Water Quality Restoration Plan

Southern Oregon Coastal Basin
Applegate Subbasin

Bureau of Land Management (BLM), Medford District
Ashland Resource Area
Grants Pass Resource Area

U.S. Forest Service (USFS), Rogue River-Siskiyou National Forest
Applegate Ranger District
Ashland Ranger District
Galice Ranger District
Illinois Valley Ranger District

January 2005

Applegate Subbasin at a Glance	
Hydrologic Unit Code Number	**17100309**
Subbasin Area/Ownership	Total: 492,866 acres USFS Ownership: 194,510 acres (39.5%) BLM Ownership: 148,289 acres (30.1%) U.S. Army Corps of Engineers: 120 acres (0.02%) State of Oregon: 1,353 acres (0.28%) Private: 148,594 acres (30.1%)
303(d) Stream Miles Assessed	Total: 117 miles USFS and BLM Ownership: 35 miles
303(d) Listed Parameters	Temperature, Sedimentation, Biological Criteria
Key Resources and Uses	Salmonids, domestic, aesthetic, recreation
Known Human Activities	Agriculture, forestry, mining, roads, urban and rural residential development
Natural Factors	Geology: intrusive and metamorphic, metamorphosed volcanic and sedimentary, and granitic intrusions Soils: various series and complexes

Statement of Purpose

This water quality restoration plan is prepared to meet the requirements of Section 303(d) of the 1972 Federal Clean Water Act.

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A. Introduction

This document describes how the U.S. Forest Service (USFS) and Bureau of Land Management (BLM) will implement and achieve the Oregon Department of Environmental Quality's (DEQ's) *Applegate Subbasin Total Maximum Daily Load (TMDL)* (ODEQ 2003b) for 303(d) listed streams on federal lands. Its organization is designed to be consistent with the DEQ's *Applegate Subbasin Water Quality Management Plan (WQMP)* (ODEQ 2003b). The area covered by this Water Quality Restoration Plan (WQRP) includes all lands managed by the USFS, Rogue River-Siskiyou National Forest and the BLM, Medford District within the Applegate Subbasin.

Beneficial Uses

The Oregon Environmental Quality Commission has adopted numeric and narrative water quality standards to protect designated beneficial uses (Table 1). In practice, water quality standards have been set at a level to protect the most sensitive uses. Cold-water aquatic life such as salmon and trout are the most sensitive beneficial uses (Table 2) in the Applegate Subbasin. Seasonal standards may be applied for uses that do not occur year round.

Table 1. Beneficial Uses in the Applegate Subbasin (OAR 340-41-362)

Beneficial Use	*Occurring*	*Beneficial Use*	*Occurring*
Public Domestic Water Supply	✓	Anadromous Fish Passage	✓
Private Domestic Water Supply	✓	Salmonid Fish Spawning	✓
Industrial Water Supply	✓	Salmonid Fish Rearing	✓
Irrigation	✓	Resident Fish and Aquatic Life	✓
Livestock Watering	✓	Wildlife and Hunting	✓
Boating	✓	Fishing	✓
Aesthetic Quality	✓	Water Contact Recreation	✓
Commercial Navigation & Trans.		Hydro Power	✓

Table 2. Sensitive Beneficial Uses in the Applegate Subbasin

Sensitive Beneficial Use	*Species*[1]
Salmonid Fish Spawning & Rearing	Fall chinook, coho (t), summer and winter steelhead trout (c), Pacific lamprey (co)
Resident Fish & Aquatic Life	Resident Fish: Rainbow trout, cutthroat trout (c), brook trout (n), brown trout (n), brook lamprey, and numerous other non-salmonid species Other Aquatic Life: tailed-frog (s), foothills yellow-legged frog (c), red-legged frog (c), Pacific giant salamander (c), western pond turtle (c), beaver, river otter, and numerous other species of frogs, salamanders, turtles, & snakes

1/ Status: (t) = threatened under Federal Endangered Species Act (ESA); (c) = candidate; (co) = species of concern; (s) = sensitive, and (n) = non-native.

Listing Status

Section 303 of the Clean Water Act of 1972, as amended by the Water Quality Act of 1987, provides direction for designation of beneficial uses and limiting discharge of pollutants to waters of the state. The DEQ is responsible for designating streams that do not meet established water quality criteria for one or more beneficial uses. These streams are included on the state's 303(d) list, which is revised every two years, and submitted to the Environmental Protection Agency (EPA) for approval. Section 303 of the Clean Water Act further requires that TMDLs be developed for waters included on the 303(d) list. A TMDL defines the amount of pollution that can be present in the waterbody without causing water quality standards to be violated. A WQMP is developed to describe a strategy for reducing water pollution to the level of the load allocations and waste load allocations prescribed in the TMDL. The approach is designed to restore the water quality and result in compliance with the water quality standards. The approach is intended to protect the designated beneficial uses of waters of the state.

The *Applegate Subbasin Total Maximum Daily Load (TMDL)* (ODEQ 2003b) and this WQRP address all listings on the 1998 Oregon 303(d) list and all temperature listings from the 2002 303(d) list for the Applegate Subbasin. Additional parameters on the 2002 303(d) list include nine dissolved oxygen listings which will be addressed by DEQ as part of the five-year review of the TMDL. At that time they will be incorporated in this WQRP.

The Applegate River and ten tributaries (11 stream segments) were on the 1998 303(d) list due to documented violations of water quality standards (ODEQ 1998). Listed parameters on the 1998 303(d) list include: summer temperature, sediment, biological criteria, habitat modification, and flow modification. Habitat and flow modification were delisted on the 2002 303(d) list because they are not the direct result of a pollutant and therefore no load capacity or allocation could be established. They will not be addressed in this WQRP.

Four stream segments placed on the 1998 303(d) list for summer temperature were dropped on the 2002 list. Two of these segments (Beaver Creek, river mile (R.M.) 3.5 to 8.7, and Powell Creek, R.M. 2.0 to 8.0) are considered to be attaining criteria and uses, and are not covered in this WQRP. The other two stream segments (Thompson Creek, R.M. 5.3 to 7.6, and Waters Creek, R.M. 0 to 2.0) are listed as potential concerns and are included in the WQRP.

The 2002 303(d) list was finalized in 2003 (ODEQ 2003a) and includes additional streams and parameters in the Applegate Subbasin. The 2002 list contains five new temperature listings: three new streams, one new segment on a 1998 listed stream, and a spawning temperature listing added to a stream listed in 1998 for summer temperature.

The *Applegate Subbasin TMDL* addresses 117 stream miles that are on the 1998 and 2002 303(d) lists (Table 3), of which 35 miles (29.9 percent) cross federal lands. The streams listed in Table 3 are mapped on Figures 1 through 5.

Table 3. 1998 303(d) Listings and 2002 303(d) Temperature Listings in the *Applegate Subbasin TMDL* (ODEQ 1998 and 2003b)

303(d) List[1]	Stream Segment	Listed Parameter	Applicable Rule	Miles Affected
1998	Applegate River, mouth to Applegate Reservoir	Summer Temperature	OAR 340-041-0365(2)(b)(A)	50
1998	Applegate River, mouth to Applegate Reservoir	Flow Modification	OAR 340-041-0362 OAR 340-041-0365(2)(I)	50
1998	Beaver Creek, mouth to Headwaters	Biological Criteria	OAR 340-041-027 OAR 340-041-0362	8.7

303(d) List[1]	Stream Segment	Listed Parameter	Applicable Rule	Miles Affected
1998	Beaver Creek, mouth to Headwaters	Habitat Modification[2]	OAR 340-041-0362 OAR 340-041-0365(2)(I)	8.7
1998	Beaver Creek, mouth to Headwaters	Flow Modification[2]	OAR 340-041-0362 OAR 340-041-0365(2)(I)	8.7
1998	Beaver Creek, mouth to Headwaters	Sedimentation	OAR 340-041-0362 OAR 340-041-0365(2)(j)	8.7
2002	Beaver Creek, RM 0 to 3.5	Summer Temperature	OAR 340-041-0365(2)(b)(A)	3.5
2002	Humbug Creek, RM 0 to 5	Summer Temperature	OAR 340-041-0365(2)(b)(A)	5.0
1998	Little Applegate River, mouth to headwaters	Summer Temperature	OAR 340-041-0365(2)(b)(A)	21
1998	Palmer Creek, mouth to headwaters	Flow Modification[2]	OAR 340-041-0362 OAR 340-041-0365(2)(I)	5.7
1998	Palmer Creek, mouth to headwaters	Habitat Modification[2]	OAR 340-041-0362 OAR 340-041-0365(2)(I)	5.7
1998	Palmer Creek, mouth to headwaters	Summer Temperature	OAR 340-041-0365(2)(b)(A)	5.7
2002	Powell Creek, mouth to RM 2.0	Spawning Temperature Oct 1 – May 31	OAR 340-041-0365(2)(b)(A)	2.0
2002	Slate Creek, RM 0 to 5.3	Summer Temperature	OAR 340-041-0365(2)(b)(A)	5.3
1998	Star Gulch, mouth to 1918 Gulch	Summer Temperature	OAR 340-041-0365(2)(b)(A)	4.0
2002	Sterling Creek, mouth to RM 2.5	Summer Temperature	OAR 340-041-0365(27)(b)(A)	2.5
1998	Thompson Creek, Mee Cove to Ninemile Creek	Summer Temperature (Potential Concern)	OAR 340-041-0365(2)(b)(A)	2.3
1998	Waters Creek, mouth to RM 2.0	Summer Temperature (Potential Concern)	OAR 340-041-0365(2)(b)(A)	2.0
1998	Waters Creek, RM 2.4 to 4.3	Summer Temperature	OAR 340-041-0365(2)(b)(A)	1.9
1998	Williams Creek, mouth to East/West Fork confluence	Summer Temperature	OAR 340-041-0365(2)(b)(A)	7.0
1998	Yale Creek, mouth to Waters Gulch	Summer Temperature	OAR 340-041-0365(2)(b)(A)	1.3
Total Stream Miles listed for Summer Temperature Criteria (June 1 to Sept 30)				**107.2**
Total Stream Miles listed as Potential Concern for Summer Temperature Criteria (June 1 to Sept 30)				**4.3**
Total Stream Miles listed for Spawning Temperature Criteria Exceedances (October 1 to May 31)				**2.0**
Total Stream Miles listed for Sedimentation				**8.7**
Total Stream Miles listed for Biological Criteria				**8.7**
Total Stream Miles listed for Habitat Modification Note: habitat modification is delisted on the 2002 303(d) list				**14.4**
Total Stream Miles listed for Flow Modification Note: flow modification is delisted on the 2002 303(d) list				**64.4**

1/ This document addresses all listings on the 1998 303(d) list, except two stream segments dropped from the 2002 303(d) list because they are attaining criteria and uses, and only the temperature listings on the 2002 303(d) list for the Applegate Subbasin. The entire 2002 303(d) list will be addressed by DEQ as part of the five-year review of the TMDL.
2/ The habitat and flow modification parameters were delisted in the 2002 303(d) list.

Figure 1. Applegate Subbasin 303(d) Temperature Listed Streams

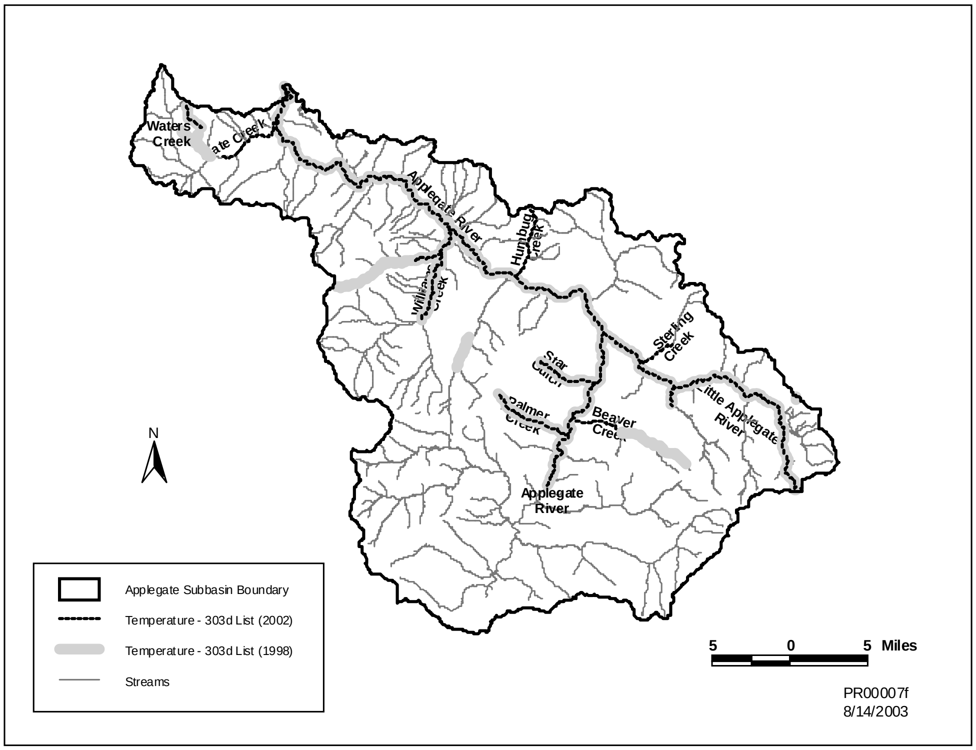


Figure 2. Applegate Subbasin 303(d) Sediment Listed Streams

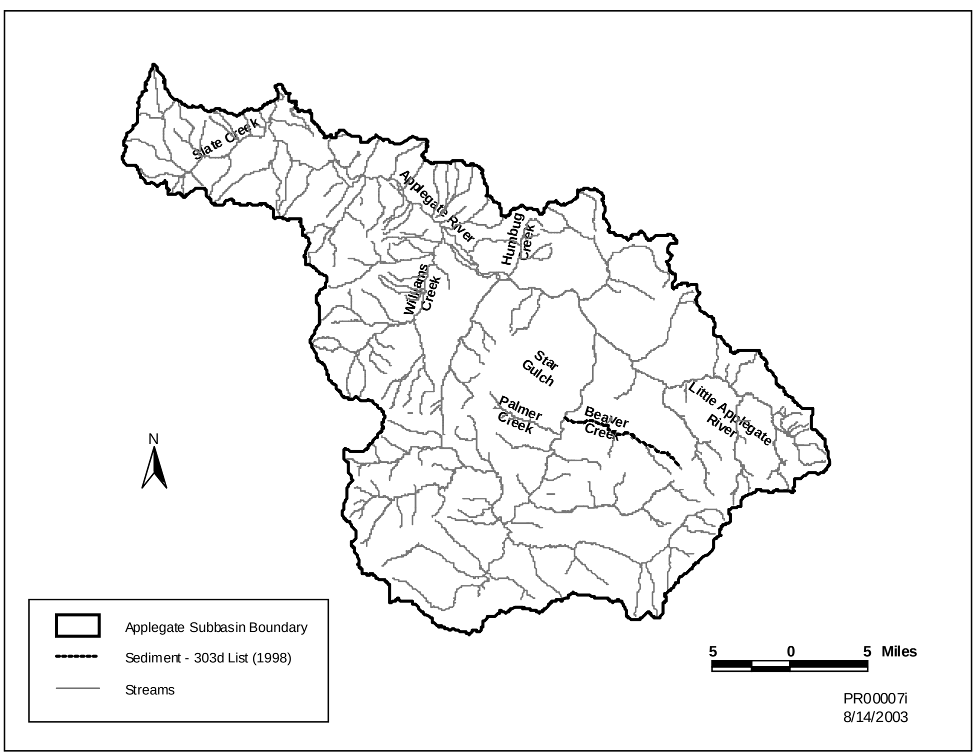
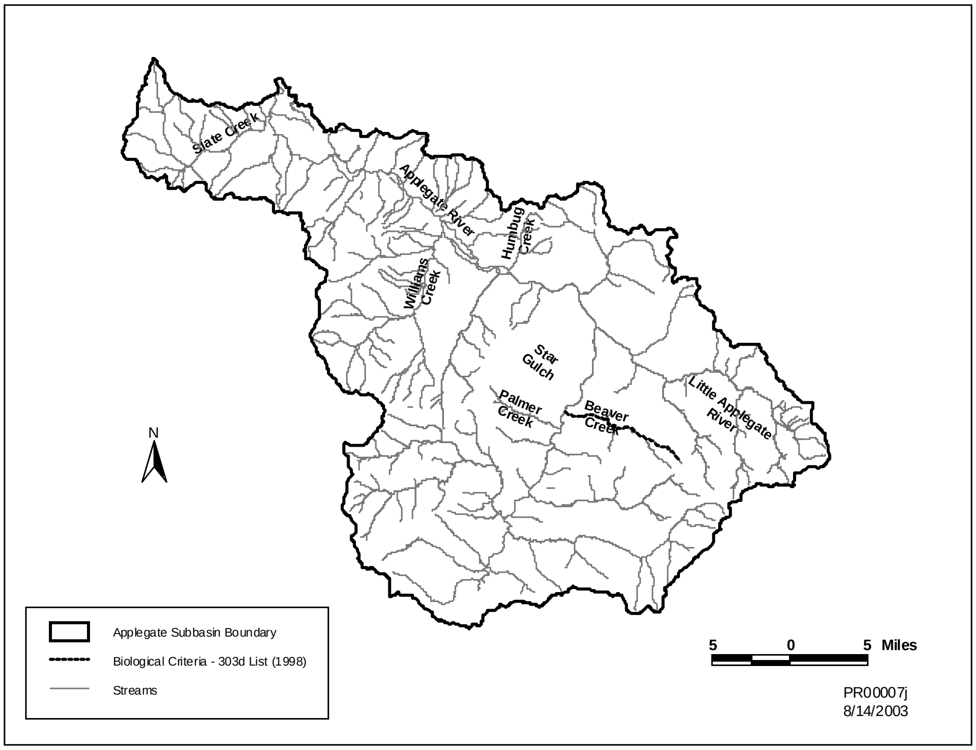


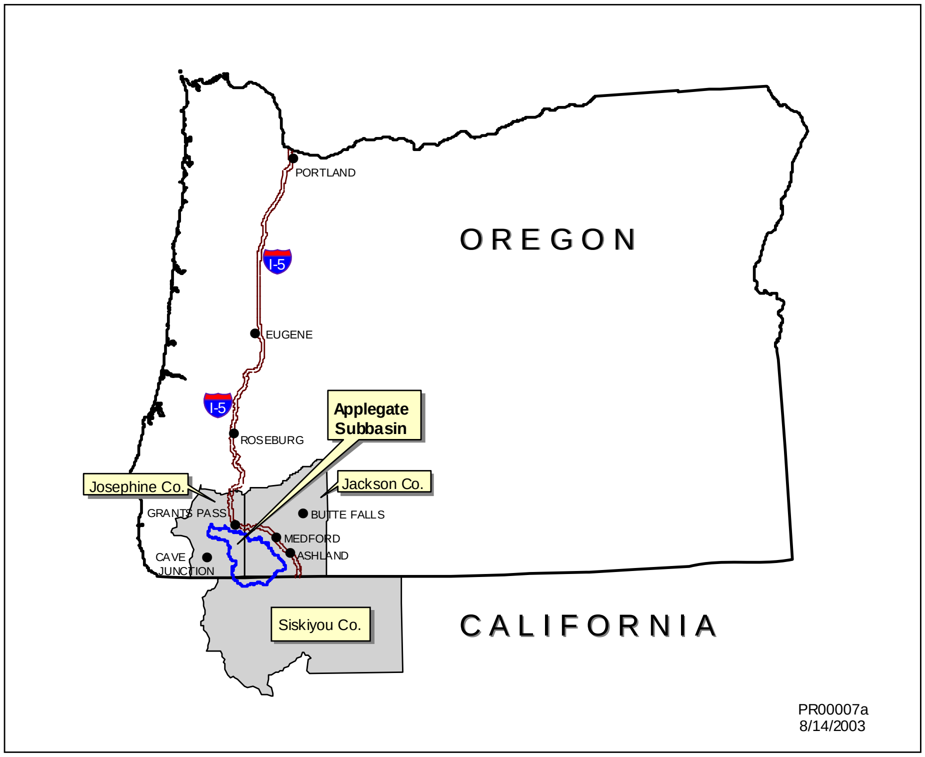
Figure 3. Applegate Subbasin 303(d) Biological Criteria Listed Streams



B. Subbasin Characterization

The Applegate Subbasin is located in southwestern Oregon (Figure 4), approximately 3 miles south of Grants Pass, Oregon and 3 miles southwest of Medford, Oregon, and encompasses 492,866 acres (770 square miles). Communities of the Applegate Subbasin include Ruch, McKee Bridge, Applegate, Provolt, Williams, Murphy, Wilderville, and Wonder (Preister 1994). The Applegate River starts in California and flows 60 miles to join the Rogue River (Preister 1994). The subbasin covers portions of three counties: Josephine and Jackson in Oregon and Siskiyou in California. Elevations within the subbasin range between approximately 880 feet (268 meters) at the confluence with the Rogue River, to just over 7,400 feet (2,256 meters) at Dutchman Peak.

Figure 4. Location of the Applegate Subbasin



The Applegate Subbasin is one of five subbasins in the Rogue River Basin (Figure 5). The Applegate Subbasin is subdivided into six watersheds: Upper Applegate River, Applegate River-McKee Bridge, Little Applegate River, Middle Applegate River, Williams Creek, and Lower Applegate River (Figure 6).

Figure 5. Rogue Basin and the Applegate Subbasin

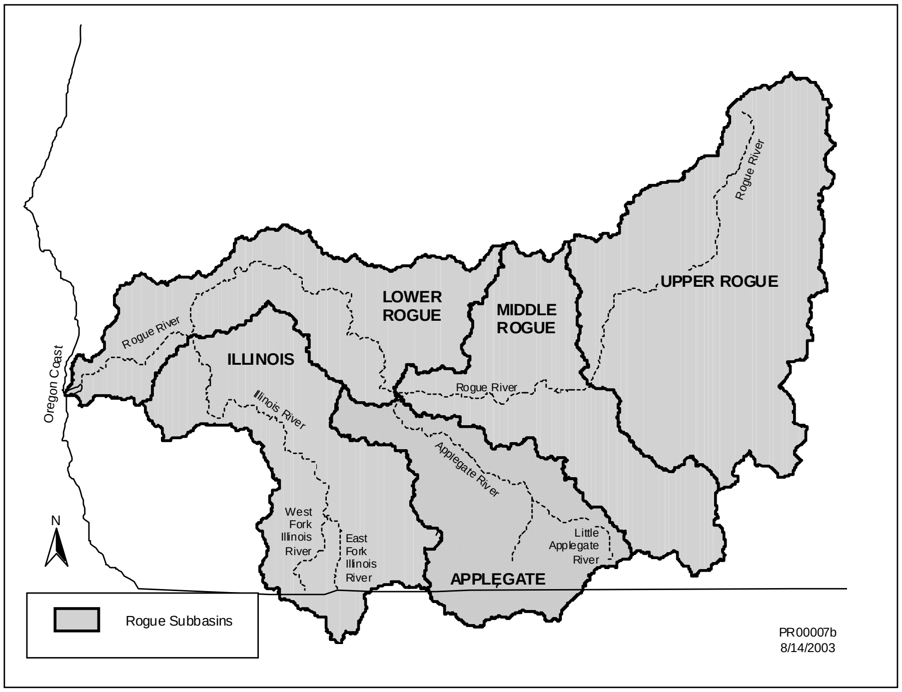
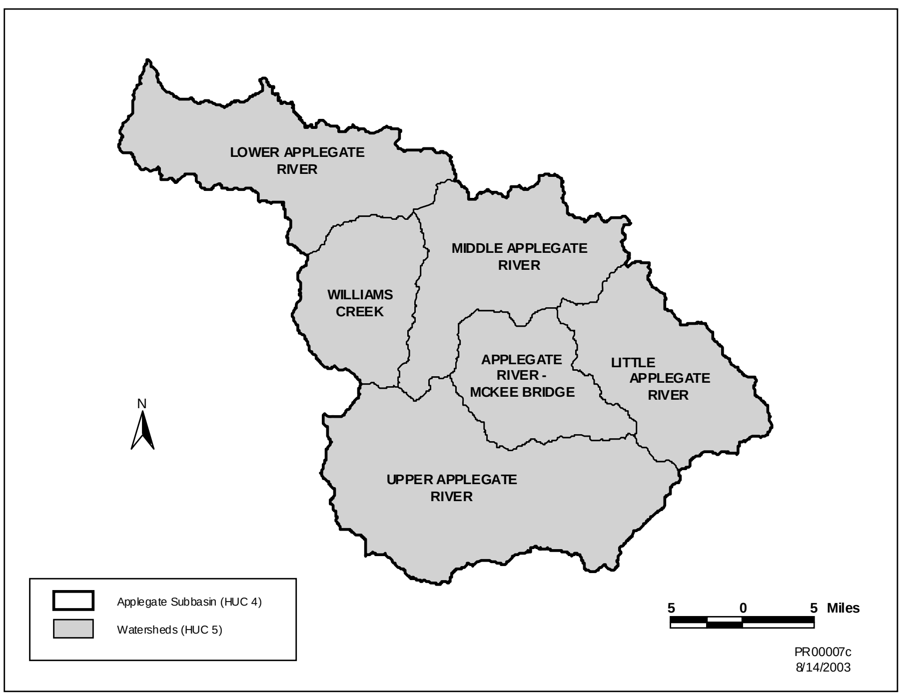


Figure 6. Watersheds within the Applegate Subbasin



Land Ownership and Use

The USFS and the BLM administer 69.6 percent of lands within the Applegate Subbasin (Figure 7 and Table 4). There are four administrative units (Ranger Districts) that manage the USFS lands and two administrative units (Resource Areas) that manage the BLM lands (Figure 8 and Table 5) USFS lands are mostly large, intact blocks, while BLM lands are blocked in some areas and intermingled with private lands in other areas. The U.S. Army Corps of Engineers manages the Applegate Reservoir (less than 0.1 percent) and the State of Oregon manages 0.28 percent within the Applegate Subbasin. The remaining 30 percent of the subbasin consists of private lands, of which eight percent is managed as industrial forest (USDA and USDI 1998). Ownership of the remaining privately-held land in the watershed is typically held in relatively small parcel holdings; 74 percent of all owners hold 23 percent of the private land in parcels of under 10 acres in size (USDA and USDI 1998). Approximately 12,650 people reside in the Applegate Subbasin, with the greatest number of people living in the Murphy and Williams areas (Preister 1994).

Figure 7. Federal Land Ownership in the Applegate Subbasin

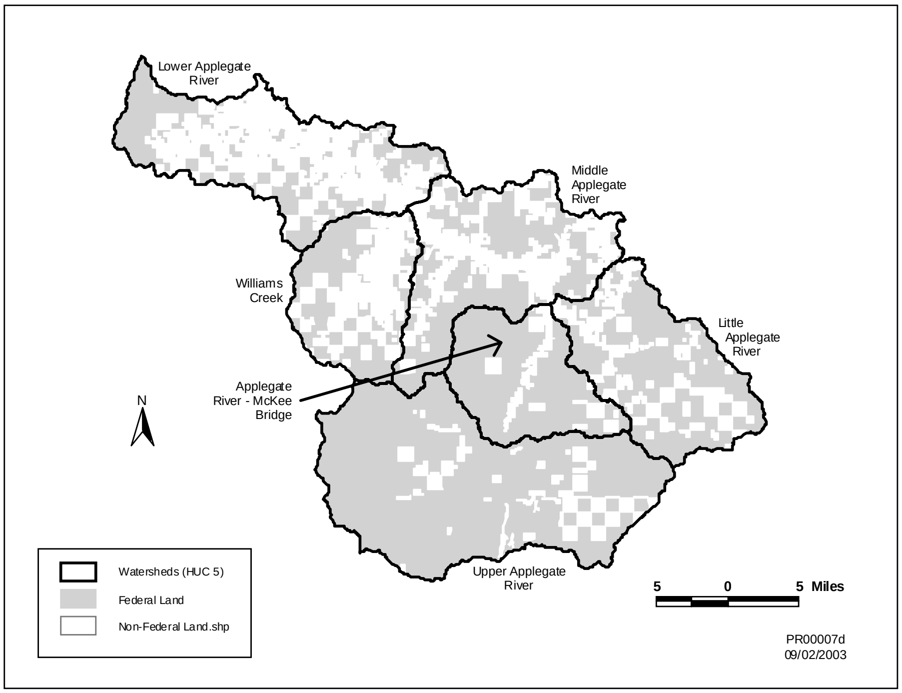


Table 4. Percentage of Federal Land in the Applegate Subbasin by Watershed

Watershed	Hydrologic Unit Code (HUC)	Total Area (Acres)	% Federal Land
Upper Applegate River	1710030901	142,205	90.5
Applegate River-McKee Bridge	1710030902	52,257	87.2
Little Applegate River	1710030903	72,260	72.3
Middle Applegate River	1710030904	82,569	59.3
Williams Creek	1710030905	52,941	53.3
Lower Applegate River	1710030906	90,634	43.3
TOTAL		492,866	69.6

Figure 8. USFS Ranger Districts and BLM Resource Areas in the Applegate Subbasin

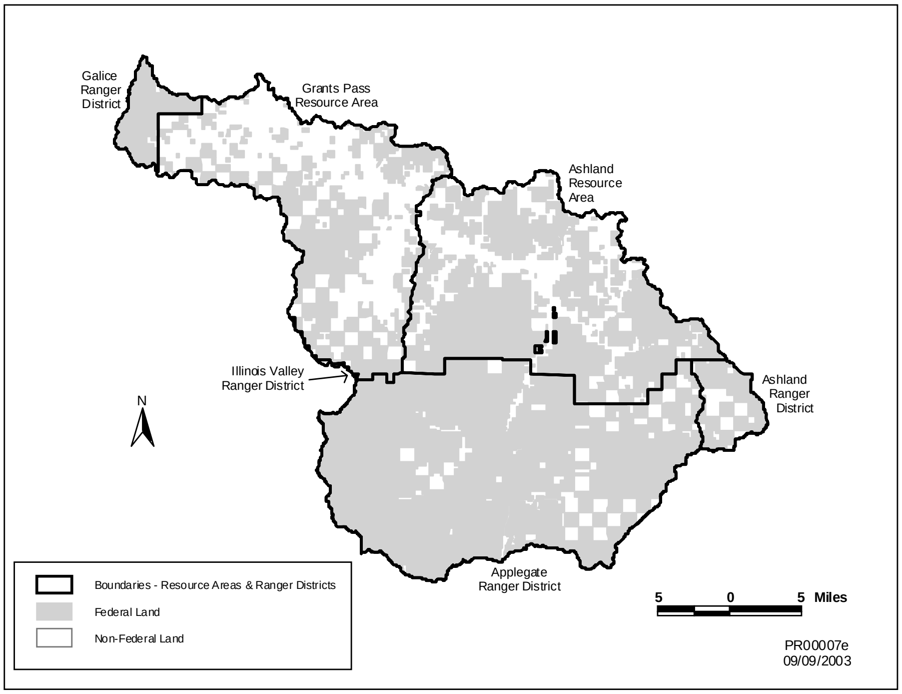


Table 5. Ownership within the Applegate Subbasin

Ownership	Acres
USFS – Applegate Ranger District	171,305
USFS – Ashland Ranger District	10,570
USFS – Galice Ranger District	12,335
USFS – Illinois Valley Ranger District	300
BLM – Ashland Resource Area	93,617
BLM – Grants Pass Resource Area	54,672
U.S. Army Corps of Engineers	120
State of Oregon	1,353
Private	148,594
TOTAL	492,866

Major land uses in the Applegate Subbasin include agriculture, timber, mining, and recreation. Many of the private landowners operate "hobby farms" and small woodlots. The majority of the individual ranches and residences are located along the Applegate River and Williams Creek. Due to the close proximity to Grants Pass and Medford, Oregon, and the range of recreation opportunities available in the Applegate Subbasin, the area receives a high degree of use for fishing, hunting, swimming, hiking, mountain biking, horseback riding, off-highway vehicle (OHV) use, and pleasure driving. Roads distributed throughout the watershed provide vehicle access to managed forestlands, residences, and recreational areas.

In 1994, all federal land in the Applegate Subbasin, except the Red Buttes Wilderness, was designated an Adaptive Management Area (AMA) under the Northwest Forest Plan (NWFP) (USDA and USDI 1994a). AMAs were designated by the NWFP as places to encourage the development and testing of technical and social approaches to achieving the ecological, economic, and other social objectives as described in the NWFP. The special emphasis for the Applegate River AMA is the development and testing of various forest management actions including partial cutting, prescribed burning, and low-impact approaches to forest harvest (e.g., aerial systems) to provide for a broad range of forest values, including late-successional forest and high quality riparian habitat.

The NWFP Standards and Guidelines incorporate the Aquatic Conservation Strategy (ACS) (amended March 2004, USDA and USDI 2004b) to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within them on public lands. A component of the ACS is the designation of Key Watersheds, which are areas that either provide, or are expected to provide, high quality habitat. Key Watersheds are intended to serve as refugia for maintaining and recovering habitat for at-risk stocks of anadromous salmonids and resident fish species. There are four designated Key Watersheds in the Applegate Subbasin: Beaver Creek, Palmer Creek, and the upper portions of the Little Applegate River and Yale Creek.

The present condition, composition and age of the vegetation on federal lands are largely the result of the past forest management activities including fire management. Prior to the NWFP, forest management activities that may have contributed to non-point source pollution included: road building, timber harvest, log removal in streams and riparian areas, burning, fertilization, and herbicide application.

Geology

The Applegate Subbasin lies entirely within the Klamath Mountains Geologic Province, also called the Siskiyou Mountains (USDA and USDI 1995). The Applegate Subbasin contains some of the oldest (150-250 million years) and most complex geologic assemblages along the U.S. West Coast (ARWC 1994). Bedrock in the subbasin is composed of intrusive and metamorphic rock types which have been faulted, folded and broadly uplifted. Major rock types in the headwaters include granite, graphite/mica schist, serpentine, and medium grade metamorphosed sedimentary formations. The vast majority of bedrock found in the middle and lowland portions of the basin is composed of weakly metamorphosed volcanic and sedimentary rocks. Notable exceptions are the large granitic intrusion near the confluence with the Rogue River and the large granitic pluton underlying the Williams Valley (ARWC 1994).

The sediment produced from granitic terrain contains mostly coarse sandy material with little gravel, cobbles or boulders. Deposited granitic sands are usually tightly packed and lack void space needed by many aquatic life forms. Granitic soils are very susceptible to surface erosion and debris slides (ARWC 1994).

Narrow bands of serpentine bedrock have very cobbly, clayey soils with a distinct plant community. When vegetation is removed it is often difficult to reestablish because of a nutrient imbalance. The low shear strength of fresh serpentine and the clayey nature of weathered serpentine make these areas very susceptible to landsliding (ARWC 1994).

The more widespread metavolcanic and metasedimentary rocks are generally more stable; however, some soil types developed on these rock formations are susceptible to high erosion rates (ARWC 1994).

Most of the Applegate River Subbasin today is characterized by highly dissected mountain slopes with long, steep, narrow canyons that have been carved into the rugged terrain by high gradient drainage. Steeper slopes in the upper and middle elevations are noted for their relatively high rates of mass wasting and erosion. In general, high erosion rates on the steep slopes cause soil profiles to be relatively thin and rocky. Major valleys have broad, gently sloping landscapes with river valley bottoms characterized by extensive accumulation of river deposits (ARWC 1994).

Climate

The Applegate Subbasin experiences a Mediterranean climate, with a prolonged cold wet period from late October through May, followed by a hot dry season from June into October. Annual rainfall amounts vary widely across the subbasin as the rugged terrain exerts a strong rain shadow and rain-producing effect. High elevations receive up to 65 inches of annual precipitation (rainfall equivalent) and lower elevations receive 20 to 35 inches of rainfall annually. The timing of precipitation in the Applegate Subbasin can be separated into a winter season of frequent storm events and a long period of summer drought.

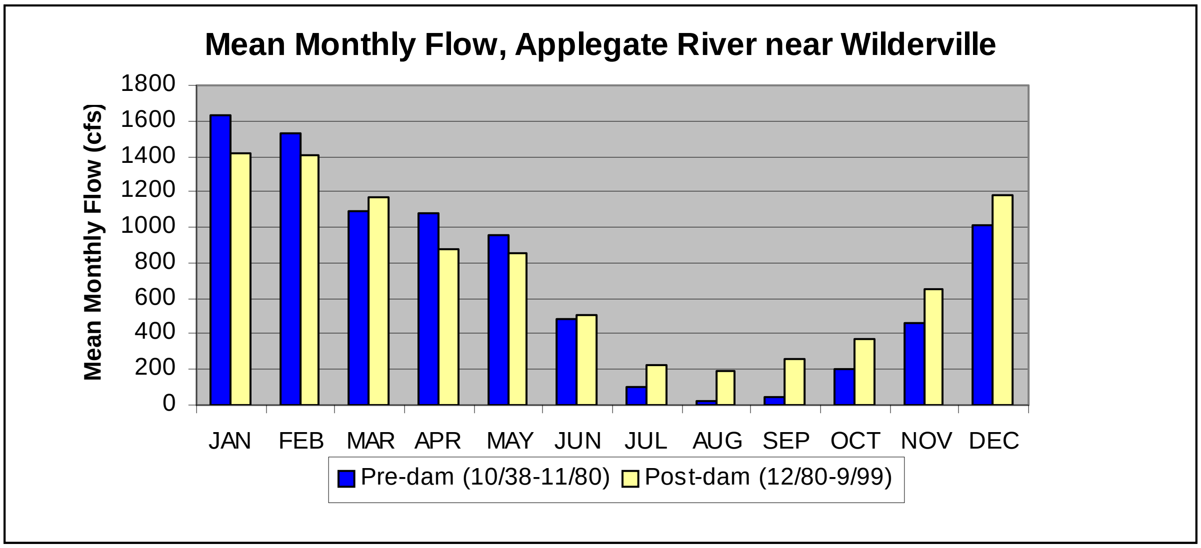
Winter precipitation at elevations above 5,000 feet generally falls as snow. Between 3,500 and 5,000 feet a mixture of rain and snow occurs and this elevation band is called the transient snow zone or rain-on-snow dominated zone. The snow level in this zone fluctuates throughout the winter in response to alternating warm and cold fronts. Rain-on-snow events in this elevation range can cause very high peak flows resulting in flooding and severe erosion.

Air temperatures display wide variations throughout the subbasin, daily, seasonally, and by elevation. Average maximum daily temperatures are 89^{o}F in Ruch during July and August (USDI 1998).

Streamflows

Streamflows in the Applegate River have been regulated by the Applegate Reservoir since its completion in December 1980. The United States Geological Survey (USGS) has operated a streamflow gaging station near Wilderville (located 7.6 miles upstream from the mouth of Applegate River) from October 1938 to September 1955 and from September 1978 to the present. For the period of record, a maximum discharge of 47,500 cubic feet per second (cfs) occurred on January 18, 1953 and outside the period of record, an estimated maximum discharge of 66,500 cfs occurred on December 22, 1955 (USGS 2002). Floods of December 22, 1964 and January 15, 1974 are known to have exceeded the December 1955 flood. Most of the runoff and flooding on the Applegate River and its tributaries are caused by winter rains, with major floods occurring when winter rains combine with melting snow. Summer low flows ranged from less than one cfs to 60 cfs prior to the completion of the Applegate Reservoir, and from 35 cfs to 140 cfs after the reservoir. The reservoir has moderated both high and low flows in the mainstem. There are fewer and smaller peak flows and also fewer extreme low flow conditions. Figure 9 shows a comparison of mean monthly flows at the Wilderville gaging station before and after completion of the Applegate Reservoir.

Figure 9. Comparison of Mean Monthly Flows Before and After Completion of the Applegate Reservoir



Aquatic Wildlife Species

The Applegate River system is an important tributary to the Rogue River for anadromous salmonids spawning and rearing habitat. Although the Applegate Subbasin is only about twelve percent of the total acreage in the Rogue, it provides spawning habitat for an estimated one-third of all the coho salmon coming up into the Rogue River (USDA and USDI 1998). Stream surveys indicate that 236 miles of streams in the subbasin support anadromous species, primarily in the main stem of Applegate River, Slate Creek, Cheney Creek, Williams Creek, Thompson Creek, Little Applegate River, Beaver Creek, Palmer Creek, and Star Gulch (Figures 10-12). Anadromous fish distribution is often limited by waterfalls or steep gradient cascades in tributaries. Although the USFS and BLM manage nearly 70 percent of lands within the Applegate Subbasin, only 28.4 percent (67 miles) of the anadromous fish-bearing streams cross federal lands.

Resident or non-anadromous trout also occur naturally (rainbow and cutthroat) or have been introduced for recreational purposes (brook trout and brown trout). Rainbow and cutthroat trout are found throughout the subbasin (Figure 13). Several other species of introduced game fish also inhabit the Applegate River system, as do numerous native non-game species. Various species of amphibians and reptiles occur in the subbasin including sensitive species such as the tailed frog, red-legged frog, foothills yellow-legged frog, Pacific giant salamander, and western pond turtle (USDA and USDI 1995).

Figure 10. Chinook Salmon Distribution in the Applegate Subbasin

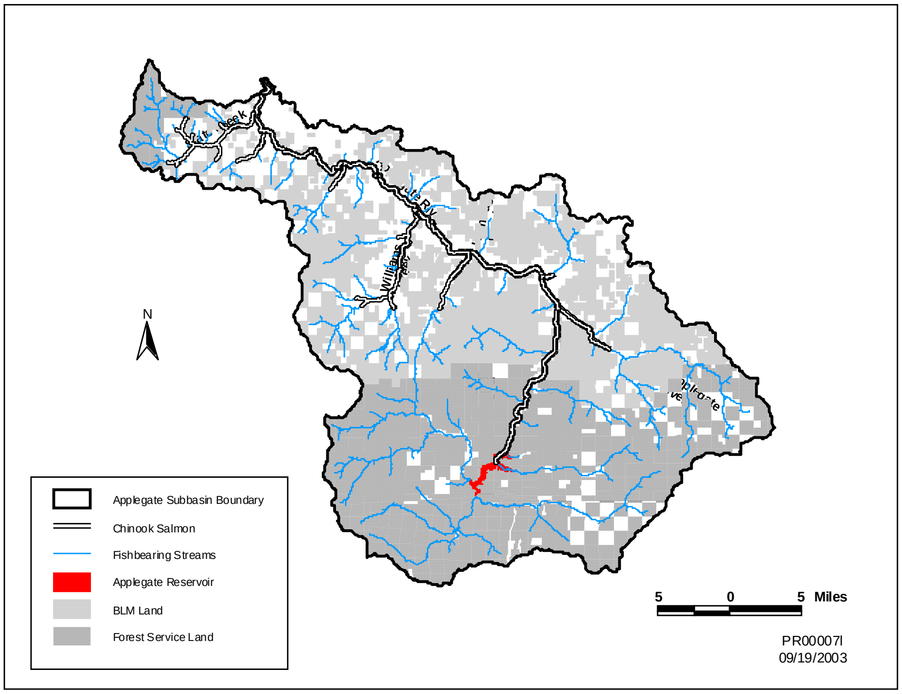


Figure 11. Coho Salmon Distribution in the Applegate Subbasin

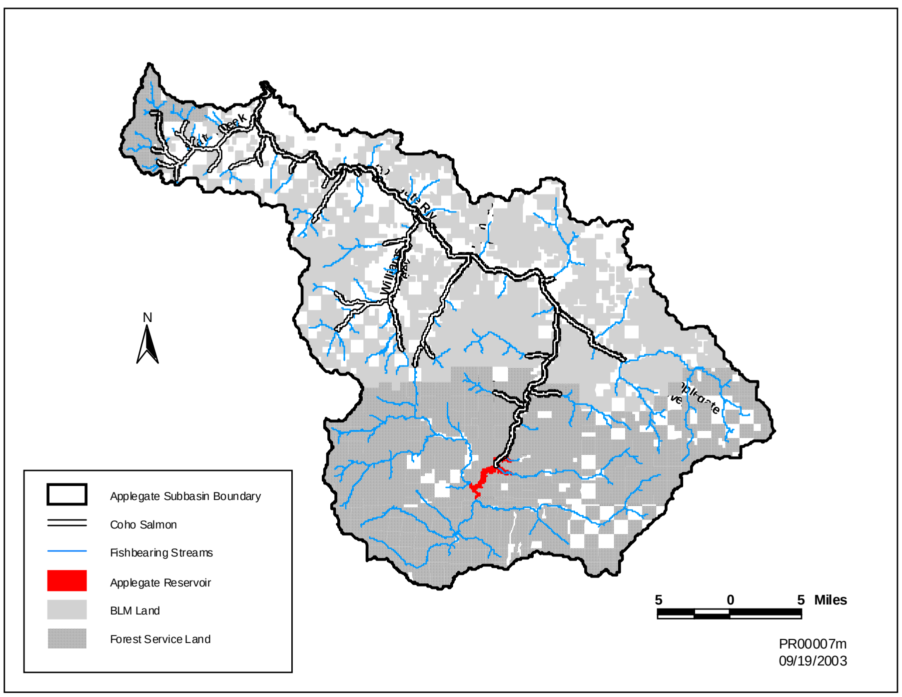


Figure 12. Steelhead Distribution in the Applegate Subbasin

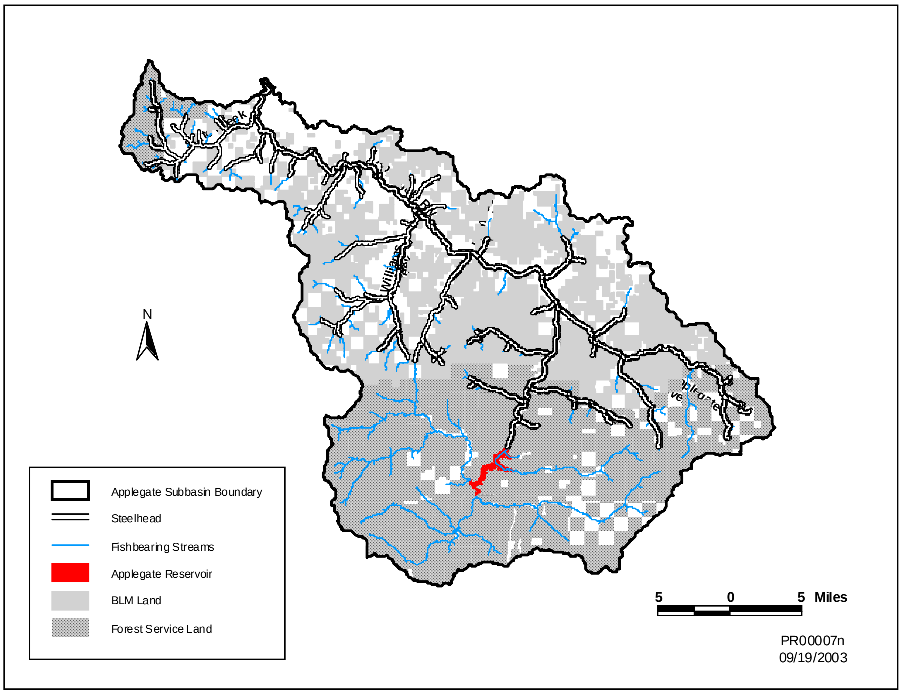
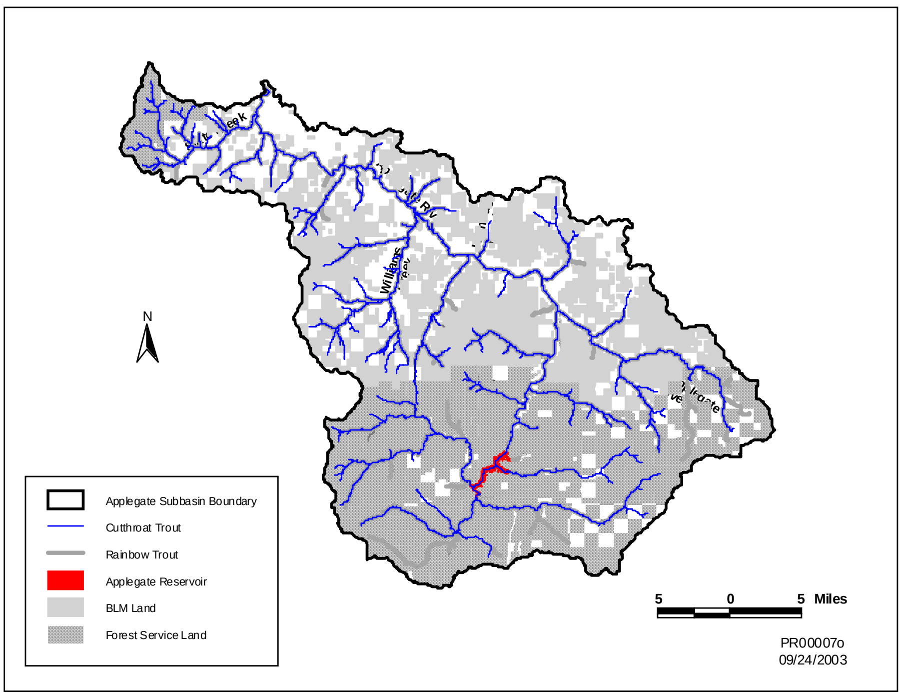


Figure 13. Resident Trout Distribution in the Applegate Subbasin



The primary elements that are likely limiting fish populations within the subbasin are high water temperature during the summer, excess fine sediment, extensive areas of oversimplified habitat, low summer flows in tributaries, no fish passage above Applegate Dam, and regulated streamflows in the mainstem (USDA and USDI 1995). When considered separately, it is not likely that any one of these attributes could solely be responsible for degraded aquatic habitat conditions for fish species. However, when considered cumulatively, all these factors add up to an aquatic environment that is applying stress to populations of aquatic organisms.

Watershed Analysis

Watershed analyses are a required component of the ACS under the NWFP. Ten watershed analyses have been completed for watershed areas that combined cover the Applegate Subbasin (Table 6). This WQRP tiers to and appends those documents. A summary of historical and present watershed conditions in the Applegate Subbasin (Table 7) has been compiled from the ten watershed analysis documents. The analysis and recommendations found in this WQRP use data from the watershed analyses. Five additional documents have been prepared for the Applegate Subbasin and were used as references for this WQRP: *Words into Action: A Community Assessment of the Applegate Valley* (Preister 1994), *Applegate Adaptive Management Area Ecosystem Health Assessment* (USDA and USDI 1994b), *Applegate Watershed Assessment* (ARWC 1994), *Applegate River Watershed Assessment: Aquatic, Wildlife, and Special Plant Habitat* (USDA and USDI 1995), and *Applegate Adaptive Management Area Guide* (USDA and USDI 1998). Additional analysis and recommendations have been included in this WQRP where data were incomplete or new information was available.

Table 6. Watershed Analyses Completed for the Applegate Subbasin

Watershed Analysis	Agency	Year Completed
Beaver and Palmer Creeks	USFS	1994
Little Applegate River	BLM/USFS	1995
Squaw/Elliott/Lake	USFS	1995
Middle Applegate	BLM	1995
Carberry Creek	USFS	1996
Cheney/Slate	BLM	1996
Williams	BLM	1996
Middle Fork Applegate River	USFS	1998
Applegate-Star/Boaz	BLM	1998
Murphy	BLM	2000

Table 7. Summary of Watershed Conditions on Federal Lands in the Applegate Subbasin

Riparian Vegetation	
Historical Condition	• Late seral vegetation dominant. • Diverse mix of species and age classes.
Present Condition	• Early to mid seral vegetation dominant. • High density, low vigor conifer stands in forested areas.
Forest Health & Productivity	
Historical Condition	• Frequent, low intensity fires maintained low fuel levels and open under-story. • Forest stands had fewer trees per acre with trees of larger diameter.
Present Condition	• Fire exclusion resulting in high fuel loads. • Forest stands lack resiliency and vigor. • High vegetation densities resulting in extreme competition. • Forests experiencing mortality due to beetle infestations. • Soil compaction in some areas due to tractor harvest resulting in slower vegetative re-growth.
Large Wood	
Historical Condition	• Probably an abundant supply of large wood in the stream channels.
Present Condition	• Many stream sections have little to no large wood. • Poor large wood recruitment due to streamside harvest and fire exclusion. • Road stream crossings disrupt transport of wood and sediment. • Stream cleaning decreased amount of large wood in the channels.
Roads	
Historic Condition	• Few roads before industrial timber harvesting began in the early 1950s.
Present Condition	• Areas with high road density. • Roads in riparian areas. • High number of stream crossings with many culverts undersized for 100-year flood. • Stream network extension (due to road ditch lines) increases winter peak flows.
Flow Regime	
Historic Condition	• Channel morphology developed in response to climatic conditions and natural ranges of streamflows. • Most likely, peak flows were lower in magnitude and frequency.
Present Condition	• Winter peak flows possibly increased by roads and harvest. • Peak flows in Applegate River reduced below Applegate Dam. • Low flows in Applegate River increased below Applegate Dam.

C. Temperature

Introduction

The sensitive beneficial uses affected by excessive temperatures include resident fish and aquatic life, salmonid fish spawning, and rearing (ODEQ 2003b).

The Oregon water quality temperature standard has been re-written. The standard that now applies to the Applegate Subbasin was approved by EPA on March 2, 2004 and is found in OAR 340-041-0028 (4) (a-c) (ODEQ 2004). Excerpts of the standard read as follows:

(4) Biologically Based Numeric Criteria. Unless superseded by the natural conditions criteria

described in section (8) of this rule, or by subsequently adopted site-specific criteria approved by EPA, the temperature criteria for State waters supporting salmonid fishes are as follows:

(a) The seven-day-average maximum temperature of a stream identified as having salmon and steelhead spawning use on subbasin maps and tables set out in OAR 340-041-0101 to OAR 340-041-0340: Tables 101B, and 121B, and Figures 130B, 151B, 160B, 170B, 220B, 230B, 271B, 286B, 300B, 310B, 320B, and 340B, may not exceed 13.0 degrees Celsius (55.4 degrees Fahrenheit) at the times indicated on these maps and tables;

(b) The seven-day-average maximum temperature of a stream identified as having core cold water habitat use on subbasin maps set out in OAR 340-041-101 to OAR 340-041-340: Figures 130A, 151A, 160A, 170A, 220A, 230A, 271A, 286A, 300A, 310A, 320A, and 340A, may not exceed 16.0 degrees Celsius (60.8 degrees Fahrenheit);

(c) The seven-day-average maximum temperature of a stream identified as having salmon and trout rearing and migration use on subbasin maps set out at OAR 340-041-0101 to OAR 340-041-0340: Figures 130A, 151A, 160A, 170A, 220A, 230A, 271A, 286A, 300A, 310A, 320A, and 340A, may not exceed 18.0 degrees Celsius (64.4 degrees Fahrenheit);

Fish use maps 271A and 271B for the Applegate Subbasin temperature water quality standards can be found at: http://www.deq.state.or.us/wq/standards/WQStdsFinalFishUseMaps.htm. Perennial streams in the Applegate River-McKee Bridge and Little Applegate River watersheds are designated as core cold water habitat on fish use map 271A. The Applegate River is also designated as core cold water habitat between the Little Applegate River and Forest Creek confluences.

A stream is listed as water quality limited for temperature if there is documentation that the seven-day moving average of the daily maximums (7-day statistic) exceeds the appropriate standard listed above. This represents the warmest seven-day period and is calculated by a moving average of the daily maximums. The critical period in the Applegate Subbasin is from June 1 through October 31 (ODEQ 2003b). This is the period when stream temperatures exceed the numeric criterion. The 1998 and 2002 303(d) listings for the Applegate Subbasin are based on the State of Oregon water quality standards adopted in 1996. The 1996 temperature criteria are included in the *Applegate Subbasin TMDL* (ODEQ 2003b). DEQ is in the process of reviewing the 303(d) listed streams under the new temperature criteria.

Within the Applegate Subbasin, 13 stream segments are on the 2002 303(d) list for exceeding the 64°F 7-day statistic for rearing salmonids and one stream segment is on the 2002 303(d) list for exceeding the 55°F 7-day statistic for spawning salmonids (Table 8 and Figure 14). Stream temperatures in the Applegate River exceed the 64°F numeric criteria in August and September and the 55°F criteria in June, July and October (ODEQ 2003b).

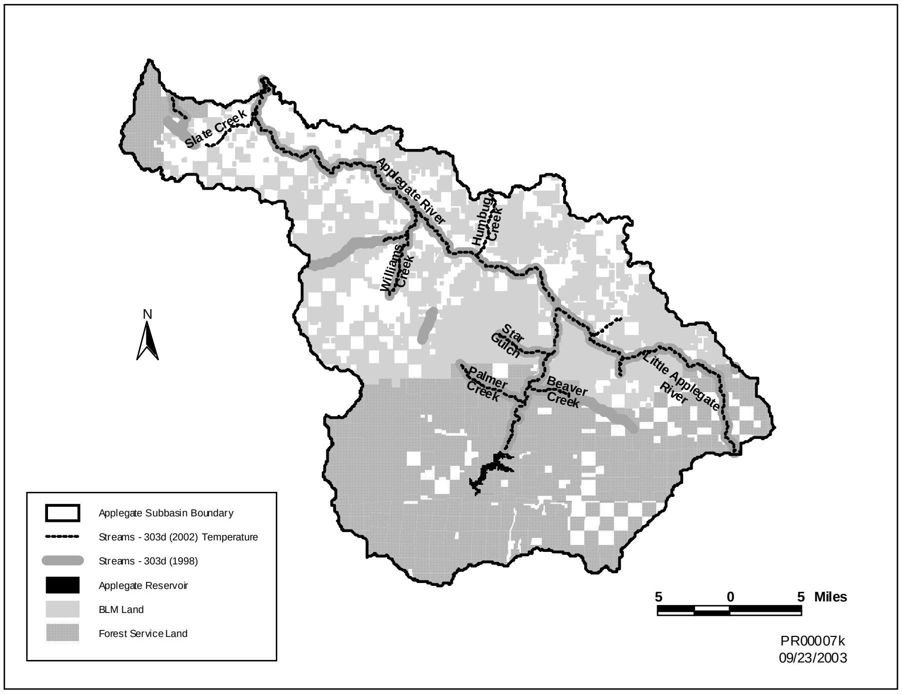
Table 8. Applegate Subbasin 2002 303(d) Temperature Listed Streams and 1998 303(d) Temperature Listed Streams that are Listed as Potential Concern in 2002

Year Listed[1]	Stream Segment	Listed Parameter	Applicable Rule	Miles Affected
1998	Applegate River, mouth to Applegate Reservoir	Summer Temperature	OAR 340-041-0365(2)(b)(A)	50
2002	Beaver Creek, RM 0 to 3.5	Summer Temperature	OAR 340-041-0365(2)(b)(A)	3.5
2002	Humbug Creek, RM 0 to 5	Summer Temperature	OAR 340-041-0365(2)(b)(A)	5.0
1998	Little Applegate River, mouth to headwaters	Summer Temperature	OAR 340-041-0365(2)(b)(A)	21

Year Listed[1]	Stream Segment	Listed Parameter	Applicable Rule	Miles Affected
1998	Palmer Creek, mouth to headwaters	Summer Temperature	OAR 340-041-0365(2)(b)(A)	5.7
2002	Powell Creek, mouth to RM 2.0	Spawning Temperature Oct 1 – May 31	OAR 340-041-0365(2)(b)(A)	2.0
2002	Slate Creek, RM 0 to 5.3	Summer Temperature	OAR 340-041-0365(2)(b)(A)	5.3
1998	Star Gulch, mouth to 1918 Gulch	Summer Temperature	OAR 340-041-0365(2)(b)(A)	4.0
2002	Sterling Creek, mouth to RM 2.5	Summer Temperature	OAR 340-041-0365(2)(b)(A)	2.5
1998	Thompson Creek, Mee Cove to Ninemile Creek	Summer Temperature (Potential Concern)	OAR 340-041-0365(2)(b)(A)	2.3
1998	Waters Creek, mouth to RM 2	Summer Temperature (Potential Concern)	OAR 340-041-0365(2)(b)(A)	2.0
1998	Waters Creek, RM 2.4 to 4.3	Summer Temperature	OAR 340-041-0365(2)(b)(A)	1.9
1998	Williams Creek, mouth to East/West Fork confluence	Summer Temperature	OAR 340-041-0365(2)(b)(A)	7.0
1998	Yale Creek, mouth to Waters Gulch	Summer Temperature	OAR 340-041-0365(2)(b)(A)	1.3
Total Stream Miles listed for Summer Temperature Criteria (June 1 to Sept 30)				**107.2**
Total Stream Miles listed as Potential Concern for Summer Temperature Criteria (June 1 to Sept. 30)				**4.2**
Total Stream Miles listed for Spawning Temperature Criteria Exceedances (October 1 to May 31)				**2.0**
Total Stream Miles listed/potential concern for Temperature Criteria Exceedance				**113.4**

[1] This document addresses all listings on the 1998 303(d) list, except two stream segments not included on the 2002 303(d) list because they are attaining criteria and uses, and only the temperature listings on the 2002 303(d) list for the Applegate Subbasin. The entire 2002 303(d) list will be addressed by DEQ as part of the five-year review of the TMDL.

Figure 14. Temperature Listed Stream Reaches on Federal Land in the Applegate Subbasin



Summertime stream temperature data have been collected throughout the Applegate Subbasin between 1993 and 2001 (Tables 9-14). Analysis of this data shows that the highest 7-day statistic (76.7^{o}F) is found at the Wilderville site on the Applegate River. Other sites with 7-day statistics over 70^{o}F include: the Applegate River near Applegate and above the Little Applegate River; Slate Creek at the mouth and above and below Waters Creek; Williams Creek at Provolt Seed Orchard and at the East/West Forks confluence; and the Little Applegate River at the mouth.

Table 9. Upper Applegate River Watershed Temperature Summary

Site Name by Subwatershed	Data Source [1]	Period of Record[2]	7-day Statistic (ave. for all years) (^{o}F)	Range of 7-day Statistic (for all years)		Average[3] # of times/yr 7-Day Statistic > 64 ^{o}F
				Minimum (^{o}F)	Maximum (^{o}F)	
Butte Fork Applegate River						
Butte Fork Applegate River @ Wilderness Bdry.	USFS	1993-1996	60.4	58.2	63.0	CA
Butte Fork Applegate River, Lower	USFS	1993-1999, 2001	61.1	58.1	64.2	CA
Elliott Creek-Dutch Creek						
Dutch Creek	USFS	1995	54.8	54.8	54.8	CA
Elliott Creek #1	USFS	1994-1995, 1997-1998	62.5	58.8	67.3	CA
Creek #2	USFS	1995, 1997-1999, 2001	65.4	62.9	68.2	CA
Elliott Creek abv Mid. Fk. Applegate	USFS	1994-1995	65.0	62.6	67.3	CA
Middle Fork Applegate River						
Cook and Green Creek	USFS	1996-2001	62.6	60.2	64.2	CA
Middle Fork Applegate River	USFS	1995-2001	68.5	64.7	72.2	CA
Sturgis Fork Carberry Creek						
Sturgis Fork Creek, Lower	USFS	1993-2001	65.4	60.1	70.5	22 (n=9)
Sturgis Fork Creek, Upper	USFS	1993-1995	60.9	59.5	62.7	0 (n=3)
Steve Fork Carberry Creek						
Steve's Fork Creek	USFS	1995-1998, 2000-2001	63.6	55.6	66.5	16 (n=6)

Site Name by Subwatershed	Data Source [1]	Period of Record [2]	7-day Statistic (ave. for all years) (°F)	Range of 7-day Statistic (for all years) Minimum (°F)	Maximum (°F)	Average [3] # of times/yr 7-Day Statistic > 64 °F
Lower Carberry Creek						
Carberry Creek	USFS	1995-1996	67.5	64.4	70.5	9 (n=2)
Squaw Creek						
Squaw Creek	USFS	1995-2000	72.0	68.1	76.8	70 (n=6)

1/ ARWC=Applegate River Watershed Council; BLM=Bureau of Land Management; USFS=U.S. Forest Service; USGS=U.S. Geological Survey
2/ June to September
3/ n=number of years of record; CA indicates the site is in California which does not use the same temperature criteria as Oregon

Table 10. Applegate River-McKee Bridge Watershed Temperature Summary

Site Name by Subwatershed	Data Source [1]	Period of Record [2]	7-day Statistic (ave. for all years) (°F)	Range of 7-day Statistic (for all years) Minimum (°F)	Maximum (°F)	Average [3] # of times/yr 7-Day Statistic > 64 °F
Applegate River-Palmer Creek						
Applegate River above Palmer Creek	ARWC	1997-1998	65.1	64.3	65.9	25 (n=2)
Applegate River near Copper	USGS	1993-2001	62.7	60.5	70.2	4 (n=9)
Palmer Creek	USFS	1995-1997, 1999, 2001	66.3	63.4	68.0	33 (n=5)
Palmer Creek abv Nine Dollar Gulch	ARWC	2001	59.4	59.4	59.4	0 (n=1)
Palmer Creek near mouth	ARWC	1997-2001	67.4	63.7	73.5	23 (n=5)
Applegate River-Beaver Creek						
Beaver Creek #1	USFS	1995-2001	63.0	61.1	64.5	1 (n=7)
Beaver Creek #2	USFS	1995-2001	65.1	62.8	67.4	15 (n=7)
Beaver Creek @ sec. 11/12 bdry	BLM	1999	61.7	61.7	61.7	0 (n=1)
Beaver Creek @ sec. 11/12 bdry	ARWC	2001	63.9	63.9	63.9	0 (n=1)
Beaver Creek below Petes Camp Cr.	BLM	1999	61.6	61.6	61.6	0 (n=1)
Beaver Creek below Petes Camp Cr.	ARWC	2001	64.1	64.1	64.1	2 (n=1)
Beaver Creek near mouth	ARWC	1997-2000	68.8	67.0	70.8	55 (n=4)
Haskins Gulch #1	USFS	1995-2001	56.6	51.9	59.3	0 (n=7)
Haskins Gulch #2	USFS	1995-1997, 1999-2001	58.0	54.6	61.1	0 (n=6)
Applegate River-Star Gulch						
1917 Gulch near mouth	BLM	1998-2000	62.3	61.0	63.3	0 (n=3)
Alexander Gulch at mouth	BLM	1996-1997, 1999-2000	60.9	59.6	62.6	0 (n=4)
Applegate River above Little Applegate	ARWC/ BLM	1994-1996, 1998-2001	71.1	69.1	76.7	81 (n=7)
Benson Gulch near mouth	BLM	1996-2000	60.9	59.9	62.2	0 (n=5)
Deadman Gulch near mouth	BLM	1996-1997	57.2	56.0	58.4	0 (n=2)
Ladybug Gulch at mouth	BLM	1996-2000	59.3	58.2	59.9	0 (n=5)
Lightning Gulch near mouth	BLM	1996-2000	61.6	60.2	62.3	0 (n=5)
Star Gulch 1 mi. above mouth	BLM	1993-2001	64.6	60.0	67.7	18 (n=9)
Star Gulch above 1917 Gulch	BLM	1998-1999	62.1	60.7	63.4	0 (n=2)
Star Gulch above Alexander Gulch	BLM	1997-1999	60.7	60.0	61.9	0 (n=3)
Star Gulch above Benson Gulch	BLM	1996, 1998-1999	65.0	63.2	65.9	11 (n=3)
Star Gulch above Deadman Gulch	BLM	1993-2001	59.2	54.1	62.3	0 (n=9)
Star Gulch above Ladybug Gulch	BLM	1996-1999	62.2	60.6	64.3	1 (n=4)
Star Gulch above Lightning Gulch	BLM	1996, 1998-1999	62.9	61.3	64.1	1 (n=4)

1/ ARWC=Applegate River Watershed Council; BLM=Bureau of Land Management; USFS=U.S. Forest Service; USGS=U.S. Geological Survey
2/ June to September
3/ n=number of years of record

Table 11. Little Applegate River Watershed Temperature Summary

Site Name by Subwatershed	Data Source[1]	Period of Record[2]	7-day Statistic (ave. for all years) (°F)	Range of 7-day Statistic (for all years) Minimum (°F)	Range of 7-day Statistic (for all years) Maximum (°F)	Average[3] # of times/yr 7-Day Statistic Over 64 °F
Upper Little Applegate River						
Bear Gulch	USFS[4]	1994-2000	59.6	57.8	60.8	0 (n=7)
First Water Gulch near mouth	BLM	1999	58.2	58.2	58.2	0 (n=1)
Glade Creek near mouth	USFS[4,5]	1993-2001	63.1	59.4	65.1	2 (n=9)
Lake Creek near mouth	USFS[4]	1994-2000	56.1	55.0	57.0	0 (n=7)
Little Applegate River abv Bear Gulch	USFS[4,5]	1994-2001	60.8	58.2	62.9	0 (n=8)
Little Applegate River abv Glade Cr.	USFS[4]	1994-2000	65.4	61.6	68.0	13 (n=7)
Little Applegate River blw McDonald Cr.	USFS[4,5]	1994-2001	63.6	59.9	65.9	6 (n=8)
McDonald Creek abv McDonald Ditch div.	BLM	2001	61.4	61.4	61.4	0 (n=1)
McDonald Creek near mouth	USFS[4]	1994-2000	61.4	58.4	63.5	0 (n=7)
McDonald Creek, upper	USFS[4,5]	1994-2001	58.2	54.5	62.1	0 (n=8)
Sheep Creek abv McDonald Ditch diversion	BLM	2001	58.0	58.0	58.0	0 (n=1)
Middle Little Applegate River						
Lick Gulch near mouth	BLM	1999	56.6	56.6	56.6	0 (n=1)
Little Applegate R. @ Tunnel Ridge trail	BLM	1994-2001	65.2	61.9	67.6	11 (n=8)
Little Applegate River below Owl G.	BLM	1999	62.4	62.4	62.4	0 (n=1)
Little Applegate River below Rush Cr.	BLM	1999	62.3	62.3	62.3	0 (n=1)
Muddy Gulch sec. 23	BLM	1999	56.9	56.9	56.9	0 (n=1)
Rush Creek abv sec 19/30 bdry	BLM	1999	59.3	59.3	59.3	0 (n=1)
Yale Creek						
Box Canyon Creek abv mouth	BLM	1994, 1996-1997, 2001	59.7	55.8	62.2	0 (n=4)
Crapsey Gulch abv mouth	USFS[4,5]	1994-2001	59.3	57.5	62.6	0 (n=8)
Dog Fork near mouth	USFS[4,5]	1994-2001	60.7	59.2	62.6	0 (n=8)
Waters Gulch near mouth	BLM	1994-2001	60.8	56.1	64.3	1 (n=8)
Yale Creek abv Box Canyon Creek	BLM	1994-1995, 1997-2001	61.6	58.6	63.5	0 (n=7)
Yale Creek abv Crapsey Gulch	USFS[4,5]	1994-2001	59.3	56.7	60.6	0 (n=8)
Yale Creek abv Waters Gulch	BLM	1994-2001	63.8	61.2	65.6	3 (n=8)
Yale Creek near mouth	ARWC/ BLM	1994-2001	64.7	61.3	67.4	9 (n=8)
Lower Little Applegate River						
Armstrong Gulch abv mouth	BLM	1996-1998	60.3	59.4	61.7	0 (n=3)
Grouse Creek near mouth	ARWC	1997-2001	67.0	63.8	68.3	28 (n=5)
Little Applegate River below Sterling Cr.	ARWC/ BLM	1994, 1996, 1998-2000	69.9	67.8	70.8	59 (n=5)
Little Applegate River below Yale Cr.	ARWC/ BLM	1994-2001	67.8	63.3	72.7	34 (n=8)
Little Applegate River @ mouth	ARWC/ BLM	1993-2001	72.8	64.0	78.7	70 (n=9)
Sterling Creek abv Armstrong Gulch	BLM	1994-2001	60.1	57.7	63.9	0 (n=8)
Sterling Creek near mouth	ARWC	1997-1998	67.3	63.6	70.9	40 (n=2)

1/ ARWC=Applegate River Watershed Council; BLM=Bureau of Land Management; USFS=U.S. Forest Service
2/ June to September
3/ n=number of years of record
4/ USFS deployed temperature recorders and BLM processed data.
5/ 2001 data was processed by the USFS; 2001 data is based on hourly recordings, rather than 30 min.

Table 12. Middle Applegate River Watershed Temperature Summary

Site Name by Subwatershed	Data Source[1]	Period of Record[2]	7-day Statistic (ave. for all years) (°F)	Range of 7-day Statistic (for all years) Minimum (°F)	Range of 7-day Statistic (for all years) Maximum (°F)	Average[3] # of times/yr 7-Day Statistic Over 64 °F
Applegate River-Spencer Creek						
Rock Gulch abv Lomas Road	BLM	1994-1997, 2000	61.3	59.5	62.0	0 (n=5)
Forest Creek						
Bishop Creek @ lwr BLM bdry sec. 24	BLM	2000	59.7	59.7	59.7	0 (n=1)

Site Name by Subwatershed	Data Source[1]	Period of Record[2]	7-day Statistic (ave. for all years) (°F)	Range of 7-day Statistic (for all years)		Average[3] # of times/yr 7-Day Statistic Over 64 °F
				Minimum (°F)	Maximum (°F)	
Forest Creek abv Poorman Creek	BLM	1995-1996	58.8	58.7	58.8	0 (n=2)
Forest Creek near mouth	ARWC	1995-2000	63.6	59.2	67.3	17 (n=6)
Forest Creek, Right Fork	BLM	1997-1999, 2001	61.1	59.3	62.0	0 (n=4)
Oregon Belle Creek abv mouth	BLM	1997-2001	58.6	56.6	60.0	0 (n=5)
Applegate River-Humbug Creek						
Applegate River near Applegate	USGS	1993-2001	72.9	70.3	77.6	85 (n=9)
Balls Branch abv Humbug Creek	BLM	1998-2000	59.3	58.7	60.1	0 (n=3)
Balls Branch abv L. Fk. Balls Branch	BLM	1998-2000	58.9	58.3	59.2	0 (n=3)
Balls Branch, L. Fk. abv mouth	BLM	1998-2000	55.4	54.6	56.6	0 (n=3)
Chapman Creek	BLM	1995, 1998, 2000	57.3	55.2	58.5	0 (n=3)
China Gulch @ lwr BLM bdry sec. 16	BLM	2000	59.0	59.0	59.0	0 (n=1)
Keeler Creek @ lwr BLM bdry sec. 25	BLM	1998-2000	65.8	64.3	67.4	17 (n=3)
Keeler Creek @ sec. 25/26 line	BLM	2000	65.6	65.6	65.6	15 (n=1)
Keeler Creek @ sec. 26/35 line	BLM	2000	61.7	61.7	61.7	0 (n=1)
Keeler Creek @ sec. 34/35 line	BLM	2000	59.0	59.0	59.0	0 (n=1)
Long Gulch @ lwr BLM bdry sec. 19	BLM	2001	51.3	51.3	51.3	0 (n=1)
Thompson Creek						
Hinkle Gulch @ lwr BLM bdry sec. 27	BLM	2000	60.5	60.5	60.5	0 (n=1)
Jamison Creek @ lwr BLM bdry sec. 7	BLM	2000	64.3	64.3	64.3	7 (n=1)
Ninemile Creek	BLM	1994-1997, 2000	60.0	58.9	60.7	0 (n=5)
Tallowbox Creek @ lwr BLM bdry sec. 5	BLM	2000	62.7	62.7	62.7	0 (n=1)
Tallowbox Creek @ sec. 4/9 line	BLM	2000	58.1	58.1	58.1	0 (n=1)
Thompson Creek abv Ninemile Creek	BLM	1994-1997, 2000	61.9	57.7	63.6	0 (n=5)
Thompson Creek abv Tallowbox Cr.	ARWC	1996, 1998-2001	66.9	65.0	69.3	39 (n=5)
Thompson Creek blw Jamison Cr.	BLM	2000	69.2	69.2	69.2	51 (n=1)
Unnamed trib. To Thompson Cr. Sec. 33	BLM	2000	64.5	64.5	64.5	9 (n=1)
Unnamed trib. To Thompson Cr. Sec. 17/18	BLM	2000	60.1	60.1	60.1	0 (n=1)
Applegate River-Slagle Creek						
Ferris Gulch @ lwr BLM bdry sec. 30	BLM	2000	62.7	62.7	62.7	0 (n=1)
Slagle Creek near BLM bdry sec. 4	BLM	2001	55.7	55.7	55.7	0 (n=1)

1/ ARWC=Applegate River Watershed Council; BLM=Bureau of Land Management; USFS=U.S. Forest Service; USGS=U.S. Geological Survey
2/ June to September
3/ n=number of years of record

Table 13. Williams Creek Watershed Temperature Summary

Site Name by Subwatershed	Data Source[1]	Period of Record[2]	7-day Statistic (ave. for all years) (°F)	Range of 7-day Statistic (for all years)		Average[3] # of times/yr 7-Day Statistic Over 64 °F
				Minimum (°F)	Maximum (°F)	
East Fork Williams Creek						
Glade Fork @ mouth	BLM	1994-1999	61.4	59.9	63.2	0 (n=6)
Pipe Fork @ sec. 35/26 line	BLM	1994-2001	59.4	57.8	60.9	0 (n=8)
Rock Creek abv mouth	BLM	1994-1999	59.8	58.9	61.6	0 (n=6)
Williams Creek, E.Fk. abv Glade Creek	BLM	1994-1999	62.0	60.5	63.1	0 (n=6)
Williams Creek, E.Fk. abv W.Fk. confl.	ARWC	1998-1999	67.1	65.5	68.6	38 (n=2)
Williams Creek, E. Fk. abv W.Fk. confl.	ARWC	2000-2001	68.2	67.5	68.9	50 (n=2)
Williams Creek, E.Fk. blw Rock Creek	ARWC	2000-2001	64.0	63.6	64.4	3 (n=2)
West Fork Williams Creek						
Bill Creek abv unnamed trib., sec. 13	BLM	1997-1999, 2001	59.0	57.2	60.2	0 (n=4)
Bill Creek abv W.Fk. Williams Creek	BLM	1994-1999, 2001	60.9	59.7	61.8	0 (n=7)
Munger Creek blw N.Fk. Munger Creek	BLM	1997-1999	61.2	60.6	61.7	0 (n=3)
Munger Creek abv W.Fk. Williams Cr.	ARWC	1996-2000	64.5	63.1	65.8	6 (n=5)
Unnamed Trib. To W.Fk. Williams Cr.	BLM	1994-1997	59.9	58.5	61.1	0 (n=4)
Williams Creek, W. Fk. @ Cave Camp Rd.	ARWC	1998-2001	64.4	62.5	66.1	5 (n=4)
Williams Creek, W.Fk. @ sec 19/18 line	BLM	1994-1997	59.7	58.4	61.4	0 (n=4)
Williams Creek, W.Fk. abv Munger Cr.	ARWC	1998-2001	65.2	62.7	67.5	16 (n=4)

Site Name by Subwatershed	Data Source[1]	Period of Record[2]	7-day Statistic (ave. for all years) (°F)	Range of 7-day Statistic (for all years)		Average[3] # of times/yr 7-Day Statistic Over 64 °F
				Minimum (°F)	Maximum (°F)	
Williams Creek, W.Fk. blw Munger Cr.	ARWC	1998	66.8	66.8	66.8	40 (n=1)
Lower Williams Creek						
Powell Creek @ sec. 17/16 line	BLM	1998, 2001	66.0	65.3	66.6	14 (n=2)
Powell Creek @ mouth	ARWC	1997	66.9	66.9	66.9	17 (n=1)
Powell Creek @ lwr BLM bdry sec. 15	BLM	1994-2001	67.0	65.2	68.2	32 (n=7)
Powell Creek @ sec. 16/17 line	ARWC	1995	61.6	61.6	61.6	0 (n=1)
Powell Creek abv unnamed trib. Sec. 17	BLM	1999-2001	62.4	60.7	63.6	0 (n=3)
Powell Creek @ rd xing sec. 19	BLM	1999-2001	58.7	57.7	59.8	0 (n=3)
Powell Creek abv road xing sec. 25	BLM	1999-2001	54.5	54.0	54.7	0 (n=3)
Unnamed trib. To Powell Creek sec. 17	BLM	1999	61.7	61.7	61.7	0 (n=1)
Wallow Creek	BLM	2000	60.2	60.2	60.2	0 (n=1)
Williams Creek @ E. & W. Fks. Confl.	ARWC	1998, 2000-2001	71.3	70.4	72.5	78 (n=3)
Williams Creek abv Banning Creek	ARWC	1997-2001	69.6	67.1	72.2	73 (n=5)
Williams Creek below Powell Creek	ARWC	1995-1999	69.9	64.7	73.6	58 (n=5)
Williams Creek @ Provolt Seed Orch.	BLM	1994-2001	72.1	69.0	75.3	90 (n=7)

1/ ARWC=Applegate River Watershed Council; BLM=Bureau of Land Management; USFS=U.S. Forest Service
2/ June to September
3/ n=number of years of record

Table 14. Lower Applegate River Watershed Temperature Summary

Site Name by Subwatershed	Data Source[1]	Period of Record[2]	7-day Statistic (ave. for all years) (°F)	Range of 7-day Statistic (for all years)		Average[3] # of times/yr 7-Day Statistic Over 64 °F
				Minimum (°F)	Maximum (°F)	
Applegate River-Murphy Creek						
Murphy Creek @ Cherry Flat, sec. 2	ARWC	1997-2001	63.9	61.9	66.1	8 (n=5)
Murphy Creek near mouth	ARWC	1995	65.8	65.8	65.8	43 (n=1)
Applegate River-Cheney Creek						
Applegate River near Wilderville	USGS	1993-2001	76.7	72.2	80.9	102 (n=9)
Cheney Creek @ mouth	ARWC	2000-2001	67.0	64.6	69.4	30 (n=2)
Cheney Creek @ sec. 13/18 line	BLM	1997	63.5	63.5	63.5	0 (n=1)
Cheney Creek, sec. 13	ARWC	1995-2001	63.5	58.4	65.9	10 (n=7)
Slate Creek						
Bear Gulch	BLM	1994-1998	65.5	63.9	68.8	19 (n=5)
Slate Creek @ mouth	ARWC	1995, 1997-2001	71.7	63.9	75.4	81 (n=6)
Slate Creek @ Jacobs Ranch	ARWC	1995, 1997-2001	67.7	63.7	69.7	41 (n=6)
Slate Creek abv Waters Creek	ARWC	1995-2001	70.0	65.5	73.5	56 (n=7)
Slate Creek blw Waters Creek @ Hwy 199	ARWC	1996	71.8	71.8	71.8	45 (n=1)
Waters Creek above Bear Gulch	BLM	1994-1998	67.0	65.6	68.4	28 (n=5)

1/ ARWC=Applegate River Watershed Council; BLM=Bureau of Land Management; USFS=U.S. Forest Service; USGS=U.S. Geological Survey
2/ June to September
3/ n=number of years of record

Nonpoint Source Factors

Stream temperature is influenced by riparian vegetation, channel morphology, hydrology, climate, and geographic location. While climate and geographic location are outside of human control, the condition of the riparian area, channel morphology and hydrology can be altered by human land use. Human activities that contribute to degraded thermal water quality conditions in the Applegate Subbasin are associated with agriculture, forestry, roads, urban development, and rural residential related riparian disturbance (ODEQ 2003b). Forest and road management are the primary federal-managed activities that have the potential to affect water quality conditions. For the Applegate Subbasin, there are four nonpoint source factors that may result in increased thermal loads: stream shade, stream channel morphology, flow, and natural sources (ODEQ 2003b).

Temperature Factor 1: Stream Shade

Stream temperature is driven by the interaction of many variables. Energy exchange may involve solar radiation, long wave radiation, evaporative heat transfer, convective heat transfer, conduction, and advection (USDA and USDI 2004a). While interaction of these variables is complex, some are much more important than others (USDA and USDI 2004a). The principal source of heat energy for streams is solar energy striking the stream surface (USDA and USDI 2004a). Exposure to direct solar radiation will often cause a dramatic increase in stream temperatures. Highly shaded streams tend to experience cooler stream temperatures due to reduced input of solar energy. Stream surface shade is dependent on riparian vegetation height, location, and density. The ability of riparian vegetation to shade the stream throughout the day depends on vegetation height and the vegetation position relative to the stream. For a stream with a given surface area and stream flow, any increase in the amount of heat entering a stream from solar radiation will have a proportional increase in stream temperature (USDA and USDI 2004a).

Removal of riparian vegetation, and the shade it provides, contributes to elevated stream temperatures (ODEQ 2003b). Activities in riparian areas such as timber harvest, residential and agricultural clearing, placer mining, and road construction, have reduced the amount of riparian vegetation in the Applegate Subbasin. Riparian areas in the subbasin cover less area and contain fewer species than under historic conditions. They tend to be younger in age and dominated by hardwoods (ODEQ 2003b). Large fir, pine, and cedar that existed along streams historically are often absent. Woodland stands are fragmented, creating a patchy, poorly connected landscape of simpler and less biologically productive habitat. These changes have resulted in less shade on stream surfaces and an increase in stream water temperatures (ODEQ 2003b). Such altered riparian areas are not sources of large wood and they lack the cool, moist microclimate that is characteristic of healthy riparian zones.

The primary reason for elevated stream temperatures on USFS and BLM-managed lands is an increase in solar radiation reaching the stream surface following timber harvest or road construction that removed stream shading vegetation. Pre-NWFP management activities along streams on federal lands in the subbasin have left a mosaic of vegetation age classes in the riparian areas. The amount of riparian area with late-successional forest characteristics has declined on federal lands primarily due to timber harvest and road construction within or adjacent to riparian areas. In some cases the large conifers have been replaced by young, small diameter conifer stands and in other cases, hardwoods have replaced conifers as the dominant species in riparian areas. In riparian areas where the trees are no longer tall enough to adequately shade the adjacent streams, the water flowing through these exposed areas is subject to increased solar radiation and subsequent elevated temperatures.

Temperature Factor 2: Stream Channel Morphology

Stream channel morphology can also affect stream temperature. Wide channels tend to have lower levels of shade due to simple geometric relationships between shade producing vegetation and the angle of the sun. For wide channels, the surface area exposed to radiant sources and ambient air temperature is greater, resulting in increased energy exchange between the stream and its environment (ODEQ 2003b). Conversely, narrow channels are more likely to experience higher levels of shade. An additional benefit inherent to narrower/deeper channel morphology is a higher frequency of pools that contribute to aquatic habitat or cold water refugia.

Large wood plays an important role in creating stream channel habitat. Obstructions created by large wood help to settle out gravel. The deposition of gravel helps to decrease thermal loading by reducing the amount of water exposed to direct solar input, as a portion of the water will travel sub-gravel and not be exposed to sun. The loss of large wood in the Applegate Subbasin has had a direct impact on stream channel morphology. Once the large wood was removed, the alluvial material held behind it washed out, causing channels to down-cut and eventually widen, allowing for increased thermal loading and stream heating.

As noted in the *Applegate Subbasin TMDL* (ODEQ 2003b), channel widening is often related to degraded riparian conditions that allow increased streambank erosion and sedimentation of the streambed. Both active streambank erosion and sedimentation correlate strongly to riparian vegetation type and age. Riparian vegetation contributes to rooting strength and floodplain/streambank roughness that dissipates erosive energies associated with flowing water. Established mature woody riparian vegetation adds the highest rooting strengths and floodplain/streambank roughness. Annual (grassy) riparian vegetation communities offer less rooting strength and floodplain/streambank roughness. It is expected that width to depth ratios would be lower (narrower and deeper channels) when established mature woody vegetation is present. Annual (grassy) riparian communities may allow channels to widen and become shallower.

Changes in sediment input can lead to a change in channel morphology (USDA 1999). When sediment input increases over the transport capability of the stream, sediment deposition can result in channel filling, thereby increasing the width-depth ratio. During storm events, management-related sources can increase sediment inputs over natural and contribute to channel widening and stream temperature increases. Roads and mass wasting (both natural and human-caused) are the two primary sediment sources on federal lands in the Applegate Subbasin.

Temperature Factor 3: Streamflow

Streamflow can influence stream temperature. The temperature change produced by a given amount of heat is inversely proportional to the volume of water heated (USDA 1999). A stream with less flow will heat up faster than a stream with more flow given all other channel and riparian characteristics are the same. Groundwater inflow tends to cool summertime stream temperatures and augment summertime flows (USDA and USDI 2001).

The Applegate Subbasin experiences extreme flow conditions typical of southwest Oregon streams. Historical flows are a function of seasonal weather patterns: rain and snow in the winter months contribute to high flow volumes, while the summer dry season reduces flow. During the 2001 drought year, minimum streamflow measured at the Wilderville USGS gaging station was 7 cfs.

According to the *Applegate Subbasin TMDL* (ODEQ 2003b): "Significant flow in the mainstem and Little Applegate River is allocated for irrigation, mining and domestic use. No new consumptive water rights for live stream flows have been issued in the Applegate since July 1934, when it was determined that natural stream flows were insufficient to meet existing consumptive rights during the irrigation season. However consumptive rights for stored water from the Applegate reservoir are still available. In addition, domestic (in-house human consumption) rights may still be obtained if the applicant can demonstrate that surface water is the only available source for their use."

Water withdrawals have the potential and likely impact surface water temperatures within the Applegate Subbasin (ODEQ 2003b). Analysis for this WQRP identified no federal water withdrawals that are affecting stream temperature in the Applegate Subbasin. Private water withdrawals from federal lands contribute to elevated temperatures on some streams. The management of water withdrawals is within the jurisdiction of the Oregon Water Resources Department and as such the USFS and BLM have no authority in this area. No flow targets or changes in water use are identified in the *Applegate Subbasin TMDL* (ODEQ 2003b).

Temperature Factor 4: Natural Sources

Natural processes that may elevate stream temperature include drought, floods, fires, insect and disease damage to riparian vegetation, and blowdown in riparian areas. The gain and loss of riparian vegetation by natural process will fluctuate within the range of natural variability. This WQRP focuses on human-caused disturbances that affect stream temperature (temperature factors 1-3) and does not discuss natural sources.

Temperature TMDL Loading Capacity and Allocations (ODEQ 2003b)

Loading Capacity: The loading capacity for the Applegate Subbasin Temperature TMDL is reached when: (1) National Pollutant Discharge Elimination System (NPDES) permitted point source effluent discharge and Applegate Dam releases result in no measurable temperature increases in surface waters and (2) solar loading is reduced to that of system potential.

The load allocation for temperature is allocated 100 percent to natural sources (Table 15). Any activity that results in anthropogenic-caused heating of the stream is unacceptable. There are no NPDES permitted point source discharges on federal lands in the Applegate Subbasin.

Table 15. Temperature TMDL Allocations (ODEQ 2003b)

Nonpoint Sources: Load Allocations by Land Use	
Source	***Load Allocation*** ***Distribution of Solar Radiation Loading Capacity***
Natural	100%
Agriculture	0%
Forestry	0%
Urban	0%
Transportation	0%
Future Sources	0%
Point Sources: Waste Load Allocations by Source	
Source	***Waste Load Allocation*** ***Distribution of Point Source Loading Capacity***
Current and Future NPDES Permit holders	No measurable increase[1] over system potential surface water temperatures
NPDES Permitted Activities: Recreational Mining	No measurable increase[1] in surface water temperatures
Dams: Load Allocation	
Source	***Waste Load Allocation*** ***Distribution of Point Source Loading Capacity***
Applegate Dam	No measurable increase[1] in surface water temperatures above that which would occur under natural conditions

1/ No measurable increase is defined as no more than 0.25^{o}F.

The nonpoint source loading capacity in the Applegate Subbasin is defined as the amount of solar radiation that reaches a stream surface when riparian vegetation and stream channels have achieved system potential. System potential, as defined in the *Applegate Subbasin TMDL* (ODEQ 2003b), is the near stream vegetation condition that can grow and reproduce on a site, given elevation, soil properties, plant biology, and hydrologic processes. System potential is an estimate of a vegetation condition without anthropogenic activities that disturb or remove near-stream vegetation.

A TMDL allows for the use of surrogate measures to achieve loading capacity. Percent-effective shade serves as the surrogate measure for meeting the temperature TMDL. Percent-effective shade is defined as the percent reduction of solar radiation load delivered to the water surface (ODEQ 2003b). It can be measured in the field and relates directly to solar loading.

Targets have not been set for the width of future channels in the Applegate Subbasin however, stream channel conditions are expected to improve as riparian vegetation matures. Because improvements are anticipated but not included in system potential, these conservative assumptions serve as an implicit margin of safety (ODEQ 2003b).

System potential shade targets (percent-effective shade) along with current shade were calculated for perennial and fish-bearing streams on federal lands within the Applegate River-McKee Bridge, Little Applegate River, and Williams Creek watersheds (Table 16). The Upper Applegate River Watershed was not included in the analysis because there are no 303(d) streams in the watershed. Federal targets for the Middle Applegate River and Lower Applegate River watersheds were not determined because the methods used did not distinguish between land ownerships. Three data analysis methods were used for the assessment: Heatsource 6.0 model (Tier I), Shadow model (Tier II), and a modified Heatsource model (Tier III). The model selection was based on the type of stream data available. These analysis methods are described in the DEQ's *Applegate Subbasin TMDL* (ODEQ 2003b).

Under the Tier II method, the system potential targets and number of years needed to obtain shade recovery were determined from forest growth curves for various tree species within southwestern Oregon. The growth curves project growth rates and maximum heights for the dominant riparian tree species. Target shade values represent the maximum potential stream shade based on the system potential tree height.

It is interesting to note that although Table 16 shows recovery time is needed for Star Gulch and its tributaries to achieve target shade, only Star Gulch has actually exceeded the state temperature criteria (Table 10).

Table 16. Percent-Effective Shade Targets for Federal Lands in the Applegate Subbasin

Applegate River-McKee Bridge Watershed (HUC #1710030902)					
Stream	**Analysis Method[1]**	**Current Shade[2]**	**Target Shade[2]**	**Additional Shade Needed[3]**	**Time to Recovery[4]**
Applegate River	Tier II	61	79	18	88
Beaver Creek	Tier II	86	87	1	0
Armstrong Gulch	Tier II	91	93	2	0
Charlie Buck Gulch	Tier II	92	94	2	0
Hanley Gulch	Tier II	92	93	1	0
Hanley Gulch Tributary	Tier II	96	95	0	0
Haskins Gulch	Tier II	92	93	1	0
Petes Camp Creek	Tier II	93	93	0	0
Brushy Gulch	Tier II	96	98	2	0
Kinney Creek	Tier II	80	97	17	0
Mule Creek	Tier II	88	89	1	0
Mule Creek Tributary	Tier II	93	93	0	0
Palmer Creek	Tier II	84	92	8	0
Bailey Gulch	Tier II	95	98	3	0
Bailey Gulch Tributary	Tier II	93	93	0	0
Lime Gulch	Tier II	93	93	0	0
Nine Dollar Gulch	Tier II	93	93	0	0
Nine Dollar Gulch Trib.	Tier II	96	94	0	0
Palmer Creek Tributary	Tier II	96	98	2	0
Star Gulch	Tier II	61	86	25	73
1917 Gulch	Tier II	63	89	26	76
1918 Gulch	Tier II	62	90	28	83
Alexander Gulch	Tier II	75	92	17	72
Benson Gulch	Tier II	64	94	30	103
Deadman Gulch	Tier II	94	97	3	0
Ladybug Gulch	Tier II	70	92	22	125
Lightning Gulch	Tier II	82	93	11	0
Water Gulch	Tier II	91	97	6	0
Water Gulch Tributary	Tier II	100	100	0	0

Little Applegate River Watershed (HUC #1710030903)					
Stream	**Analysis Method[1]**	**Current Shade[2]**	**Target Shade[2]**	**Additional Shade Needed[3]**	**Time to Recovery[4]**
Little Applegate River	Tier II	93	96	3	0
Glade Creek	Tier II	92	96	4	0
Yale Creek	Tier II	96	98	2	0
Sterling Creek	Tier II	87	95	8	0
Middle Applegate River Watershed (HUC #1710030904)					
Stream	**Analysis Method[1]**	**Current Shade[2]**	**Target Shade[2]**	**Additional Shade Needed[3]**	**Time to Recovery[4]**
Applegate River	Tier I	ND	ND	ND	ND
Thompson Creek	Tier III	ND	ND	ND	ND
Williams Creek Watershed (HUC #1710030905)					
Stream	**Analysis Method[1]**	**Current Shade[2]**	**Target Shade[2]**	**Additional Shade Needed[3]**	**Time to Recovery[4]**
Williams Cr (mouth to forks)	Tier II	33	70	37	12
Powell Creek	Tier II	78	92	14	75
Honeysuckle Creek	Tier II	91	94	3	0
Wallow Creek	Tier II	92	96	4	0
Williams Creek, East Fork	Tier II	91	93	2	0
Clapboard Gulch	Tier II	91	94	3	0
Sugarloaf Gulch	Tier II	89	97	8	0
Glade Creek	Tier II	94	97	3	0
Rock Creek	Tier II	90	93	3	0
Rt. Hand Fk., Rock Creek	Tier II	89	96	7	0
Williams Creek, West Fork	Tier II	84	95	11	0
Bill Creek	Tier II	72	96	24	89
Rt. Hand Fk., WF Williams	Tier II	87	92	5	0
Bear Wallow Creek	Tier II	80	94	14	0
Lone Creek	Tier II	88	97	9	0
Tree Branch	Tier II	89	95	6	0
Munger Creek	Tier II	82	96	14	0
N. Fk. Munger Creek	Tier II	54	92	38	85
Lower Applegate River Watershed (HUC #1710030906)					
Stream	**Analysis Method[1]**	**Current Shade[2]**	**Target Shade[2]**	**Additional Shade Needed[3]**	**Time to Recovery[4]**
Applegate River	Tier I	ND	ND	ND	ND
Cheney Creek	Tier III	ND	ND	ND	ND
Slate Creek	Tier III	ND	ND	ND	ND
Waters Creek	Tier III	ND	ND	ND	ND

1/ Tier I – Heatsource 6.0 model; Tier II – Shadow model; Tier III – Modified Heatsource model.
2/ Current shade and target shade refer to percent-effective shade defined as the percent reduction of solar radiation load delivered to the water surface.
3/ Additional shade needed is the increase in percent-effective shade required to meet the target shade.
4/ If current shade is >80%, the time to recovery is listed as 0 years. If current shade is <80%, the time to recovery is listed as the number of years needed to reach full system potential percent-effective shade. Any increase over 80% effective shade is considered a margin of safety. At a value of >80% effective shade, a stream is considered recovered and the stream should not be a candidate for active restoration. Additional shade should come from passive management of the riparian area. Years to recovery are a weighted average of recovery time for individual stream reaches.
ND = data not determined for federal lands

D. Sedimentation

The following discussion of sedimentation is taken from the DEQ's *Applegate Subbasin TMDL* (ODEQ 2003b).

Within the Applegate Subbasin, Beaver Creek is the only stream on the 1998 303(d) list for sedimentation (Table 17, Figure 2). This listing was based on an analysis of macroinvertebrate populations determined to be impaired due to fine sediments (USDA 1994b). Beaver Creek is also on the 1998 303(d) list for temperature, biological criteria, habitat modification, and flow modification.

Table 17. 303(d) Sediment Listed Stream Reaches in the Applegate Subbasin

Stream Segment	Listed Parameter	Applicable Rule	Miles Affected
Beaver Creek, mouth to Headwaters	Sedimentation	OAR 340-041-0007 (13)	8.7
		Total stream miles listed for sedimentation	**8.7**

State of Oregon water quality standards (ODEQ 2004) related to sedimentation are found in the following Oregon Administrative Rules (OAR):

> *Statewide Narrative Criteria* OAR 340-041-0007 (13) - "The formation of appreciable bottom or sludge deposits or the formation of any organic or inorganic deposits deleterious to fish or other aquatic life or injurious to public health, recreation, or industry shall not be allowed."
>
> *Biocriteria* OAR 340-041-0011 - "Waters of the State shall be of sufficient quality to support aquatic species without detrimental changes in the resident biological communities."
>
> *Turbidity* OAR 340-41-0036 - "No more than a ten percent cumulative increase in natural stream turbidities may be allowed, as measured relative to a control point immediately upstream of the turbidity causing activity."

Beneficial uses are defined in the Oregon Administrative Rules for the Applegate Subbasin and apply to all waterways within the subbasin, including Beaver Creek (Table 1). Sedimentation affects the beneficial uses of Salmonid Fish Spawning, Salmonid Fish Rearing, Resident Fish and Aquatic Life (ODEQ 2003b).

Fine sediments can adversely affect fish and other aquatic organisms by: 1) killing salmonids, 2) reducing growth, or reducing disease resistance; 3) interfering with the development of eggs and larvae; 4) modifying natural movements and migration of salmonids, and 5) reducing the abundance of food organisms (ODEQ 2003b).

Sediment Sources

Sediment is a natural part of stream systems and there is an equilibrium between sediment input, routing, and in-stream storage that needs to be maintained to have healthy stream systems. This means maintaining a balance between the amount of fine sediment, coarse bed load sediment and larger elements of instream structure (wood, boulders). Management activities have affected this natural equilibrium by increasing sediment inputs and decreasing instream storage.

The sediments found in Beaver Creek may be from nonpoint sources associated with forestry activities, roads and road/stream crossings, and agricultural maintenance of riparian areas (ODEQ 2003b). Specific human-caused processes on federal lands that have likely contributed to sedimentation in Beaver Creek include: surface erosion from roads; ditches accelerating peak flows; road/stream crossings; increased peak flows, bank erosion, and surface erosion from timber harvest; and increased mass wasting from timber harvest. Sediment inputs are dependent on quantity and intensity of precipitation. Winter is the time of maximum sediment input and maximum movement of sediments through the system, however, impacts from sediment are yearlong.

Beaver Creek Drainage Description, Ownership, and Land Uses

The Beaver Creek analysis watershed encompasses approximately 14,018 acres in the Applegate Subbasin (Figure 15). It is located in the Klamath Mountains Physiographic Province and ranges in elevation from 1,600 feet to over 5,200 feet. Ownership found in the Beaver Creek drainage consists of USFS, Rogue River National Forest (69 percent), BLM Medford District (19 percent), and private (12 percent). Land uses include forestlands, agricultural lands, rural residences, and transportation uses.

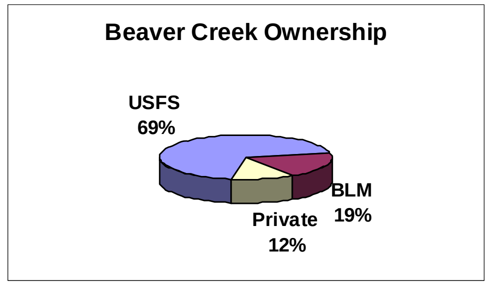
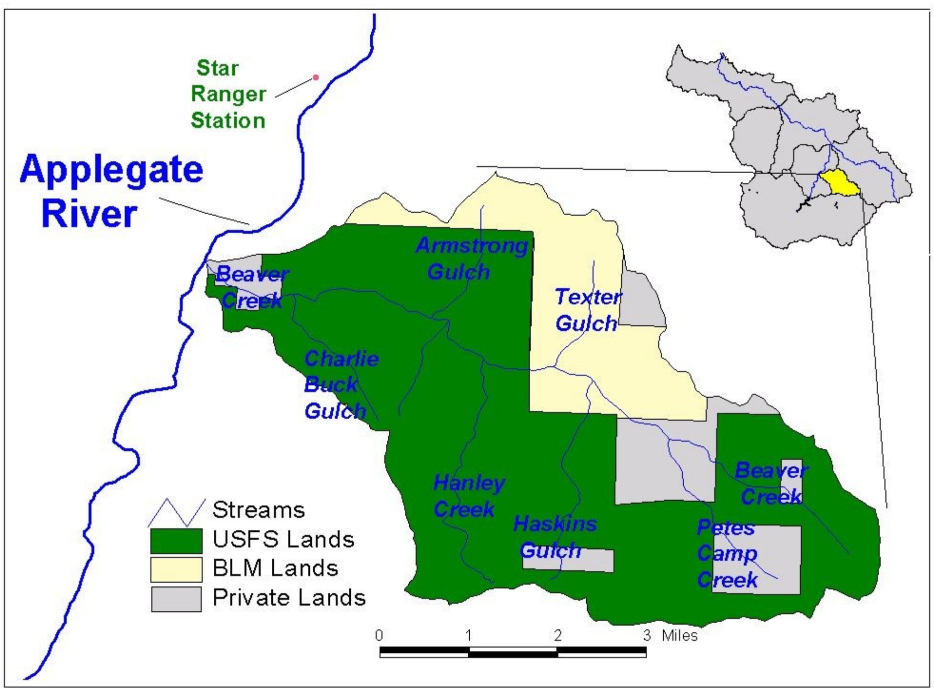


Figure 15. Location of Beaver Creek and Tributaries



Aquatic Wildlife

Beaver Creek contains a diversity of fish and aquatic life. Beaver Creek is particularly important to the health of Applegate River fish stocks because: 1) it is one of the largest streams accessible to anadromous salmonids below the Applegate Dam (a total migratory block for all fish); 2) it is listed as a Key Watershed under the Northwest Forest Plan; and 3) it has important diverse aquatic microhabitats for some aquatic species not found in the main channel of the Applegate River.

Coho salmon in Beaver Creek are listed as threatened by the National Oceanic and Atmospheric Administration (NOAA) Fisheries. Coho salmon in the Applegate Subbasin belong to the Southern Oregon-Northern California Coast (SONCC) Evolutionary Significant Unit (ESU) which occurs between Cape Blanco, Oregon and Punta Gorda, California and it is this ESU that is listed as threatened by NOAA Fisheries. Steelhead in Beaver Creek belong to the Klamath Mountain Province ESU, which is inclusive of the Klamath River in CA north to the Elk River in Oregon. A 2001 status review concluded that the listing of this ESU was not warranted.

Aquatic insects are sensitive to changes in aquatic habitat and are often used to assess the quality of habitat conditions. Aquatic insects serve as the primary food source for fish and play an important role in stream ecology. The richness and variety of macroinvertebrate species is affected by excessive sedimentation because sediment may fill the interstices between coarser substrate and reduce available habitat.

The designation of Beaver Creek as exceeding biological criteria due to excessive sedimentation and the resulting placement on the 1998 303(d) list came from a macroinvertebrate study performed in 1991 by Aquatic Biology Associates. This study determined that macroinvertebrate populations in Beaver Creek were impaired due to excessive fine sediments. The key points derived from the 1991 study included:

- Macroinvertebrate impairments are due to habitat quality limitations, rather than water quality limitations.
- Overall habitat complexity in Beaver Creek is moderately to severely impaired (the stream tends to be wide and shallow, is sluiced to bedrock in many reaches, fine sediment has filled in hyporheic interstitial spaces, reduced crevice space in the surface armor layer of riffles, and filled in pools).
- Fine sediment is a problem in the system, including both silt and sand. Silt levels are moderate in slack water areas. High levels of silt can smother margin and pool invertebrate communities. Low or moderate levels of silt greatly depress invertebrate abundance on the margins, and inhibit scrapers. High levels of sand were common in many of the streams sampled. Sand can fill in hyporheic interstitial space, embed crevices in the surface armor rocks of riffles, and fill in pools and spawning gravel. Sand appears to be mobilized during high flow, causing moderate to severe scour of surface substrates. Scour can cause direct mortality of many invertebrate taxa, or indirectly impact them by affecting their food source or habitat (e.g. Nostoc algae and moss).
- Highly intolerant taxa were not present in high numbers and richness in most systems. The small numbers can be attributed to the above habitat factors, plus in some systems, high water temperatures and reduced base flows probably contributed to their low levels.
- Many of the positive indicator groups or taxa in a healthy stream system are absent from Beaver Creek, or present in very low numbers.

The macroinvertebrate study site is located just downstream of the Beaver Sulphur Campground (T.40S., R.3W., Sec. 2, SE1/4). The site appears to have a long history of impairment. This impairment comes not only from logging and roading, but also from catastrophic floods that have greatly influenced habitat structure. No sensitive or Threatened or Endangered aquatic invertebrate taxa were encountered at the Beaver Creek 1991 sampling site.

Macroinvertebrate collection (biomonitoring) was continued at the Beaver Creek site in 1996, 1998, 1999, and 2000. The cumulative results of the 1996-2000 biomonitoring are contained the report entitled; “Benthic Invertebrate Biomonitoring Trend Analysis 1992-2000” (Schroeder 2002).

The summary scores from this period (1996, 1998, 1999, 2000) indicate that macroinvertebrate populations have remained stable or have been improving at this site during the study period (Table 18).

Scores in the detritus and margin habitats have improved as evidenced by an increased abundance of positive indicators. Increased total taxa richness also improved scores in the detritus habitat. Moderate to high percentage of collector taxa indicates higher than optimal fine particulate organic matter (fine sediment) inputs within Beaver Creek. In addition, results from 1996-2000 show a low abundance of intolerant and cold-water taxa suggesting excessive summer temperatures are present in the creek.

Table 18. Beaver Creek Macroinvertebrates: Scores and Trends 1996-2000 (Schroeder 2002)

Habitat Type	Scores	Trend
Erosional	Low to Moderate	Static
Margin	Moderate to High	Improved
Detritus	Low to Moderate	Improved

Nonpoint Source Factors

There are four predominant nonpoint source factors that influence sediment loads in the Beaver Creek analysis watershed: riparian vegetation, livestock grazing, roads, and road-stream crossings.

Sediment Factor 1: Riparian Vegetation

Riparian vegetation provides shade and an insulating canopy, preventing adverse water temperatures during both summer and winter. It also acts as a filter to prevent addition of sediment, and its roots provide streambank stability and cover for rearing salmonids. Riparian vegetation directly influences the food chain of a stream ecosystem by providing organic detritus and terrestrial insects, and by controlling aquatic productivity that depends on solar radiation.

For Beaver Creek and its major tributaries, data reveal that within the Riparian Reserves the overall percentage of medium to large diameter class trees with 71 -100 percent canopy closure is extremely low (USDA 1994b). This may be partly due to roads built within the riparian zone (e.g., USFS Road 20 and USFS Road 1095). Survey work done by the USFS (ODEQ 2003b) 300 feet on either side of the stream indicated that the age of the riparian vegetation along Beaver Creek and several primary tributaries averaged in the middle to late seral stage, although several tributaries had significant percentages of the riparian area in the early seral stage (Charlie Buck 41 percent and Haskins 60 percent) (Table 19). The seral stage of riparian vegetation is significant because data has indicated that fines are expected to decrease with an increase in the amount and age of woody riparian vegetation (ODEQ 2003b).

Table 19. Riparian Characteristics for Beaver Creek and Major Tributaries (ODEQ 2003b)

Beaver Creek and Tributaries	Average Age of Riparian Vegetation (years)	Percent Early Seral Stage[1]
Armstrong Gulch	81	0%
Beaver Creek	71	8%
Charley Buck Gulch	89	41%
Hanley Gulch	110	0%
Haskins Gulch	69	60%
Petes Camp Creek	77	0%

1/ Seral Stage: Refers to the age and type of vegetation that develops from the stage of bare ground to the climax stage. Seral Stage - *Early*: 0-39 years of age, *Mid*: 40-100 years of age, *Late*: 100+ years of age

Sediment Factor 2: Livestock Grazing

The most apparent effects of livestock grazing on stream habitat are the reduction of shade and cover and resultant increases in stream temperature (grazing on shrubs and herbaceous vegetation), degraded water quality (livestock defecation and addition of sediment by streambank trampling), changes in stream morphology, and the addition of sediment through bank degradation and off-site soil erosion (livestock trails along a streambank cause channel widening and downcutting).

Grazing impacts in Beaver Creek are most prevalent in the headwater areas. Livestock movement appears to depend on seasonal climatic conditions. In years of higher precipitation livestock tend to stay higher in the drainage. In drier years they tend to concentrate lower in the drainage, and along the mainstem of Beaver Creek. The headwaters have sustained the greatest impact and if current grazing patterns are maintained these impacts may increase thereby increasing recovery times (USDA 1994b).

The Beaver Creek analysis watershed falls within two federally-administered grazing allotments: the Lower Big Applegate allotment is administered by the BLM and the Beaver-Silver Cattle and Horse Grazing allotment is administered by the USFS.

Sediment Factor 3: Roads

Road density, use, design, and location can be important in affecting the extent and magnitude of road-related sediment impacts (Reiter et al. 1995). King and Tennyson (1984) observed altered hydrology when roads constituted more than 4 percent of the drainage area. This correlates to approximately 4 miles of road per square mile of area. Other studies evaluating storm response to road construction indicate sediment effects begin when over 15 percent of the area is road surface. Results are extremely variable because the effects of roads are not well defined and are difficult to detect, especially as the size of floods increases (Grant, Megahan, and Thomas 1999).

Road impacts include cutbanks, fill slopes, ditch lines, and road surfaces. As road surface area increases, the potential for sedimentation in a watershed increases. Wider road prisms, and thus a greater area of road disturbances and potential erosion, are found on steeper slopes. In those Beaver Creek tributaries where granitics predominate, such as Haskins and Hanley Gulches, soil erosion and sedimentation from roads are more severe than elsewhere in the watershed (ODEQ 2003b).

A normal function of intermittent channels is the storage and transfer of sediment. Many system and nonsystem roads and landings are located in or adjacent to intermittent channels. During periodic drought conditions, such as that which existed through the early 1990s, sediment from roads and other sources has accumulated and been stored in these channels. During ensuing major flood events, such as occurred in 1997, large concentrations of the sediment stored in these tributaries entered Beaver Creek. This is in addition to sediment directly derived from roads (ODEQ 2003b).

Roads also have an impact on the sinuosity of a stream system if constructed within the flood prone area. Such roads confine the stream's ability to migrate laterally. This forced straightening of the channel results in energy dissipation in a downward direction and/or against the banks, thereby resulting in accelerated channel erosion. Many of the roads, skid trails, and landings in their current locations near channels will continue to directly produce sediment, prevent lateral stream migration, divert and concentrate overland flow, and inhibit the growth of streamside vegetation which protects stream temperatures as well as provides coarse woody debris recruitment which aids in the trapping, storage, and sorting of sediment (ODEQ 2003b).

Road densities for Beaver Creek tributaries (Figure 17) range from 0.60 to 4.64 miles/square mile (Table 20). These values are taken from the Beaver Palmer Watershed Analysis (USDA 1994b); they are considered conservative because the more recent detailed *USFS Rogue River National Forest Draft Roads Analysis for the Siskiyou Mountain Area* (USDA 2002) found the overall road density for Beaver Creek was higher (3.89 miles/square mile) than described in the 1994 Watershed Analysis (2.72 miles/square mile). According to the Draft Roads Analysis, there are 75.70 miles of classified roads distributed over 19.5 square miles for the average density of 3.89 miles of road per square mile. Classified roads are roads constructed or maintained for long-term highway vehicle use. While not all private roads or private lands are included in this analysis; public lands comprise 88 percent of the Beaver Creek drainage, so that the final road density including private lands is likely to be very close to the 3.89 miles/square mile in the

Draft Roads Analysis. Unclassified roads are not included in this analysis. Both the tributary road densities in Table 20, and Beaver Creek's 3.89 miles/square mile road density value would be even higher if they included unclassified roads. Unclassified roads are not part of the USFS forest transportation system and include unplanned roads, abandoned roads, off-road vehicle tracks, and once authorized roads that were not decommissioned at the end of authorization. These roads are usually not surfaced or maintained and have the potential to deliver as much or more sediment than classified roads.

Table 20. Road Density in the Beaver Creek Drainage Areas (USDA 1994b)

Beaver Creek Drainage Areas	Current System Road Density[1] (mi./sq. mi.)
Armstrong	2.1
Baldy	3.44
Beaver Headwaters	3.98
Beaver Middle	0.60
Boaz	1.66
Charley Buck	3.30
Hanley	4.64
Haskins	4.18
Jackson	1.62
Medite	2.11
Petes Camp	2.26
Texter	1.14

1/ Classified roads only (USDA 1994b).

Beaver Creek tributaries with the highest classified road densities include Hanley Gulch (4.64 mi./sq. mi.), Haskins Gulch (4.18 mi./sq. mi.), Beaver Creek headwaters (3.98 mi./sq. mi.), Baldy Creek (3.44 mi./sq. mi.), and Charley Buck Gulch (3.30 mi./sq. mi.).

Sediment Factor 4: Road-Stream Crossings

The potential for sediment input to streams is greatest where roads cross streams. The sediment derives from road surface, ditch line, cut slope, and fill slope erosion, which is routed directly into the stream. Stream crossings on USFS classified roads, and main private roads, primarily occur in the lower portion of the Beaver Creek drainage adjacent to the main stem and large tributaries. The number of stream crossings is particularly high in the following tributaries: Baldy, Beaver headwaters, Boaz, Charley Buck, Hanley Gulch, Petes Camp, and Texter (USDA 1994b). Data are only available for system roads, no nonsystem road crossings are included (Table 21).

Table 21. Number of Road-Stream Crossings in the Beaver Creek Drainage Areas (USDA 1994b)

Beaver Creek Drainage Areas	Number of Road-Stream Crossings (system roads only) Position in drainage High, Middle, Low
Armstrong	7 (low)
Baldy	23 (low)
Beaver Headwaters	20 (low), 4 (high)
Beaver Middle	4 (middle)
Boaz	11 (low)
Charley Buck	10 (low), 9 (high)
Hanley	16 (low), 30 (middle)
Haskins	6 (low), 6 (high)
Jackson	3 (high)
Medite	1 (middle)

Beaver Creek Drainage Areas	Number of Road-Stream Crossings (system roads only) Position in drainage High, Middle, Low
Petes Camp	12 (low), 8 (high)
Texter	15 (low)

Sediment Measurements

Embeddedness is a measurement of the average proportion of gravel/cobble substrate that is buried, or embedded, by fine sediments. While low percentages of surface fines were found in riffle and glides in Beaver Creek, sediment embeddedness of spawning and macroinvertebrate habitat (gravels and small to medium cobbles) has been found to be widespread (USFS 1994, Tioga Resources, Inc. 1999). Biological activity in the gravel/cobble substrate, whether the incubation of salmonid eggs or the early stages of the life cycle of many macroinvertebrates, depends on the maintenance of inter-gravel flows for the replenishment of nutrients and oxygen, and the removal of metabolic wastes. Unacceptable embeddedness refers to the filling of these inter-gravel, or interstitial, spaces to the point where the processes of nutrient and oxygen replenishment and waste removal are disrupted, resulting in the suffocation of eggs, the trapping of emergent fry, and the reduction in diversity and numbers of desirable but highly sediment-sensitive taxa, such as caddisflies. Above this condition, however, insect populations decline substantially as habitat spaces become smaller and filled. Studies by Bjornn, et al. (1974, 1977) concluded that approximately one-third embeddedness (33 percent) or less is probably the normal condition in proper functioning streams. Current recommendations consider a stream impaired when cobble embeddedness of a particular riffle or glide reaches or exceeds 33 percent (Maiyo 2003, USDA 1994a), which is the case in much of the lower 3.9 miles (Reach 1 and 2) of Beaver Creek (Table 22, Tioga Resources, Inc. 1999).

Table 22. Beaver Creek Reaches and Embeddedness (ODEQ 2003b)

Reach Number	River Mile	Channel Condition
1	0-1.2	Spawning gravels quite common but decomposed gravel fines had most all habitats very embedded (>33%).[1]
2	1.2-3.9	Streambed dominated by gravel and cobble . Surveyors report that most habitats were embedded[1] (>33%) with decomposed granite.
3	3.9-5.2	Streambed dominated by gravel and cobble. Exposed bedrock was 17% at one site indicating that portions of the reach are scouring.
4	5.2-6.4	Coarse textured streambed dominated by boulders and cobbles. Channel indicates scouring.
5	6.4-7.5	Coarse textured streambed dominated by boulders and cobbles. Channel indicates scouring.

1/ Embedded refers to >33% embeddedness as determined by a Wolman Pebble Count procedure.

An effective way to determine the sediment trends in an aquatic ecosystem is to measure the percentage of scoured pool volume that is filled by fine sediment. The fraction of total scoured pool volume, V* (V star), is a qualitative measure of fine sediment deposition in pools (Hilton and Lisle 1993). This method offers a direct indication of the potential impact of sediment on crucial rearing and resting habitat for salmonids. Studies indicate a strong correlation between V* and the sediment budgets calculated for a watershed. In these studies the greatest amount of sedimentation of pools (highest V*s) were found in those watersheds with the highest level of logging and roading. Specifically, Lisle and Hilton (1992) found V* values of <10% corresponded to low sediment yields, V* >10% and <20% related to a moderate sediment yield and V* values >20% were associated with high sediment yields. Studies performed in the granitic watersheds of Bear Creek and GrassValley are comparable to the Beaver Creek area in the Applegate Subbasin. Bear Creek, with very little management-related disturbance (1 percent logged) had a V* value of 9 percent. In contrast, the Grass Valley watershed with 84 percent logged had a V* value of 50 percent. According to data provided by the Applegate River Watershed Council (Mike Mathews, unpublished data), the current average V* for Beaver Creek is 35 percent and ranges from 13 to 60 percent (Table 23)

Table 23. V* Values for Beaver Creek (ODEQ 2003b)

Site (pool number)[1]	Date	V* Value (%)
1	9/27/2000	50
2	9/27/2000	60
3	9/28/2000	27
4	9/28/2000	54
5	9/28/2000	13
6	10/3/2000	20
7	10/3/2000	26
8	10/3/2000	29
9	10/3/2000	45
10	10/4/2000	35
11	10/4/2000	30

[1]The 11 pools are located in reaches from RM 1.0 to RM 3.5.

Sediment TMDL Loading Capacity and Allocations (ODEQ 2003b)

Loading Capacity: The numeric target is <33% cobble embeddedness within Beaver Creek. This is defined as the greatest amount of sediment loading that this 303(d) listed waterway can contain and still attain water quality standards. Thus, the sediment loading capacity is that amount of sediment coming from all streams in the Beaver Creek analysis watershed resulting in <33% cobble embeddedness within Beaver Creek.

Load Allocations/Surrogate Measures

The load allocation for sedimentation is given 100 percent to natural background sources therefore any activity that increases the sediment load is not allowed (Table 24). Given the data available, it is not possible for sedimentation to be expressed as a load other than to state that it is the amount of sediment resulting in <33% cobble embeddedness within Beaver Creek. For this TMDL, other appropriate measures will be utilized to achieve the loading capacity. These surrogate measures apply to all designated management agencies and land uses occurring in the Beaver Creek analysis watershed. Surrogate measures that apply are: 1) system potential riparian vegetation, 2) decreases in road densities, and 3) improvements to road-stream crossings.

Table 24. Sedimentation TMDL Allocations (ODEQ 2003b)

Nonpoint Sources: Beaver Creek Load Allocations by Land Use	
Source	***Load Allocation*** **Distribution of Sedimentation Loading Capacity to nonpoint sources**
Natural	100%
Agriculture	0%
Forestry	0%
Urban	0%
Transportation	0%
Future Sources	0%

Point Sources: Beaver Creek Waste Load Allocations by Source	
Source	***Waste Load Allocation*** ***Distribution of sedimentation Loading Capacity to point sources***
Current and Future NPDES Permit holders	0%
NPDES Permitted Activities: Recreational Mining	0%

Surrogate Measure #1: System Potential Riparian Vegetation.
System potential riparian vegetation is a surrogate measure to meet the sedimentation TMDL. It is identical to the targets set in the temperature TMDL. Therefore the measures implemented to meet the temperature TMDL will also meet the surrogate measure targets for the sedimentation TMDL.

A wider intact mature riparian vegetation community zone than is necessary to achieve the temperature TMDL may be necessary to filter sediment from upslope sources. On federal lands, which comprise 88 percent of the Beaver Creek analysis watershed, Riparian Reserve zones managed for late successional purposes must be a minimum of 150 feet slope distance on either side of perennial non fish-bearing streams and 300 feet on either side of fish-bearing streams. This may be more than that required to meet the percent effective shade targets but will provide additional protection from sediments.

Surrogate Measure #2: Decrease Road Densities and Mitigate Impacts from Retained Roads.
Reduction of road densities is one of the most important and effective measures for reducing sediment production from roads, and is prescribed for several Beaver Creek drainage areas. The DEQ target for the next 10 years for classified roads in the Beaver Creek analysis watershed has been developed in conjunction with the USFS (Table 25).

Table 25. Long-Term Road Density Targets for Beaver Creek Drainage Areas (ODEQ 2003b)

Beaver Creek Drainage Areas	Area (acres)	Current Road Density (miles/sq mile)**	10-year Target Road Density (miles/sq mile)**	Percent Reduction
Armstrong Creek	963	2.10	2.10	0
Baldy Creek	761	3.44	2.50	27%
Beaver Headwaters	1570	3.98	2.50	37%
Beaver Middle	187	0.60	0.60	0
Boaz	1171	1.66	1.66	0
Charley Buck	638	3.30	2.50	24%
Hanley	2112	4.64	2.50	46%
Haskins	1098	4.18	2.50	40%
Jackson	232	1.62	1.62	0
Medite	383	2.11	2.11	0
Petes Camp	2172	2.26	2.26	0
Texter	2165	1.14	1.14	0

******System road miles only

The following practices are recommended to mitigate impacts from retained roads in the Beaver Creek analysis watershed:

- Reengineer all portions of roads on unstable geology to minimize risk of slope failure, particularly where those lands are within draws or on the lower 1/3rd of the slope;
- Reroute roads around sensitive areas including floodplains, wetlands, and Riparian Reserves to the maximum extent possible;

- Where it is not possible to reroute roads around floodplains and Riparian Reserves, provide for road surfacing sufficient to prevent surface erosion in those sensitive zones. Also stabilize all road cuts and fills in floodplains and Riparian Reserves, as well as stream crossings, using all vegetative and mechanical means available;
- Resize all culverts (including dipping/hardening of associated crossings) on fish-bearing streams to convey 100-year floods including associated bedload and debris without loss of crossings (or replace with bridges).

Since they are associated with the transportation system, restore landings within sensitive areas (Riparian Reserves, floodplains, wetlands) to natural conditions. This involves reshaping and/or ripping if necessary, and planting with native species.

Surrogate Measure #3: Improve Road-Stream Crossings.
On federal lands in the Beaver Creek analysis watershed, 20 road crossings per year will be assessed to ensure that they can convey a 100 year flood event. In those drainages where the crossing frequencies currently exceed the centerpoints of the medium frequency ranges, or 2.0 crossings/stream mile and 3.0 crossings/road mile (USDA 2002), the target crossing frequencies are a maximum of 2.0 crossings/stream mile and 3.0 crossings/road mile (Table 26). In drainages where targets are already met or exceeding this goal, there will be no net increase in crossing frequency from current conditions.

Table 26. Stream Crossings and Percent Reduction Targets for Beaver Creek Drainage Areas (ODEQ 2003b)

Beaver Creek Drainage Areas	Number of Drainage Crossings and Position in Drainage[1]	Miles of Stream	Miles of Roads	Number of Crossings per mile of stream.	Number of Crossings per mile of road	Percent Reduction: Crossings per mile of stream	Percent Reduction: Crossings per mile of road
Armstrong	7 low	5.47	3.62	1.3	1.9	0%	0%
Baldy	23 low	8.29	4.51	2.8	5.1	29%	41%
Beaver Head	20 low, 4 high	9.54	11.24	2.5	2.1	20%	0%
Beaver Mid	4 middle	1.5	NA	2.7	NA	26%	0%
Boaz	11 low	8.14	3.04	1.4	3.6	0%	17%
Charley Buck	10 low, 9 high	8.56	3.36	2.2	5.6	9%	46%
Hanley	16 low, 30 middle	15.96	16.64	2.9	2.8	31%	0%
Haskins	6 low, 6 high	6.38	7.24	1.9	1.6	0%	0%
Jackson	3 high	1.14	0.96	2.6	3.1	23%	3%
Medite	1 middle	2.13	NA	0.5	NA	0%	NA
Petes Camp	12 low, 8 high	13.5	9.58	1.5	2.1	0%	0%
Texter	15 low	1.52	7.47	9.9	2.0	80%	0%

1/ Low refers to the lower third of the slope, middle to the middle third, and high to the upper third of the slope between ridge top and stream bottom.
NA = data not available

E. Biological Criteria

The following discussion of biological criteria is taken from the DEQ's *Applegate Subbasin TMDL* (ODEQ 2003b).

Within the Applegate Subbasin, Beaver Creek is the only stream on the 1998 303(d) list for biological criteria (Table 27, Figure 3). Biological criteria impairment in Beaver Creek is the direct result of impairments to macroinvertebrate communities. Aquatic macroinvertebrates are the bugs commonly found in lakes, streams, ponds, marshes, and puddles. As well as serving as an important food source for fish and other aquatic organisms, macroinvertebrates play an important role in maintaining the health of the aquatic ecosystem by eating bacteria and dead, decaying plants and animals. These organisms are good indicators of watershed health since overall water and habitat quality determines which types of macroinvertebrates can survive in a body of water. Populations in Beaver Creek have been moderately to severely impaired as a result of poor habitat quality (excessive fine sediments) and water quality limitations (high summer temperatures) (Schroeder 2002). Beaver Creek is also on the 1998 303(d) list for temperature, sediment, habitat modification, and flow modification.

Table 27. 303(d) Biological Criteria Listed Stream Reaches in the Applegate Subbasin

Stream Segment	Listed Parameter	Applicable Rule	Miles Affected
Beaver Creek, mouth to Headwaters	Biological Criteria	OAR 340-041-0011	8.7
		Total stream miles listed for biological criteria	**8.7**

The biological criterion standard applicable to Beaver Creek states "Waters of the State shall be of sufficient quality to support aquatic species without detrimental changes in the resident biological communities" (OAR 340-041-0011) (ODEQ 2004).

Beneficial uses are defined in the Oregon Administrative Rules for the Applegate Subbasin and apply to all waterways within the subbasin, including Beaver Creek (Table 1). The beneficial uses affected by the biological criterion standard include Resident Fish and Aquatic Life (ODEQ 2003b).

Biological Criteria Sources

Sedimentation and high summer temperatures have been determined as the cause of the macroinvertebrate impairments in Beaver Creek (ODEQ 2003b). The sediment and temperature sections of this WQRP address the sources of sediment and high summer temperature.

Biological Criteria TMDL Loading Capacity and Allocations (ODEQ 2003b)

Loading Capacity: The *Applegate Subbasin TMDL* does not directly set loading capacities and allocations for biological criteria because it is believed that TMDL allocations set to meet both the temperature and sedimentation TMDLs (riparian shade, streambank and channel restoration, stabilization of sediment sources) will restore the condition of the biological communities in Beaver Creek and throughout the Subbasin. The biological criteria TMDL applies to the Beaver Creek analysis watershed and is defined as 1.) system potential riparian vegetation (as defined in the temperature TMDL) and 2.) that amount of sediment coming from all streams in the analysis watershed resulting in <33% cobble embeddedness within Beaver Creek. The temperature TMDL surrogate is defined as increasing riparian vegetation to meet the percent-effective shade targets. The sedimentation TMDL is defined as meeting a <33% cobble embeddedness numeric target achieved by implementing surrogate measures related to riparian vegetation, road densities, and number of road crossings.

Element 2. Goals and Objectives

The overall long-term goal of this WQRP is to achieve compliance with water quality standards for each of the 303(d) listed parameters and streams on federal land in the Applegate Subbasin. The WQRP identifies TMDL implementation strategies to achieve this goal. Recovery goals will focus on protecting areas where water quality meets standards and avoiding future impairments of these areas, and restoring areas that do not currently meet water quality standards.

The recovery of water quality conditions on federal land in the Applegate Subbasin will be dependent upon implementation of the USFS Rogue River and Siskiyou National Forest Land and Resource Management Plans (LRMPs) and the BLM Medford District Resource Management Plan (RMP) as amended by the NWFP (USDA and USDI 1994a). These plans reference best management practices (BMPs) that are intended to prevent or reduce water pollution to meet the goals of the Clean Water Act.

Paramount to recovery is adherence to the Standards and Guidelines of the NWFP (as amended, USDA and USDI 2004b) to meet the ACS. This includes protection of riparian areas and necessary silvicultural treatments to achieve vegetative potential as rapidly as possible. The ACS was developed to restore and maintain the ecological health of watersheds and aquatic ecosystems on public lands. The NWFP requires federal decision makers to ensure that proposed management activities are consistent with ACS objectives. The NWFP amendment in March 2004 clarified provisions relating to the ACS. It explains that the ACS objectives were intended to be applied and achieved at the fifth-field watershed and larger scales, and over a period of decades or longer rather than in the short-term. ACS objectives are listed on page B-11 of the NWFP Record of Decision (ROD). ACS objectives 3-8 contain guidance related to maintaining and restoring water quality. In general, the objectives are long range (10 to 100 years) and strive to maintain and restore ecosystem health at the watershed scale.

Recovery goals for temperature and sediment on federal land are specified in Table 28. Biological criteria goals are covered under temperature and sediment.

Table 28. Recovery Goals for Federal Land in the Applegate Subbasin

Element	Goal	Passive Restoration	Active Restoration
Temperature ***Shade***	• Achieve coolest water possible through achievement of percent effective shade targets (Table 16).	• Allow riparian vegetation to grow up to reach target values.[1]	• Use prescriptions that ensure long-term riparian vegetation health. • Implement prescriptions that increase growth rate and survival of riparian vegetation. • Plant native species from local genetic stock to create a stand that will result in increased tree height and density.[1]

Element	Goal	Passive Restoration	Active Restoration
Temperature ***Channel Morphology***	• Increase the amount of large wood in channels. • Improve riparian rooting strength and streambank roughness. • Decrease bedload contribution to channels during large storm events. • Maintain or improve channel types, focusing on width-to-depth ratios. • Increase wood-to-sediment ratio during mass failures.	• Follow NWFP Standards and Guidelines or watershed analysis recommendations for Riparian Reserve widths (including unstable lands). • Allow historic failures to revegetate. • Allow natural channel evolution to continue. Time required varies with channel type.	• Promote riparian conifer growth for future large wood recruitment. • Encourage woody riparian vegetation versus annual species. • Stabilize streambanks where indicated. • Maintain and improve road surfacing. • Reduce road densities by decommissioning non-essential roads. • Increase culverts to 100-yr flow size and/or provide for overtopping during floods. • Minimize future slope failures through stability review and land reallocation if necessary. • Ensure that unstable sites retain large wood to increase wood-to-sediment ratio.
Temperature ***Streamflow***	• Maintain optimum flows for fish life. • Maintain minimum flows for fish passage.		• Utilize authorized water storage facilities to avoid diverting streamflows during low flows.
Sediment **(Beaver Creek Analysis Watershed)** ***Riparian Vegetation***	• Filter sediment from upslope sources.	• Follow NWFP Standards and Guidelines or watershed analysis recommendations for Riparian Reserve widths (including unstable lands).	• Stabilize streambanks where indicated. • Implement prescriptions that increase growth rate and survival of riparian vegetation. • Use prescriptions that ensure long-term riparian vegetation health.
Sediment **(Beaver Creek Analysis Watershed)** ***Livestock Grazing***	• Maintain or improve riparian vegetation in allotments. • Decrease bank degradation and off-site soil erosion caused by livestock.		• Manage livestock to maintain or improve riparian vegetation. • Update USFS range allotment plan to control livestock movement through riparian areas. • Complete assessment, evaluation, and determination of rangeland health for the BLM allotment followed by the appropriate level of NEPA analysis for issuing a grazing lease renewal.

Element	Goal	Passive Restoration	Active Restoration
Sediment (Beaver Creek Analysis Watershed) ***Roads***	• Decrease sediment production and delivery from roads.	• Allow natural decommissioning to occur on non-essential roads.	• Reengineer all portions of roads on unstable geology. • Reroute roads around sensitive areas (i.e. floodplains, wetlands, and Riparian Reserves). • Surface roads in sensitive areas if not able to reroute. • Stabilize all road cuts and fills in floodplains and Riparian Reserves. • Resize all culverts on fish-bearing streams to convey 100-year floods including associated bedload and debris. • Restore landings within sensitive areas (Riparian Reserves, floodplains, wetlands) by reshaping and/or ripping if necessary, and planting with native species. • Reduce road densities by decommissioning non-essential roads. • Apply appropriate BMPs identified in LRMP and RMP to minimize soil erosion and water quality degration.
Sediment (Beaver Creek Analysis Watershed) ***Road-Stream Crossings***	• Decrease sediment input at road-stream crossings.		• Reduce the number of road-stream crossings.

1/ Passive versus active restoration of riparian areas. If current percent effective shade is greater than or equal to 80 percent, the stream is considered recovered in terms of percent effective shade and the riparian area should not be a candidate for active restoration for the purposes of temperature recovery (ODEQ 2003b). If current shade is less than 80 percent, the site may benefit from active restoration and should be examined.

Element 3. Identification of Responsible Parties

The USFS and BLM are recognized by Oregon DEQ as Designated Management Agencies for implementing the Clean Water Act on USFS and BLM-administered lands in Oregon. Each federal agency has signed a Memorandum of Agreement (MOA) with the DEQ that defines the process by which DEQ, USFS, and BLM will cooperatively meet State and Federal water quality rules and regulations. The Director of DEQ, the USFS Regional Forester, and the BLM State Director are responsible for ensuring implementation of the agencies' MOAs.

This WQRP covers federal land in the Applegate Subbasin and was jointly prepared by the Rogue River-Siskiyou National Forest and the Medford District BLM with the assistance of the DEQ. Both federal agencies will be responsible for implementing the management actions contained in this plan. The federal officials responsible for the creation, implementation, and maintenance of this WQRP are the District Rangers for the Applegate, Ashland, Galice, and Illinois Valley Ranger Districts within the Rogue River-Siskiyou National Forest; and the Field Managers for the Ashland and Grants Pass Resource Areas within the Medford District BLM.

This WQRP will be submitted to the DEQ and it will be inserted in the *Applegate Subbasin WQMP* (ODEQ 2003b). The WQMP covers all land within the Applegate Subbasin regardless of jurisdiction or ownership.

It must be noted that 70 percent of the 303(d) listed stream miles in the Applegate Subbasin are located on lands under private jurisdiction. While partnerships with private, local, and state organizations will be pursued, the BLM and USFS can only control the implementation of this WQRP on public lands. Other organizations or groups that are (or will be) involved in partnerships for implementing, monitoring, and maintaining the WQMP include the Applegate River and Williams Creek Watershed Councils, U.S. Geological Survey (USGS), U.S. Army Corps of Engineers, Jackson and Josephine Counties, Oregon Department of Forestry (ODF), Oregon Department of Agriculture (ODA), Oregon Department of Transportation (ODOT), Oregon Department of Fish and Wildlife (ODFW), Oregon Water Resources Department (WRD), and Oregon DEQ.

Element 4. Proposed Management Measures

The NWFP ACS describes general guidance for managing Riparian Reserves to meet the ACS objectives. Riparian Reserves, Key Watersheds, watershed analysis, and watershed restoration components of the ACS are designed to operate together to maintain and restore the productivity and resiliency of riparian and aquatic ecosystems.

Specific NWFP Standards and Guidelines (USDA and USDI 1994a, pp. C-31-C-38) direct the types of activities and how they will be accomplished. These Standards and Guidelines effectively serve as general BMPs to prevent or reduce water pollution in order to meet the goals of Clean Water Act compliance. Riparian Reserve widths are determined from the Standards and Guidelines (USDA and USDI 1994a, p. C-30). The minimum reserve width for fish-bearing streams, lakes, and natural ponds in the Applegate Subbasin is 300 feet slope distance on each side of the stream or waterbody. Perennial nonfish-bearing streams, constructed ponds and reservoirs, and wetlands greater than 1 acre receive a minimum reserve width of 150 feet slope distance on each side of the stream or waterbody. Intermittent streams receive a minimum reserve width of 100 feet slope distance on each side of the stream and Riparian Reserves for wetlands less than 1 acre include the wetland and extend to the outer edges of the riparian vegetation.

The Rogue River and Siskiyou National Forest LRMPs and the Medford District RMP reference BMPs that are important for preventing and controlling nonpoint source pollution to the "maximum extent practicable". BMPs are developed on a site-specific basis and are presented for public comment during the National Environmental Policy Act (NEPA) process. One element of BMP implementation includes effectiveness monitoring and modification of BMPs when water quality goals are not being achieved.

In the NWFP, Key Watersheds provide the refuge areas for maintenance and protection of aquatic populations. With time, species are predicted to re-populate other areas (non-key watersheds) as they begin to recover. Beaver Creek, Palmer Creek, and the upper portions of the Little Applegate River and Yale Creek are identified as Key Watersheds in the NWFP. These four Key Watersheds are high priority areas for federal land restoration.

Although passive restoration will be the primary means to achieving the stream shade goal (Table 28), active restoration measures will be considered for streams with current shade that is less than 80 percent (Table 16). The *Sufficiency Analysis for Stream Temperature* (USDA and USDI 2004a) provides a tool for analyzing the effect of silvicultural practices within Riparian Reserves on effective shade. Shade nomographs were computed based on stream width, vegetation height, hill slope, and orientation factors and provide no-cut buffer widths to maintain stream shade while applying vegetation treatments to improve and restore riparian conditions.

The primary means to achieving the channel morphology goals (Table 28) on federal lands will be through passive restoration and protection of unstable areas. Active restoration measures will focus on promoting riparian conifer growth for future large wood recruitment through silvicultural practices, maintaining and improving road surfaces, and reducing road densities. The highest priority areas for road treatments will be in the Riparian Reserves and unstable areas.

Guidelines to use for reducing road densities to meet TMDL load allocations in Beaver Creek analysis watershed (Table 25) are as follows:

- Review unclassified roads first and include those that are absolutely essential with the classified roads. Decommission all remaining unclassified roads. On decommissioned roads one or more of the following actions will be taken: stream crossings will be reestablished to the natural stream gradient. This will be accomplished by removing the culvert and road fill within the stream crossing areas. Stream side slopes will be reestablished to natural contours then seeded with native or approved seed and mulched. Excavated material will be removed from stream crossing areas and placed at stable locations;
- When reducing classified road density to attain the long-term target, attempt to reduce roads in the most sensitive locations in the following descending order of importance:
    - Unstable terrain, identified in the Rogue River NF GIS data base;
    - Floodplains, wetlands and seep areas;
    - Riparian Reserves (minimum of 300 feet for fish-bearing streams and 150 feet for permanently flowing non fish-bearing streams) as described in the NWFP;
    - The lower 1/3rd of the slope;
    - On soils with very severe and severe soil erosion potential as described in the Rogue River NF Soil Resource Inventory (USFS 1977);
- Classified roads that are determined no longer needed, either short term or long term, should be decommissioned as previously described;
- If it is necessary to retain classified road densities greater than the target road density, then as many Level 2 maintenance roads as possible should be placed in Level 1 status. This involves pulling culverts and fills at stream crossings, providing proper long-term road drainage, possibly seeding, and closing roads with barriers such as boulders, earth mounds, or gates. (Level 2 is the maintenance level assigned to roads open for use by high clearance vehicles. Level 1 is the maintenance level assigned to intermittent service roads during the time they are closed to vehicular traffic. The closure period is one year or longer.)

Compliance with the sediment load allocation on federal lands in the Beaver Creek analysis watershed will include the assessment of 20 road crossings per year to ensure that they can convey a 100 year flood event. In those drainages where the crossing frequencies currently exceed the centerpoints of the medium frequency ranges, or 2.0 crossings/stream mile and 3.0 crossings/road mile (USDA 2002), the target crossing frequencies are a maximum of 2.0 crossings/stream mile and 3.0 crossings/road mile (Table 26). In drainages where targets are already met or exceeding this goal, there will be no net increase in crossing frequency from current conditions.

Element 5. Time Line for Implementation

The major provisions of this plan have already been implemented. Protection of riparian areas along all streams has been ongoing since the NWFP became effective in 1994. Inherent in the NWFP implementation is the passive restoration of riparian areas that ensued as a result of the Riparian Reserves. Implementation of active restoration activities beyond the inherent passive riparian restoration occurs in the context of watershed analyses and through site-specific projects. Restoration projects require analysis under the NEPA. The timing for implementation of those activities is dependent on funding availability.

The problems leading to water quality limitations and 303(d) listing have accumulated over many decades. Natural recovery and restorative management actions to address these problems will occur over an extended period of time. Implementation will continue until the restoration goals, objectives, and management measures as described in this WQRP are achieved. While active restoration may provide immediate, localized improvement, recovery at the subbasin scale is long term in nature. The ACS contained in the NWFP (as amended, USDA and USDI 2004b) describes restoration timeframes. ACS seeks to "prevent further degradation and restore habitat over broad landscapes as opposed to individual projects or small watersheds. Because it is based on natural disturbance processes, it may take decades, possibly more than a century to achieve objectives."

Stream temperature and habitat modification recovery is largely dependent on vegetation recovery. Actions implemented now will not begin to show returns in terms of reduced stream temperatures or improved aquatic habitat for a number of years. Full recovery of these conditions will not occur for many decades (Table 16). Stream temperatures will begin to decline and recover before the riparian areas reach their maximum potentials. Growth of the future system potential vegetation was modeled with the assumption that there will be no management activities such as thinning to enhance growth. If silvicultural activities were to occur, the vegetation would grow more quickly and recovery could be accelerated.

It will take a longer time for aquatic habitat recovery than for shade recovery. Instream conditions will recover only after mature conifers begin to enter the waterways through one of several delivery mechanisms, e.g. blowdown, wildfire, debris flows down tributary streams and into fish-bearing reaches, and flooding. Tree growth from the current condition of young conifers to mature age conifers will take approximately 200 to 250 years. This will represent full biological recovery of these stream channels, while temperature recovery and stabilization of streambanks will occur earlier.

New roads constructed on federal lands in the Applegate Subbasin since 1994 have been mostly located on or near ridgetops. Numerous restoration projects have been implemented on federal lands including road decommissioning and road drainage improvements. Beaver Creek will require long-term active restoration to meet the TMDL targets for road density and road-stream crossings. The timeline for achieving road-related restoration targets is dependent upon funding levels.

Element 6. Reasonable Assurance of Implementation

The USFS Applegate, Ashland, Galice, and Illinois Valley District Rangers and the BLM Ashland and Grants Pass Field Managers are responsible for ensuring this WQRP is implemented, reviewed, and amended as needed. These officials are responsible for all WQRPs for lands under their jurisdiction.

They will ensure coordination and consistency in plan development, implementation, monitoring, review, and revision. They will ensure priorities are monitored and revised as needed. They will review and consider funding needs for this and other WQRPs in annual budget planning.

The two agencies are committed to not only working cooperatively with each other but with all interested parties in the subbasin. This includes watershed councils, other government agencies, and private entities. The problems affecting water quality are widespread; coordination and innovative partnerships are key ingredients to successful restoration efforts.

The Rogue River-Siskiyou National Forest and the Medford District BLM have jointly developed this WQRP and fully intend to implement this plan within current and future funding constraints. Since 1994, the two agencies have been coordinating activities for the Applegate River Adaptive Management Area (AMA) which covers nearly all federal lands within the Applegate Subbasin. This includes creating several assessments (USDA and USDI 1994a; USDA and USDI 1995) and a joint AMA Plan (USDA and USDI 1998).

Implementation and adoption of the MOAs with the DEQ also provide assurances that water quality protection and restoration on lands administered by the USFS and BLM will progress in an effective manner.

Element 7. Monitoring and Evaluation

Monitoring and evaluation have two basic components: 1) monitoring the implementation of this WQRP and 2) monitoring the physical, chemical, and biological parameters for water quality. Monitoring information will provide a check on progress being made toward achieving the TMDL allocations and meeting water quality standards, and will be used as part of the Adaptive Management process.

The objectives of this monitoring effort are to demonstrate long-term recovery, better understand natural variability, track implementation of projects and BMPs, and evaluate effectiveness of TMDL implementation. This monitoring and feedback mechanism is a major component of the "reasonable assurance of implementation" for this WQRP.

Monitoring will be used to ensure that decisions and priorities conveyed by USFS and BLM management plans are being implemented, to document progress toward attainment of state water quality standards, to identify whether resource management objectives are being attained, and to document whether mitigating measures and other management direction are effective.

DEQ will evaluate progress of actions to attain water quality standards. If DEQ determines that implementation is not proceeding or if implementation measures are in place, but water quality standards or load allocations are not or will not be attained, then DEQ will work with USFS and BLM to assess the situation and to take appropriate action. Such action may include additional implementation measures, modifications to the TMDL, and/or placing the water body on the 303(d) list when the list is next submitted to EPA.

Forest Service and BLM Management Plans

The NWFP, the LRMPs for the Rogue River-Siskiyou National Forest, and the RMP for the BLM Medford District are ongoing federal land management plans. The NWFP became effective in 1994. The NWFP requires that if results of monitoring indicate management is not achieving ACS objectives, among them water quality, plan amendments may be required. These plan amendments could, in part, redirect management toward attainment of state water quality standards.

The LRMPs became effective in 1989 (Siskiyou National Forest) and 1990 (Rogue River National Forest) and cover a period of approximately 10 years or until the next LRMP becomes effective. The RMP was implemented in 1995 and also covers a period of approximately 10 years or until the next RMP is completed. These plans contain requirements for implementation, effectiveness, and validation monitoring of BMPs for water resources. USFS monitoring reports and BLM annual program summaries provide feedback and track how management actions are being implemented.

Regulations under the National Forest Management Act (NFMA) (36 CFR 219.12, k) require that LRMP implementation be evaluated periodically on a sample basis to determine how well objectives have been met, and how closely management Standards and Guidelines have been followed. These monitoring requirements have been incorporated into the Rogue River and Siskiyou LRMPs. Monitoring serves as the basic tool to evaluate management direction and to determine if there is a need to amend or revise the LRMP or to change the way management activities are conducted.

RMP monitoring will be conducted as identified in the approved BLM Medford District plan. Monitoring and evaluations will be utilized to ensure that decisions and priorities conveyed by the RMP are being implemented, that progress toward identified resource objectives is occurring, and that mitigating measures and other management direction are effective.

WQRP Implementation and Effectiveness Monitoring

As restoration activities that benefit aquatic resources are completed they will be annually provided to the Interagency Restoration DAtabase (IRDA). This database was developed by the Regional Ecosystem Office (REO) to track all restoration accomplishments by federal agencies in the areas covered by the NWFP. It is an ArcView based application and is available via the Internet at the REO website (www.reo.gov). It also contains data from the state of Oregon. The IRDA is intended to provide for consistent and universal reporting and accountability among federal agencies and to provide a common approach to meeting federal agency commitments made in monitoring and reporting restoration efforts in the Oregon Coastal Salmon Restoration Initiative. Activities that are tracked include in-stream structure and passage, riparian treatments, upland treatments, road decommissioning and improvements, and wetland treatments.

In addition, implementation and effectiveness monitoring will be accomplished for restoration projects according to project level specifications and requirements.

Water Quality Monitoring

Water quality monitoring is critical for assessing the success of this WQRP. This data will be used to evaluate the success of plan implementation and effectiveness. Ongoing monitoring will detect improvements in water quality conditions as well as progress toward reaching the water quality standards.

The base water quality monitoring program will include continued stream temperature monitoring for temperature listed reaches on federal lands. Additional core indicators of water quality and stream health that will be monitored if funds and personnel are available include: stream temperature for non-303(d) listed reaches, stream shade, stream channel condition, macroinvertebrates, sediment delivery, and embeddedness.

Discussion of the results of all monitoring associated with compliance with this WQRP will be published annually in the Rogue River-Siskiyou National Forest Monitoring Report and Medford District Program Summary.

Stream Temperature Monitoring

The BLM and USFS have collected stream temperature data in the Applegate Subbasin since 1993 and will continue to monitor stream temperatures in order to detect any changes in temperature from long-term data sets. Monitoring is conducted to meet a variety of objectives, thus long-term monitoring sites as well as project-specific, short-term sites will be used. Objectives include: monitor long-term temperature recovery; better understand the natural temperature variability; track potential project effects; and determine the upper extent of the problem area and delist the reaches or streams that through time meet the water quality standard for temperature. At a minimum, annual monitoring will continue on the temperature listed stream reaches on federal lands until such time as they reach the state standard.

Sampling methods and quality control will follow DEQ protocol. Generally, stream temperatures will be monitored from June 1 to September 30 to ensure that critical high temperature periods are covered. Measurements will be made with sensors programmed to record samples at least hourly. Qualified personnel will review raw data and delete erroneous data due to unit malfunction or other factors. Valid data will be processed to compute the 7-day rolling average of daily maximum temperature at each site. The resulting files will be stored in the agencies' databases. A summary of the data will be forwarded annually to the DEQ.

Stream Shade Monitoring

Guidelines in the Northwest Forest Plan specify that vegetation management activities that occur within the Riparian Reserves must have a goal of improving riparian conditions. The existing level of stream shade provided by the adjacent riparian stand will be determined prior to Riparian Reserve treatments that have the potential to influence water temperature. Measurement of angular canopy density (the measure of canopy closure as projected in a straight line from the stream surface to the sun) will be made in a manner that can be repeated within the portion of the adjacent stand within one tree height of the streambank at bankfull width. The measurement will occur within the stand, and not be influenced by the opening over the actual stream channel. Immediately after treatment, the shade measurement procedure will be repeated to verify that the treatment met the prescribed goals.

Stream Channel Condition Monitoring

Restoration activities designed to improve stream channel conditions (i.e. road surface and drainage improvements, road decommissioning, and unstable area protection) will be reported as part of the annual USFS monitoring report and the BLM program summary.

Macroinvertebrate Monitoring – Beaver Creek

Macroinvertebrates (aquatic insects) will be the primary tool used to monitor how aquatic life in Beaver Creek is responding to changes in stream habitat. Macroinvertebrate monitoring will provide a trend indicator for sedimentation in Beaver Creek. The monitoring to set the baseline conditions in Beaver Creek has been accomplished. Follow-up monitoring will be on an irregular basis based on recommendations by biologists and hydrologists following high water events.

Sediment Delivery Monitoring – Beaver Creek

Because there are both natural and management related sediment sources in the Beaver Creek analysis watershed, it is impossible to take channel measurements (either V* or cross sections) and relate the data to how successful restoration has been in reducing management related sediment. Rather, the Forest Service proposes to monitor sediment sources, such as roads, following large storms to determine if they are delivering sediment to streams. This monitoring will track road decommissionings to determine if they are effective in reducing sediment delivery to streams.

Embeddedness Monitoring – Beaver Creek

There are established reference reaches in Beaver Creek. One of the parameters measured in these reaches is Wolman pebble counts. On an irregular basis based on flow conditions, these reference reaches will be resurveyed and the bottom composition sizes will be compared to earlier samples.

Monitoring Data and Adaptive Management

This WQRP is intended to be adaptive in nature. Sampling methodology, timing, frequency, and location will be refined as appropriate based on lessons learned, new information and techniques, and data analysis. A formal review involving USFS, BLM, and DEQ will take place every five years, starting in 2010, to review the collected data and activity accomplishment. This ensures a formal mechanism for reviewing accomplishments, monitoring results, and new information. The evaluations will be used to determine whether management actions are having the desired effects or if changes in management actions and/or TMDLs are needed.

Element 8. Public Involvement

The NFMA, the Federal Land Policy Management Act (FLPMA), and the NEPA require public participation for any activities proposed for federal lands. The NWFP, the LRMPs for the Rogue River-Siskiyou National Forest, and the RMP for the BLM Medford District each went through an extensive public involvement process. Many of the elements contained in this WQRP are derived from these existing land use planning documents.

Public involvement was also included in the development of the watershed analyses that have been completed for all federal lands within the Applegate Subbasin. Additionally, the NEPA process requires public involvement prior to land management actions, providing another opportunity for public participation. During this process, the USFS and BLM send scoping letters and schedule meetings with the public. The public comment period ensures that public participation is incorporated into the decision-making process.

The DEQ has lead responsibility for creating Total Maximum Daily Loads (TMDLs) and WQMPs to address water quality impaired streams for Oregon. This WQRP will be provided to the DEQ for incorporation into the Applegate Subbasin WQMP. In 2003, DEQ conducted a comprehensive public involvement strategy, which included informational sessions, mailings, and public hearings for the Applegate Subbasin WQMP.

Element 9. Costs and Funding

Active restoration can be quite costly, especially for road upgrades and major culvert replacements. The cost varies with the level of restoration. The cost of riparian silvicultural treatments on forested lands is generally covered with appropriated funds and will vary depending on treatment type. The cost of WQRP monitoring is estimated to be $50,000 per year and includes data collection, database management, data analysis, and report preparation.

Funding for project implementation and monitoring is derived from a number of sources. Implementation of the proposed actions discussed in this document will be contingent on securing adequate funding. Funds for project implementation originate from grants, cost-share projects, specific budget requests, appropriated funds, revenue generating activities (such as timber sales and the USFS Knudsen-Vandenburg (KV) funds), or other sources. Potential sources of funding to implement restoration projects on federal lands include BLM Clean Water and Watershed Restoration funds, Jobs-in-the-Woods funds, and Title 2 funds from the Secure Rural Schools and Community Self-Determination Act of 2000 (Public Law 106-393).

The Jobs-in-the-Woods (JITW) program has provided funding to the Rogue River-Siskiyou National Forest and the Medford District for watershed restoration since 1994. The JITW program is no longer available for the Rogue River-Siskiyou National Forest. The Medford District's JITW budget for fiscal year (FY) 2004 was $981,000. In FY 2005, the BLM is shifting the JITW emphasis from fish habitat and water quality restoration to restoration of late-successional reserves. Only $90,000 of the BLM's FY 2005 JITW budget is allocated to watershed restoration.

The Title 2 program began in FY 2000 and will continue through FY 2006. Projects funded by the Title 2 program must meet certain criteria and be approved by the appropriate resource advisory committee. At least 50 percent of all project funds must be used for projects that are primarily dedicated to: road maintenance, decommissioning, or obliteration; or restoration of streams and watersheds. The available funds are based on County payments.

It is important to note that many of the specific management practices contained in this WQRP are the implementation of BMPs during ongoing management activities such as timber harvest, silvicultural treatments, fuels management, etc. These practices are not dependent on specific restoration funding.

Work on federal lands will be accomplished to improve water quality as quickly as possible by addressing the highest existing and at-risk management-related contributors to water quality problems. Every attempt will be made to secure funding for restoration activity accomplishment but it must be recognized that the federal agencies are subject to political and economic realities. Currently, timber harvest is minimal due to lawsuits and the requirements of the clearances needed to proceed. If this situation continues, a major source of funding is lost. Historically, budget line items for restoration are a fraction of the total requirement. Therefore, it must be recognized that restoration actions are subject to the availability of funding.

Another important factor for implementation time lines and funding is that managers must consider the Applegate Subbasin along with all other watersheds under their jurisdiction when determining budget allocations.

Element 10. Citation to Legal Authorities

The Endangered Species Act (ESA) and the Clean Water Act (CWA) are two federal laws which guide public land management. These laws are meant to provide for the recovery and preservation of endangered and threatened species and the quality of the nation's waters. The USFS and BLM are required to assist in implementing these two laws. The NWFP and land management plans are mechanisms for the USFS and BLM to implement the ESA and CWA. They provide the overall planning framework for the development and implementation of this WQRP.

Clean Water Act Section 303(d)

Section 303(d) of the 1972 federal CWA as amended requires states to develop a list of rivers, streams, and lakes that cannot meet water quality standards without application of additional pollution controls beyond the existing requirements on industrial sources and sewage treatment plants. Waters that need this additional help are referred to as "water quality limited" (WQL). Water quality limited waterbodies must be identified by the Environmental Protection Agency (EPA) or by a delegated state agency. In Oregon, this responsibility rests with the DEQ. The DEQ updates the list of water quality limited waters every two years. The list is referred to as the 303(d) list. Section 303 of the CWA further requires that TMDLs be developed for all waters on the 303(d) list. A TMDL defines the amount of pollution that can be present in the waterbody without causing water quality standards to be violated. A WQMP is developed to describe a strategy for reducing water pollution to the level of the load allocations and waste load allocations prescribed in the TMDL, which is designed to restore the water quality and result in compliance with the water quality standards. In this way, the designated beneficial uses of the water will be protected for all citizens.

Northwest Forest Plan

In response to environmental concerns and litigation related to timber harvest and other operations on federal lands, the USFS and the BLM commissioned the Forest Ecosystem Management Assessment Team (FEMAT) to formulate and assess the consequences of management options. The assessment emphasizes producing management alternatives that comply with existing laws and maintaining the highest contribution of economic and social well being. The "backbone" of ecosystem management is recognized as constructing a network of late-successional forests and an interim and long-term scheme that protects aquatic and associated riparian habitats adequate to provide for threatened and at-risk species. Biological objectives of the Northwest Forest Plan include assuring adequate habitat on federal lands to aid the "recovery" of late-successional forest habitat-associated species listed as threatened under the ESA and preventing species from being listed under the ESA.

The LRMPs for the Rogue River-Siskiyou National Forest and RMP for the BLM Medford District provide for water quality and riparian management and are written to ensure attainment of ACS objectives and compliance with the CWA.

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List of Preparers:

Laurie Lindell	Hydrologist, BLM Medford District
Jon Brazier	Hydrologist, Rogue River-Siskiyou National Forest
Mike Zan	Hydrologist, retired from Rogue River-Siskiyou National Forest

With Assistance From:

Bill Meyers	Oregon DEQ
Pam Riggs	GIS Specialist, Umpqua National Forest
Randy Frick	Fish Biologist, Rogue River-Siskiyou National Forest