and Ephemeral Draw Crossings (number)

Sub-watershed	Intermittent			Ephemeral		
	Existing Condition	Proposed Decommissioning	Post-Activity	Existing Condition	Proposed Decommissioning	Post-Activity
Hog	0	N/A	N/A	6	0	6
Jack	15	6	9	13	3	10
Keller	0	N/A	N/A	4	0	4
Snow	9	4	5	23	6	17
Total	24	10	14	46	9	37

Site-specific BMPs would be used to retain sediment within harvest units and to limit the amount entering streams during culvert and road work. Sediment which would result from culvert work would disperse with the next high flows so there would be no cumulative effect of sedimentation. Reductions in potential sediment producing interactions with legacy effects such as gullied or otherwise impacted draws would occur.

Road density is shown in Table WS-14. Road density would be decreased under alternatives 2, 3 and 5, moving the project area toward the Desired Condition. Reduced road density is in an indicator of decreased drainage efficiency and decreased sediment transport . The largest changes are in Snow Creek and Jack Creek subwatersheds. Road densities in these subwatersheds would remain elevated but would decrease below 3 mi./sq. mi., which is one threshold used to indicate watershed health.

Table WS-14: Alternatives 2, 3 and 5 - Open and Closed Road Miles and Road Density by Subwatershed. (Includes Private and Public Ownership)

Subwatershed	Open Roads (Miles)	Closed Roads (Miles)	Open + Closed Roads (Miles)	Decommissioned Roads (Miles)	Road Density (Mi/ $Mi^{2)}$
Hog	35.93	18.96	54.89	0.2	5.78

Jack	38.13	4.13	42.26	7.1	2.66
Keller	23.08	21.32	44.4	0.0	3.79
Snow	22.26	7.23	29.49	5.8	2.92
Total	119.4	51.64	171.04	13.1	

General Water Quality – Chemical Pollutants

Effects of chemical pollutants are discussed in the Fisheries Section.

Clean Water Act Section 303(d) List of Water Quality Limited Waterbodies

No changes to the Section 303(d) List of Water Quality Limited Waterbodies would be made under any alternative. Effects on 303(d) listed streams (e.g. Snow Creek) would be similar to those described above in the General Water Quality - Temperature section above. In addition, although culvert removal on the 2400203 road would expose stream water to solar radiation, no measurable effect on stream temperature is expected due to the short distance that would be exposed and the rate of stream flow. Similarly no measurable effect on stream temperature is expected due to the removal of incidental amounts of shade provided by dead tree boles during obliteration of about 0.8 mi. of the 2400133.

Recognizing that a WQRP will be required for the Silvies Sub-basin in 2007, the Flagtail IDT has identified the elements of a WQRP incorporated into the Flagtail Fire Recovery Project under the NEPA process in Appendix L.

Summary

Alternatives 2, 3, and 5 contain varying amounts of commercial harvest, particularly of tractor yarding; however, the effects on sediment delivery to streams would not be measurably different due to the implementation of BMPs and the high variability associated with assessing sediment transport. For these same reasons, these alternatives are not measurably different from Alternatives 1 and 4. These alternatives contain the same amount of riparian road decommissioning, which is greater than that proposed under Alternative 4 and the No Action Alternative. Consequently total direct and indirect effects on temperature are expected to be greater than those that would occur under the other alternatives. They differ in the amount of road maintenance which would occur with Alternative 3 receiving the least and Alternative 2, the most. No maintenance would occur under the other alternatives.

These three action alternatives improve water quality by improving stream temperature over 20-40 years and by reducing sediment delivery beginning within two years of road maintenance, reconstruction and decommissioning. Under most run off events, beneficial effects on water quality would be largest under these alternatives because more road related problems would be alleviated and BMPs would be applied to limit disturbance from harvest activities. Under five year or greater run off events, the contribution from uplands would be greater than under the other alternatives, especially during the period of recovery of ground cover on skid trails.

Cumulative Effects

General Water Quality

Cumulative effects of activities described in Appendix J are similar to those described for the No Action Alternative.

The overall effect of the activities proposed under these alternatives and of on-going and foreseeable activities would be improved water quality due to the reduction of sediment and the gradual recovery of shade and subsurface flow over 7-40 years. These beneficial cumulative effects would be passed downstream but likely would be diluted and not measurable due to their dispersion over time and over approximately 15 river miles of the Silvies River (the confluence of Jack Creek is located about 15 miles downstream of the Snow Creek confluence).

It is recognized that erosion monitoring is considered to be more variable than erosion studies (USDA Forest Service, 1999, "A Framework…"), the best of which have a variability of plus or minus 100%. The limited administrataive studies conducted on the Malheur indicate that for high probability, low runoff events, WEPP appears to be consistent with local events. No data are available to check the consistency of the model with low probability, high runoff events.

The overall effect of these alternatives combined with on-going and foreseeable activities would be to improve water quality more than under Alternative 4 because of the additional riparian road decommissioning along Snow Creek and more than under Alternative 1. Treatments would likely become effective beginning (unmeasurably) at years 7-10 and may become measurable by years 20-30.

Clean Water Act Section 303(d) List of Water Quality Limited Waterbodies

As described for General Water Quality, Appendix J was reviewed; effects of these activities are similar to those described for the No Action Alternative. Cumulative effects on Snow Creek are greatest under these three alternatives due to the combined rehabilitation of riparian vegetation, coarse woody material, and riparian roads. Planting conifers and riparian hardwoods and placing coarse woody material in Snow Creek would maintain or reduce stream temperatures over various periods of time. Felling hazard trees in RHCAs would not have a measurable effect on stream temperature due to the small amount of shade removed. Decommissioning roads and crossings in Snow Creek would add to the effects of other activities. There would be no cumulative effects on the lower 20 miles of the Silvies River because this segment is located too far away. There would be no cumulative effects on Scotty Creek because it does not drain the project area and because there are no direct or indirect effects from this alternative.

Alternative 4

Direct and Indirect Effects

General Water Quality – Temperature

Effects would be similar to those described for the other action alternatives except that treatements in Snow Creek drainage would be reduced with a corresponding reduction in effects as discussed in the Clean Water Act Section 303(d) List of Water Quality Limited Waterbodies below.

General Water Quality – Sediment

The effects of Alternative 4 are the same as Alternative 2, 3 and 5 for fuels or harvest activities since soil and concentrated water would be retained within activity units because of the use of low psi equipment and the application of other BMPs. Sediment reduction due to road decommissioning would be similar to that of the other three action alternatives except that sediment inputs to Snow Creek would not be reduced along about 0.8 miles of stream and at one crossing (see Tables WS-15, WS-16, and WS-17). This change is so small at the subwatershed scale that there is no change in road densities (see Table WS-18) compared with the other action alternatives. No improvements would occur to old skid trails that are poorly drained. Routine maintenance of roads is not likely to provide the same sediment control that maintenance associated with the other three action alternatives would due to funding limitations. Rilling and rutting would continue to concentrate sediment and flows as described for the Existing Condition and the No Action Alternative. Overall sediment delivery would be reduced under this alternative, but not to the same extent as under Alternatives 2, 3 and 5 since fewer roads would be treated.

Table WS-15: Alternative 4 - Proposed Road Decommissioning in Flagtail Burn – Total and Within 100 ft. of Stream Channels and Ephemeral Draws -- by Stream Type and Subwatershed (Miles)

Sub-watershed	Total Road Miles Proposed for Decomm-issioning	Total Subwatershed Roads within 100 Ft. of Channels and Draws (Miles)	Proposed Decommiss-ioning — Roads Within 100 Ft. of Fish-bearing Channel (Miles)	Proposed Decommiss-ioning– Roads Within 100 Ft. of Perennial Channels (Miles)	Proposed Decommiss-ioning– Roads Within 100 Ft. of Intermittent Channels (Miles)	Proposed-Decommiss-ioning– Ephemeral Draws and Uplands (Miles)
Hog	0.1	8.3	0	0	0	0
Jack	7.1	3.6	.8	.0	.7	2.1
Keller	0	6.7	0	0	0	0
Snow	4.7	4.6	1.2	.1	.7	1.8
Total	11.9	23.2	2.0	0.1	1.4	3.9

Table WS-16: Alternative 4 - Fish-bearing and Perennial Stream Crossings (number)

Sub-watershed	Fish-bearing			Perennial		
	Existing Condition	Proposed Decommissioning	Post-Activity	Existing Condition	Proposed Decommissioning	Post-Activity
Hog	0	N/A	N/A	0	N/A	N/A
Jack	1	1	0	3	1	2
Keller	0	N/A	N/A	1	0	1
Snow	7	2	5	6	3	3
Total	8	3	5	10	4	6

Table WS-17: Alternative 4 - Intermittent Stream and Ephemeral Draw Crossings (number)

Sub-watershed	Intermittent			Ephemeral		
	Existing Condition	Proposed Decommissioning	Post-Activity	Existing Condition	Proposed Decommissioning	Post-Activity
Hog	0	N/A	N/A	6	0	6
Jack	15	6	9	13	3	10
Keller	0	N/A	N/A	4	0	4
Snow	9	4	5	23	5	18
Total	24	10	14	46	8	38

Table WS-18: Alternative 4 - Open and Closed Road Miles and Road Density by Subwatershed. (Includes Private and Public Ownership)

Subwatershed	Open Roads (Miles)	Closed Roads (Miles)	Open + Closed Roads (Miles)	Decommissioned Roads (Miles)	Road Density (Mi/ Mi^{2})
Hog	35.93	18.96	54.89	0.2	5.78
Jack	38.13	4.13	42.26	7.1	2.66
Keller	23.08	21.32	44.4	0.0	3.79
Snow	22.26	7.23	29.49	5.0	2.92
Total	119.4	51.64	171.04	12.3	

WEPP modeling indicated that the sediment yield under typical 5 year and greater runoff events would be similar to the No Action Alternative due to the lack of skid trails. Again this value is not substantially different from the harvest alternatives due to the variation associated with both sediment sampling and sediment modeling and to the implementation of BMPs. Under Alternative 4 and a five year or greater event, less activity related sediment would be generated due to a lack of skid trails and maintenance of higher amount of ground cover with a greater proportion of the total sediment generated from legacy activities and roads, which are not included in the WEPP model. Roads are also chronic sources of sediment, especially if poorly maintained and are likely to generate sediment anytime water is concentrated on them.

General Water Quality – Chemical Pollutants

Effects of chemical pollutants are discussed in the Fisheries Section

Clean Water Act Section 303(d) List of Water Quality Limited Waterbodies

No changes to the Section 303(d) List of Water Quality Limited Waterbodies would be made under this alternative. Effects on 303(d) listed streams (e.g. Snow Creek) would be reduced compared to the other action alternatives and compared to treatments on other streams in the project area. A culvert on the 2400203 road would not be removed and about 0.8 mi. of the 2400133 would not be decommissioned, reducing beneficial effects on Snow Creek compared to the other action alternatives.

Recognizing that a WQRP will be required for the Silvies Sub-basin in 2007, the Flagtail IDT has identified the elements of a WQRP incorporated into the Flagtail Fire Recovery Project under the NEPA process in Appendix L.

Summary

Alternative 4 includes less ground- disturbing activity than the other action alternatives but because of the the implementation of BMPs and the uncertainty associated with sediment modeling, the difference between Alternative 4 and the other action alternatives is not measurable. Under Alternative 4 fewer roads would be treated, for either maintenance or decommissioning; consequently the primary source of sedimentation in the project area would not be controlled as much as under the other action alternatives. The number and miles of roads and crossings that would be decommissioned in Snow Creek (on the 303(d) list) would be reduced, resulting in less rehabilitation in this drainage. The difference between alternatives would probably not be measurable for 20-30 years at a minimum due to the length of the recovery period.

Cumulative Effects

General Water Quality

Cumulative effects of activities described in Appendix J are similar to those described for the No Action Alternative.

The cumulative effects are similar to those for Alternatives 2, 3 and 5. Improvements in stream temperature and sediment would be reduced slightly because of fewer road rehabilitation activities along Snow Creek and no road maintenance. The overall effect of the activities proposed under these alternatives and of on-going and foreseeable activities would be improved water quality due to the reduction of sediment reaching streams and the gradual recovery of shade over 7-40 years. These beneficial cumulative effects would be passed downstream as described for Alternatives 2, 3 and 5.

Placement of coarse woody material would be similar as for the other alternatives. Material not trapped by the wood would be exported downstream as described in the fisheries section.

Clean Water Act Section 303(d) List of Water Quality Limited Waterbodies

Since there are no direct or indirect effects on the listed stream from this alternative, there would be no cumulative effects on Snow Creek. Similarly there would be no cumulative effects on the lower 20 miles of the Silvies River. There would be no cumulative effects on Scotty Creek because it does not drain the project area and because there are no direct or indirect effects from this alternative. As described for General Water Quality, Appendix J was reviewed. Similarly, planting conifers and riparian hardwoods and placing coarse woody material in Snow Creek would maintain or reduce stream temperatures over various periods of time. Felling hazard trees in RHCAs would not have a measurable effect on stream temperature due to the small amount of shade removed. The effects of re-initiation of grazing would be similar to those before the fire as the same standards and guidelines, which allow for gradual recovery of riparian vegetation in degraded areas, would apply; grazing would not be expected to have measurable effects on stream temperature for two, somewhat opposing reasons. First utilization of shade-providing vegetation is limited. Second, although riparian vegetation recovery is expected under the current standards and guidelines, it may be slow and correlated changes in temperature would be difficult to measure against the natural variation of stream temperatures. Felling hazard trees along the 31 road and other foreseeable silvicultural treatments, such as those at Flagtail Lookout, are located outside the Snow Creek drainage and, therefore, would not affect the temperature of Snow Creek.

Comparison of Alternatives

The similarity/differences of the alternatives on watershed effects has already been discussed in previous sections. These discussions form the basis for this summary. According to WEPP modeling of harvest activities, almost no differences are seen among the five alternatives when the less than five year or most probable (80%) runoff events are considered for year 2004. (The larger of these events would be expected to yield zero to trace or small amounts of sediment from the steepest slopes in the Flagtail area.) When five year events are considered, while WEPP displays calculable differences between alternatives, these differences are not considered statistically or observably different (USDA Forest Service, undated, "Forest Service Policy…"). The difference among alternatives is the time window during which the area would be most vulnerable to five year and larger events, considering both harvest and roading. Due to time constraints no WEPP modeling was conducted for years beyond 2004. In order to identify windows of vulnerability, alternatives were rated based on timing and persistency of vulnerability to increased sediment yields from either harvest activities or roading. These ratings are included in the Analysis File.

When only harvest and fuel treatment activities are considered in establishing this window of vulnerability, Alternatives 1 and, to a lesser extent, Alternative 4 clearly are vulnerable for a shorter period of time because ground cover recovery is not delayed as it is in the alternatives that include harvest. Alternative 4 includes grapple piling which is expected to have very small (2%) decrease in ground cover during year of operation, which then recovers (see Soils Section) in less than three years. However, following harvest, ground cover continues to recover in the three harvest alternatives, decreasing vulnerability to five year and larger storms over time until the vulnerability is about the same as for Alternatives 1 and 4 about seven years after the fire (five years after the harvest activities). Because ground cover on skid trails would still be recovering five and six years after the fire (three to four years after harvest) under Alternatives 2, 3, and 5 compared to Alternatives 1 and 4 in which ground cover would be approaching pre-fire conditions, the window of vulnerability for the alternatives which include harvest would be longer. Also, since some BMPs and mitigations would be implemented as harvest operations are completed, there is another window of vulnerability, about a year long, during and immediately post-harvest, when disturbance would have occurred but BMPs and mitigations, such as waterbarring and seeding, would not yet have occurred or become effective.

However, when consideration of roading is included in the evaluation, Alternatives 1 and 4 leave streams in more vulnerable condition after about three years than do the other three alternatives. This elevated vulnerability would last as long as the roads are present on the landscape. Under Alternative 1 the elevated vulnerability due to roading is located throughout the area because no road treatments of any kind are proposed. Under Alternative 4 the increased vulnerability is limited in space to Snow Creek; however, the magnitude of the vulnerability to this creek is relatively large as Alternative 4 leaves a road (0.8 mi.) that is a known sediment source in place as well as a crossing that is undersized and is placed on a locally long, shallow fill. Also, reconstruction of another sediment source, a failing culvert fill, on Snow Creek would not be implemented.

Thus, under Alternatives 2, 3, and 5, the Flagtail area is most vulnerable to five year and larger events following harvest and until sometime between post-fire years four and seven when the adverse effects of delayed ground cover recovery are countered by the beneficial effects of road maintenance, reconstruction, and decommissioning. Conversely, under Alternative 1, the vulnerability to five year and larger storms is less than under the harvest alternatives until between post-fire years four and seven. After this point of balance, under Alternative 1, the effects of the roads are not countered by a lack of disturbance. Under Alternative 4 this point of comparison is slightly different and more complex to describe due to the proposed fuel treatments and lack of harvest and due to a reduction in proposed road treatments. Under Alternative 4 the Flagtail area is most vulnerable to five year and larger events following fuels treatment and until sometime between post-fire years four and six when the adverse effects of delayed recovery of a very small amount of ground cover (2%) are countered by the beneficial effects of road decommissioning. However, since fewer roads and crossings are decommissioned, this effect is reduced relative to the harvest alternatives after post-fire year six because the road segment along and crossing of Snow Creek would remain on the road system, untreated, and a known sediment source at another crossing of Snow Creek (culvert fill failure) would not be controlled by reconstruction. In addition, most of the remaining open and closed roads would not have been maintained and their condition would be the same as the existing condition (see Transportation and Watershed Sediment Existing Conditions).

While the discussion above considers the most compressed schedule for implementation of proposed activities, the trend would be maintained if activities were implemented over more years. Implementing activities over a longer time would result in a shift in the "balance point" between the effects of harvest/fuel activities and road activities approximately proportional to the extension in time.

There are no measurable differences in effects among Alternatives on 303(d) listed streams – either on Snow Creek, listed for temperature, in the project area; on other listed segments in the Upper Silvies Watershed (Scotty Creek, also listed for temperature) because its confluence with the Silvies is downstream of the confluences of all the project streams); or on the downstream listed segment of the Silvies River (listed for temperature and dissolved oxygen) which is below (outside) the boundary for watershed cumulative effects.

As the WEPP modeling showed, the vulnerability of the Flagtail area to greater than five year runoff events, remained elevated about eleven-fold two years after the fire. As discussed in the Fire section, fuel treatment activities proposed under the various alternatives vary in their effects on future catastrophic fire with future catastrophic fire expected to be progressively more intense under Alternative 2, Alternative 5, Alternative 3, Alternative 4, and the No Action Alternative. Similarly the likelihood of having a fire with a risk of sedimentation less than, similar to, or greater than that for the Flagtail Fire for five year and greater events follows a similar progression. The difference in effects of future potentially catastrophic fires under the most probably runoff events was not modeled. However, since the model is sensitive to the amount of ground cover lost, which would be higher with more intense fire, it is expected that either the magnitude of post-fire runoff following a five year or greater event would increase or a smaller, more likely event would result in sedimentation that could be calculated or both. These changes would be in proportion to the intensity and size of the fire.

Consistency With Direction and Regulations

The five alternatives are consistent with the Clean Water Act and other applicable laws and the Forest Plan as amended because they would not measurably increase watershed effects over natural, post-fire levels. The action alternatives also provide two different levels of road reconstruction and decommissioning, either of which would move watershed function toward desired future conditions.

The FEIS is consistent with the "Forest Service and Bureau of Land Management Protocol for Addressing Clean Water Act Section 303(d) Listed Waters." In addition to the Protocol, the May 2002 Memorandum of Understanding Between USDA Forest Service and Oregon Department of Environmental Quality to Meet State and Federal Water Quality Rules and Regulations states "WQRP's (Water Quality Restoration Plans) should be completed where management activities have the potential to affect impaired waters 303(d) listed and a TMDL is not yet in place (p. 6). For this project the protocol and decision framework were not initiated because the project would not measurably affect the parameter (summer temperature) for which Snow Creek is listed and, therefore, a WQRP is not needed for this project.Similarly, the project would not affect the three parameters for which the lower Silvies River (river miles 0-20) is listed (Water Quality Section). This determination is also based on the application of INFISH RHCAs and site specific BMPs (see Chapter 2 – Mitigation). Also the implementation of the Protocol requires a collaborative approach with the State and Tribes with the Forest Service assisting in the development of a TMDL. The TMDL for the Silvies sub-basin is scheduled for 2007 (Oregon, 2004b). Following this timeline and using a collaborative approach, the Forest will undertake the development and implementation of a WQRP for the Silvies sub-basin in order to provide the specific actions needed for the Forest to meet TMDL requirements. Thus, the FEIS is consistent with the direction and regulations of the Clean Water Act and 303(d) listed streams. Recognizing that the Forest would be developing a WQRP in support of the State scheduled TMDL, the components of a WQRP were identified and incorporated into the Flagtail Fire Recovery Project in Appendix L.

The proposed alternatives would have no impact on floodplains or wetlands as described in Executive Orders 11988 and 11990. Wetlands that meet the Jurisdictional Definition (Corps of Engineers) are found in the Flagtail Burn Area. These areas will be avoided during activities as described in the Mitigation and mapped as determinations are made.

Irreversible and Irretrievable Commitments of Resources

There are no irretrievable or irreversible watershed effects under any of the Alternatives.