BEAR/MARTEN WATERSHED

McKENZIE RESOURCE AREA

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U. S. Department of the Interior
Bureau of Land Management
Eugene District
Oregon

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CHAPTER 1
INTRODUCTION

General Description

The Bear/Marten Watershed Analysis area is a 35,840 acre watershed situated on the north and south sides of the McKenzie River approximately 16 miles east of Springfield and 3 miles east of Vida on U.S. Highway 126. The western downstream end of the watershed (800 ft.) begins near the west side of the Ben and Kay Dorris State Wayside Park, located between the highway and the river. BLM administers 11,050 acres and the U.S. Forest Service administers 3,202 acres. The watershed is in the Central Cascade Adaptive Management Area. It has 2 Key Watersheds, Bald Eagle Habitat Areas, a Potential Area of Critical Environmental Concern (ACEC), a segment of the McKenzie River that is eligible for Wild and Scenic River designation, and the McKenzie River Special Recreation Management Area (SRMA).

The major mountain peaks that create the high points to this watershed are Mt. Hagen (3,330 ft.) on the northeast edge forming the divide with Gate Creek to the north; Mt. Pernot (4,160 ft.), Fawn Rock (3,401 ft.), Nimrod Butte (3,600 ft.) and Goat Point (3,920 ft.) on the south rim to form the divide with Fall Creek watershed to the south. Mt. Jimbo (2,800 ft.), Marten Ridge, and Eagle Rock are major features within the watershed. (See General view map)

The Bear/Marten watershed lies within the western slopes of the Cascade foothills. Precipitation varies from 50 to 80 inches annually, with temperatures slightly below freezing in the winter to 90 to 100 degrees in summer.

Purpose of the Document

Management Direction

Watershed analysis focuses on implementing the Aquatic Conservation Strategy (ACS) of the *Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl (ROD)* and the *Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl (S&Gs)*. The ROD states that "Watershed Analysis is required in Key Watersheds, for roadless areas in Non-Key Watersheds, and Riparian Reserves prior to determining how proposed land management activities meet Aquatic Conservation Strategy objectives. Ultimately, watershed analysis should be conducted in all watersheds on Federal lands as a basis for ecosystem planning and management" (USDA, USDI Record of Decision, 1994).

The term "Forest Plan" is used to denote the document that contains the ROD and S&Gs. The Forest Plan provides a scientifically sound and legally responsible approach to managing Federal forest lands that takes into consideration all elements of the ecosystem. It focuses on reducing fragmented late-successional forests and restoring watersheds to provide healthy riparian and fish habitats. The Forest Plan is notable for focusing on all the components that

make up the ecosystem rather than focusing on a single resource.

End Product - The end product will be a document that can be used by the Area Manager in making management decisions for the watershed. It will provide the Area Manager and BLM personnel with a basis for suggesting projects for implementation. It will also provide information to be used in the analysis of environmental effects of proposed projects.

How To Use This Document (Document Layout)

This document has the following chapters:

< Introduction - Chapter 1
< Characterization - Chapter 2
< Key Issues and Questions - Chapter 3
< Current and Reference Conditions - Chapter 4
< Synthesis and Recommendations Chapter 5
< Appendix

The Introduction chapter consists of a general description of the watershed and watershed analysis. The Characterization chapter summarizes the current conditions of important resources in the watershed such as soils, water, wildlife, recreation, fisheries, and vegetation. The Key Issues and Questions chapter highlights the important values, resources or concerns in the watershed. The Current and Reference chapter briefly describes the current and reference condition of the watershed. The Synthesis and Recommendations chapter describes the interrelationship of the various resources in the watershed and suggests management of the watershed; the Recommendations section will be reviewed and possibly refined during the landscape design. The Appendix contains supporting documents.

Steps

The steps involved in this process involved the following:

< developing issues and key questions
< writing resource-based reports
< reviewing the issues and key questions
< having groups focus on specific issues for synthesis and recommendations
< compiling information from the groups to develop the synthesis and recommendation chapter

A landscape design will be developed after the watershed analysis is completed. Throughout the process, information was compiled and discussed that would be used in the landscape design. For example, some key questions were developed that will not be answered in the watershed analysis but will be answered in the landscape design. This was done so that the work done in the watershed analysis could be easily transferred into the landscape design.

Public Involvement

The project was mentioned in several of the Eugene BLM Planning Focus issues that were sent out to the public. The major public involvement will occur prior and during the development of the landscape design.

Team Membership

There were 2 teams for this analysis. The Core Team consisted of people who were heavily involved in the process from start to finished. They attended most of the meetings. The Expanded Team consisted of people who supplied information to the team and attended meetings as needed. For synthesis and recommendations, focus groups were developed made up of Core Team and Expanded Team members, depending on the issue.

Core Team

Mabel Alejandro	Soils
Graham Armstrong	Hydrology
Lynn Larson	Forest Ecology
Karen Martin	Fisheries
Greg Miller	Wildlife
Trish Wilson	Team Lead

Expanded Team

John Applegarth	Wildlife - amphibians, invertebrates, reptiles
Greg Bashor	Engineering
Dale Hanson	GIS
Vicki Kellerman	Recreation
Dave Mattson	Timber
Cheshire Mayrsohn	Botany
Nancy Wogen	Botany, ACEC

CHAPTER 2
CHARACTERIZATION

This chapter summarizes the information contained in Chapter 4 - Reference and Current Conditions - Social, Physical, and Biological.

SOCIAL

OWNERSHIP

The lands (35,840 acres) within the Bear/Marten Watershed are a mixture of ownership, management goals, and strategies. The majority of the land base, 18,415 acres (60%), is private ownership, combining a small mix of private residences and farmland along the river within a large area of industrial forest ownership in the uplands.

The Federal government is the major landowner with 40 percent of the land base and Weyerhaeuser is the second major landowner with 37 percent of the land base. Several other timber companies own additional smaller pieces. Federal forest land is administered by the BLM (31%) and the U.S. Forest Service (9%). The land ownership pattern is as described in the following table.

OWNERSHIP TYPES	ACRES	PERCENTAGE
Private Industrial Forestry	19,327	54
Small Private Ownership	2,222	6
Federal	14,252	40
State and City	39	1

Land Use Allocation on Federal Lands

An estimated 40 percent of the watershed is in Federal land ownership (BLM 31%, Forest Service 9%). The following table shows the break of acres by land use allocation. The watershed is part of the Central Cascades Adaptive Management Area. This is the major land use allocation. However, there are some underlying land use designations.

The table below also describes underlying designations. There is overlap between the

underlying designations. For example, an estimated 75 percent of BLM lands are within the key watershed boundaries; some of the lands are also designated as Riparian Reserves.

Additional Land Use Designations

UNDERLYING DESIGNATIONS	ACRES	PERCENTAGE BLM LAND
Key Watershed	14,366	75
BEHA	1,140	3
Riparian Reserves	4,391	31
Unmapped LSR	509	1.5

Central Cascades Adaptive Management Area (CCAMA)

The Central Cascades Adaptive Management Area is a landscape consisting of 158,000 acres of both USFS and BLM lands. Part of this landscape (about 14,252 acres) is located in the Bear/Marten Watershed Analysis Area. The focus of the AMA is Intensive research on ecosystem and landscape processes and its application to forest management using experiments and demonstrations at the stand and watershed level and approaches for integrating forest and stream management objectives, and implication of natural disturbance regimes.

This watershed analysis unit is all CCAMA. Some specific recommendations may be developed directly to meet the CCAMA concept. However, this analysis was approached with the concept of CCAMA throughout the process. The idea of doing a landscape design is but one example of doing things differently in the Adaptive Management Area.

RECREATION

The McKenzie River is the most important recreation resource in the analysis area and is a significant provider of quality recreational opportunities for a large number of people. Its proximity to the Eugene/Springfield area, accessibility from Highway 126, and scenic beauty account for its growing popularity.

The McKenzie is one of Oregon's most popular rivers for fishing. Guided and nonguided angling contributes substantially to the economy of the area. Driftboaters and river rafters are commonly seen on the river during the summer months and boaters spend large percentages of their time in sight of other boaters.

An 11-mile segment of the McKenzie River within the study area has been found suitable for study for inclusion in the National Wild and Scenic Rivers System. One quarter mile on either side of the river from Ennis Creek to Goodpasture Bridge should be managed to protect

Outstandingly Remarkable Values (ORV) and maintain and enhance the natural integrity of river related values.

Lands within McKenzie River, Segment A (Wild and Scenic River) and the McKenzie River Special Recreation Management Area (SRMA) must be managed for VRM Class II visual quality objectives. This requires that management activities may be seen but should not attract the attention of the casual observer and should result in low levels of change to the characteristic landscape.

The BLM manages the majority of the public shoreline in this analysis area. In general Lane County manages the majority of public access parks along the McKenzie River.

Few of the roadways within the watershed allow for legal public access for recreational activities. Evidence of timber harvest is predominant outside of the river corridor area.

PHYSICAL

HYDROLOGY

The Bear/Marten Watershed Analysis Unit (WAU) has a drainage area of approximately 53 square miles. It is located just upstream from the town of Vida. Average annual precipitation ranges through the WAU from 60 inches to 70 inches with the greater amounts at the higher elevations. The main tributary streams are Gale, Marten, Deer, and Enis creeks on the south side of the McKenzie River and Bear, Rough, and Rail creeks on the north side. This makes up 5.7 percent of the total drainage area at Vida. About 31 percent of the drainage area at Vida is controlled by dams at Blue River and Cougar reservoirs. Oregon Department of Environmental Quality did an assessment of the McKenzie River and found it to have some of the highest water quality in the State based upon compliance with State water quality standards, Oregon Water Quality Index (McKenzie Water Quality Report, September 1996). However, there have been some temperature problems associated with the construction of the 2 flood control dams that have led to declines in the salmon runs and have had some impact on bull trout. The McKenzie River is the source of drinking water for the city of Eugene.

SOILS

Geology - The geology of the Bear/Marten WA area consists of Western Cascade Province Tertiary volcanics, landslides, river terraces, and alluvium from the Quaternary period (see Geology Map). Much of the area has been mapped as the Tuffaceous Sedimentary Undivided Series (Tu), consisting of an undifferentiated mixture of tuffaceous sedimentary rocks, basalt flows, tuff, and tuff breccia. In comparison, the Bear Creek and Jimbo Mtn. subbasins are dominated by an intrusive igneous, medium-grained rock (diorite) feature (Thi) that is less competent than basalt or andesite but more competent than tuff. The weathering pattern of all these rock types has resulted

in a topography typified by steep slopes and often narrow ridges.

Soil Productivity And Resiliency

Soils in the Bear/Marten Watershed Analysis Unit were analyzed in terms of their productivity and sensitivity to natural and human caused disturbance using the Resiliency Unit concept. In this concept, the soils in the watershed were stratified into Low, Moderate, or High resiliency categories across the landscape according to physical properties and processes that have evolved over time in response to climate, geology, geomorphology, and the biotic community.

The Bear/Marten landscape is dominated by soils in the high and moderate resiliency categories (65% High, 42% Moderate) (see Soil Resiliency map). Soils in the High resiliency category are the most productive areas, capable of sustaining substantial manipulation and still maintaining nutrient capital, inherent physical and chemical capabilities, hydrologic function, and natural rates of erosion. These soils occur on gentle to steep topography, and are deep, well-drained, highly permeable dark brown clay loams. In comparison, soils in the Low resiliency category occupy only 4 percent of the analysis area. In general, these soils are found on steep slopes, are shallow, with a high rock fragment content, and often associated with scattered rock outcroppings. Nutrients and water are limiting factors, making these the least productive areas and, as such, difficult to reclaim once soil and vegetation disturbance have occurred.

Erosional Processes And Sediment Delivery

The delivery of fine and coarse sediment to streams is a natural process. However, human caused activities can accelerate this process, changing the frequency and spatial distribution of delivery patterns to the degree water resource values are compromised. For the Bear/Marten WA area, Hillslope Erosion, Road-Related Erosion and Mass Wasting were analyzed to determine their relative contribution of sediment to streams, and where human activities have accelerated the rate of delivery.

Hillslope erosion was found to be a minor component of sediment delivery to streams in the analysis area. The Hillslope Erosion assessment indicated 78.3 percent of the Bear/Marten WA area has a low potential for hillslope erosion. The combination of characteristics such as a protective surface organic layer, high soil strength, and high permeability have resulted in soils resistant to detachment and overland flow. The results are consistent with observations in the field, where surface erosion and overland flow as a result of management activities, such as yarding skid trails, are found to be uncommon and discontinuous in nature, rarely resulting in delivery to water resources.

A road-related surface erosion assessment was conducted for the roads in the analysis area to determine the potential for sediment delivery from roads. The analysis indicated road erosion is delivering fine sediment to streams at a rate less than the estimated natural background levels. The potential contribution of fine sediment delivery from BLM roads is small, and is directly related to the low BLM road miles, the predominance of ridge top road locations, and the presence of adequate relief drainage. The highest potential for sediment contribution from BLM roads is occurring in the Marten Creek, Little Bear, and Jimbo Mtn. subbasins, generally

as a result of high cutslope delivery rates and low cutslope vegetative cover.

Mass wasting is a natural process in the Bear/Marten Watershed Analysis area, and the primary source of fine and coarse sediment to stream channels. A Slope Failure Potential analysis determined approximately 12.5 percent of the analysis area to have an inherently high potential for slope failure. These areas are typically associated with steep, convergent headwalls and steep slopes adjacent to streams. Road construction on steep, midslope road locations where sidecasting has occurred or where oversteepened, raveling or failing cutbanks are compromising road drainage, have increased the potential for landslide activity.

ROADS

	Bear/Marten Watershed	BLM Roads in Watershed
Miles of Road	187.8	41.2
Road Density (mi/mi^2)	3.3	2.4

BIOLOGICAL

VEGETATION

The BLM ownership is 11,050 acres, 34 percent of the watershed. The young seral forest ages on the BLM ownership have been part of the reason forest management activities have been delayed. Some of the first harvest actions on BLM land were at the lower end of the Marten Ridge road, Rd. No. 16-2E-36.2, which was constructed in 1964 for a partial cut harvest in Section 01. The Hagen/Bear Creek road system, Rd. No. 16-3E-26.3 on the north side of the watershed was built in 1982 to develop the Bear Creek timber sales.

Current BLM Age Classes in Bear/Marten Watershed

Age Class (years)	Acres	Percent BLM Lands (11,050 Ac.)	Percent of Watershed (32,667 Ac.)
Recent Harvest	135	1.22%	0.41%
0 - 9	649	5.87%	1.99%
10 - 19	302	2.73%	0.92%
20 - 29	0	0.00%	0.00%

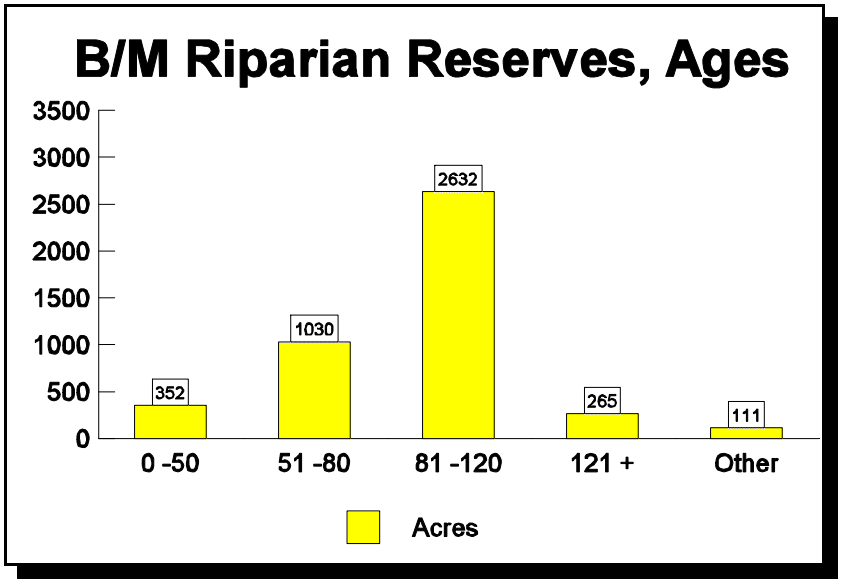
30 - 39	6	0.05%	0.02%
40 - 49	46	0.42%	0.14%
50 - 80	3053	27.63%	9.35%
81- 120	6073	54.96%	18.59%
121+	515	4.66%	1.58%
FOI Outs	271	2.45%	0.83%
Total	11050	100.00%	33.83%

SURVEY AND MANAGE PLANTS

The Eugene District ROD/RMP lists several plants that qualify for special management guidelines. *Allotropa virgata*, (candystick plant) is a "survey and manage plant" known to occur in the Bear/Marten watershed. The watershed has little actual survey information, but a variety of habitats exist within the area that may be suitable to other survey and manage and/or special status plant species.

RIPARIAN/AQUATIC

There are approximately 4,391 acres in the interim Riparian Reserves within a BLM land base of 11,050 acres, or about 31 percent is in projected Riparian Reserves. The acre breakdown by age class is described in the chart below. An estimated 65.9 percent of the Riparian Reserves are 80+ in age.



Stream Channel Geomorphology

Mass wasting is a natural process in this watershed, and has resulted in stream channels that have been repeatedly impacted by debris torrents and dam break floods. Three known debris torrents have occurred in the past 10 years (2 in 1996) that temporarily displaced fish populations on BLM land. At least 2 of these were management related. There are 16 known debris dams on fish bearing streams (BLM) in the watershed (see Fish Barriers map). All of these are a result of past upslope landslides. Some of these dams are over 100' long, and have accumulated large amounts of large woody debris (LWD) and sediment behind them. At some point these debris dams will break and the channels downstream will, once again, be impacted.

FISHERIES AND AQUATIC HABITAT

The Bear/Marten watershed tributaries support populations of spring chinook salmon, rainbow/steelhead trout (including McKenzie redsides), cutthroat trout, at least one population of Isolated cutthroat trout, and several sculpin species. Dace may also be present in Marten and Deer creeks. All of these are also present in the McKenzie River (except the isolated cutthroat) along with bull trout, mountain whitefish, and several species of cyprinids. Salmon spawn and rear in Marten and Deer Creeks. These 2 streams are also probably used by bull trout for foraging and winter refuge.

There are approximately 76 miles of potential fish habitat in the watershed (19 BLM miles) including the McKenzie River. Approximately 38 miles (15 BLM miles) are known to support fish. Virtually all potential habitat (80%) on BLM land is being used. The other 20 percent is mostly in Rough Creek. Habitat in Rough Creek is the best in the watershed, but fish are not present and access to the McKenzie River is blocked by high gradient.

Almost 70 waterfalls or other natural barriers exist in the watershed. Some are passable during high flows but many are probably permanent barriers. This means that fish populations are often fragmented. If this condition has persisted long enough, genetically isolated populations result. There is reason to believe that at least one and probably more of these unique populations inhabit the Bear/Marten watershed. Only 3 culvert barriers currently exist in the watershed that are impediments to fish passage.

The overall condition of the habitat in fish bearing streams is good as measured by PACFISH standards for bank stability, large woody debris, and pool frequency. Streambanks are generally stable throughout the watershed. Mature conifer is the dominant riparian vegetation type on BLM land. Consequently, large woody debris (LWD) is generally abundant in stream channels. However, much of it is found in large jams that were formed by debris torrents or hillslope failures. These jams do not provide much habitat for fish. Over time, jams may break up and re-form in response to high flows. Therefore, habitat (especially pools) may be very abundant in some years and fairly rare in others depending on how LWD from these jams behaves in the channel. Over the last 10 years, pool numbers have ranged from 90 to 75 percent of the PACFISH goal.

The other 2 PACFISH standards are width:depth ratio and water temperature. All stream

channels in this watershed are proportionately “too wide” and “too shallow” relative to the width:depth standard. Because this condition was found throughout the watershed by all surveys, old and new; this is probably a natural feature of this area and does not seriously compromise overall habitat quality. Water temperature data is limited to 2 summer surveys: USFS 1992 (Deer, S. Fk. Deer) and WEYCO 1994 (Marten, Gale, Deer). All were within acceptable limits, but Deer Creek may be getting too warm. In 1994 Deer Creek registered 67E, one degree below the 68E maximum set by PACFISH.

WILDLIFE

With the contiguousness and older age of the forested habitat in the Bear/Marten watershed, the quality of habitat for wildlife species known or suspected to occur in the watershed is high. The age of the forested stands and their development has the potential to provide much more high quality habitat in the future as these stands continue to develop characteristics of old growth forests. These conditions make this a unique watershed for BLM in that many species of wildlife not found in other areas of the District may be found in this watershed.

The condition of the riparian areas provides for high water quality which in turn provides for species of wildlife, both aquatic and terrestrial, that depend on high water quality for their life history needs (e.g., harlequin duck, tailed-frog).

From data collected on snags and down wood, in some age classes in the watershed there are numbers of snags high enough to support nesting habitat for 100 percent cavity nester populations. Also from the data there are large amounts of down wood in the area, indicating that this watershed has the potential to provide habitat for many species of wildlife that may not be found in other watersheds on the District (e.g., martens and fishers).

With relatively low road densities in the watershed, and the placement of existing usable roads out of the riparian areas, the impacts of roads on wildlife in the watershed is at a minimum. The impacts of people using the roads for illegal activities (poaching) is also at a minimum, as wildlife species can seek refuge in the bottom of undisturbed steep drainages.

The portion of the watershed that receives the most use by the public is along the McKenzie River. With the amount of use that the river receives and the probable increase in this use, the species of wildlife residing along and using the river will be impacted the most. Snags that are present along the river are highly used and are a limited resource. Habitats that are impacted by boaters stopping for lunch or rests during float trips are highly impacted during the summer. Some recovery of these areas occurs during the winter months with the rising waters, but we are unsure how much recovery occurs. Controlling the number of areas that are used by recreationists along the river, is the best way to minimize impacts to the wildlife species in the area.

Amphibians, Invertebrates, and Reptiles

There are no Survey and Manage amphibians on the Eugene District. The only Survey and Manage animals that are of concern in the Eugene District and for this watershed are 4

species of mollusks. The 4 mollusks are *Megomphix hemphilli*, the Oregon Megomphix, *Deroceras hesperium*, the Evening Fieldslug, *Prophysaon coeruleum*, the Blue-gray Taildropper, *Prophysaon dubium*, the Papillose Taildropper. There are no know sites for the 4 mollusks in this watershed.

A number of special status amphibians are known or potentially present in this watershed. They are:

Aneides ferreus, Clouded Salamander (known to be present)
Batrachoseps wrightorum, Oregon Slender Salamander (possibly present)
Ascaphus truei, Tailed Frog (known to be present)
Rana aurora, Red-legged Frog (known to be present)

CHAPTER 3
VALUES, ISSUES, AND KEY QUESTIONS

Chapter 2 identified a variety of uses, values, and dominant features associated with the Bear/Marten Watershed, and in this chapter the focus will be to analyze those that are most relevant to management decisions, human values, or resource conditions. Since the Federal ownership in the watershed is 40 percent, the key issues and questions were developed not only to focus on key ecosystem features but where Federal decisions could play a major role in the conditions/functions of the key ecosystem features.

The core team identified 6 major issues for the Bear/Marten Watershed. After identification of these issues/values, they selected a series of key questions that will assist in addressing each issue - the issues were not ranked in any priority. The Bear/Marten Watershed Analysis will focus on 4 issues/values as follows:

- Special Status Species
- Aquatic Conservation Strategy (ACS) Objectives
- Habitat
- Human Use

Two other issues that were identified will primarily be addressed in the Landscape Design are the Proposed ACEC and Commodity Production and Maintaining Ecologocial Integrity. (See Appendix A for detailed information on the issues and key questions to be addressed through watershed analysis.

1. SPECIAL STATUS SPECIES

Special Status Species are those listed as Federally or State Threatened, Endangered, Sensitive, Proposed Threatened, or Endangered Species. There are some special status species that are found in this watershed and are known to occur in few places in the McKenzie Resource Area. The Bear/Marten watershed has the potential to play a major role in the habitat needs for certain species.

Issue: What special status species need to be actively managed for?

a. What Threatened and Endangered species exist in the watershed? What is the condition of their habitats?

b. What can be done to proactively manage or minimize impacts to Threatened and Endangered (T&E) species?

c What Survey and Manage (S&M) species have the potential to exist? Where do they exist?

d. What other Special Status Species exist in the watershed?

2. ACS OBJECTIVES

The Aquatic Conservation Strategy (ACS) is a key component in the Northwest Forest Plan (NFP). The ACS was developed to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within them on public lands. Watershed analysis, watershed restoration, Riparian Reserves, and key watersheds are the 4 components in the ACS. There are 2 key watersheds in the Bear/Marten Watershed unit.

Issue: How does the BLM use watershed analysis and watershed restoration projects to guide management in the Riparian Reserves and key watersheds to meet the goals of the ACS?

The questions below relate to the ACS objectives on page b-11 of the Standard and Guidelines in the Pacific Northwest Forest Plan. The objectives are not restated here but are referenced by number (see the end of this section for description of objectives).

Objective 1

a. What are the current distribution and diversity of the habitat?
b. What species have adapted and how does BLM manage for them?
c. How could stand density management be used to convert Riparian Reserve (RR) stands to Late-Successional Old Growth? Is this needed in the watershed? If so, where could this occur?

Objective 2

a. Where do barriers to fish exist?
b. Where are there barriers to movement of materials within the channels?
c. What barriers exist in the Riparian Reserves' terrestrial portion that impede movement of terrestrial organisms?

Objective 3

a. Where are stream reaches that are sensitive to disturbance? How do we manage for them?
b. What is the channel condition/capacity?

Objective 4

a. What is the current water quality? How can water quality be maintained?
b. What and where are aquatic invertebrates and other species that are indicators of water quality?

Objective 5

a. Where in the watershed and on BLM lands do erosion processes (mass wasting, hill slope erosion, road-related erosion) have the greatest potential to deliver sediment to stream channels or other water resources?
b. What are the natural tendencies for landslides and debris torrents in riparian areas?
c. What are the opportunities to decommission and repair roads to reduce sedimentation?

Objective 6

How could BLM actions in this watershed impact peak flow and increase sedimentation?

Objective 7

How does BLM maintain and restore the timing, variability, and duration of *flood plain inundation* and water table elevation in meadows and wetlands?

Objective 8

a. What is the condition of the Riparian Reserve? What specific areas could benefit from vegetation treatment?
b. Where is Large Woody Debris (LWD) recruitment potential now? Where and how can BLM manage for it in the future?
c. Where do hardwoods occur? How much? What kind?

Objective 9

a. What are the stream reaches that are most responsive to habitat creation (best for habitat improvement)?
b. Where is it possible to consider adjusting Riparian Reserve? Where can the Riparian Reserve boundaries be adjusted without detrimental impacts to species of concern?
c. Where is potential fish habitat? For species of concern?
d. What is the aquatic habitat condition? Trend? What are the critical limiting factors and what could BLM do to correct them?

3. HABITAT

With the extent of the contiguous terrestrial habitat that exists within this watershed, and the wildlife species associated with these habitats, Bear/Marten watershed is a unique watershed in the McKenzie Resource Area. Many wildlife species occupying the watershed do not have the disturbances associated with other portions of the Resource Area because of less miles of roads, the blocked Federal ownership, the uniform stands of forested habitats, the proximity to old growth forest stands on Forest Service lands, and the minimal amount of forest management that has occurred within the watershed.

Issue: Maintain a range of habitats for species living in the watershed.

a. What are the land use allocations? And administrative outs?
b. What is the historical pattern? How has it influenced the current condition?

c. What are the natural disturbances? How could BLM manage to reflect what has been created in the current conditions?
d. What special habitats exist?
e. How will BLM manage special habitats?
f. What is the current and potential vegetation species' composition and distribution? Age class?
g. What vegetation types exist and what limitations are there for management actions?
h. Where should alternative regeneration and thinning prescriptions be applied? In uplands and riparian areas?
i. How much interior forest exists?
j. What is the condition of the terrestrial habitat for the species of concern? What are the trends?
k. Where does the best suitable habitat occur for these species of concern?
l. What opportunities are there for dispersal corridors from Bear Creek to the Late-Successional Reserve (LSR)?
m. How should BLM manage bald eagle habitat areas?
n. What areas are best for snag creation and Down Woody Debris (DWD)?
o. Are there areas where BLM could manage for different levels (above 40% minimum) of cavity nester populations?
p. What is the current condition of DWD and snags in the area? What areas would benefit most from management actions?

4. HUMAN USE

An 11-mile segment of the McKenzie River has been found suitable for inclusion in the National Wild and Scenic Rivers System. The highest potential classification of this segment is “Recreational.” Management of recreational river areas should give primary emphasis to protecting the Outstandingly Remarkable Values (ORV) while providing river related outdoor recreation opportunities in a recreational setting. The preliminary boundary is one-quarter mile from the ordinary high water mark on both sides of the river.

The McKenzie River SRMA and Segment A are designated as Visual Resource Management Class II areas. This requires retention of the existing character of the landscapes. Changes in any of the basic elements (form, line, color, texture) caused by a management activity should not be evident in the characteristic landscape. Contrasts are seen but must not attract attention.

The McKenzie River and riparian areas provide a variety of recreational opportunities. Portions of the upland are part of the scenery viewed from recreational sites and the river. The river, riparian areas, and uplands contribute to the economy through recreational activities and timber harvesting in the uplands.

Issue: What human activities occur in this watershed analysis area and what benefits are provided to the local and regional area?

a. What limits to management activities are there in the SRMA and Segment A?
b. What do recreationists want from the watershed?
c. Where should recreation use be encouraged and discouraged?

d. What changes can be expected in recreation use in the future?
e. How can the BLM contribute to the goals of local planning efforts?
g. What commodities, benefits, and values does this watershed provide for people?
h. How can the visual resource quality of the river corridor be maintained?

CHAPTER 4
REFERENCE AND CURRENT CONDITIONS

This chapter describes the reference and current conditions of the resources within the Bear/Marten Watershed. The reference and current condition discussion is focused on the key issues and questions. The chapter is organized as follows.

SOCIAL
- Cultural Resources
- Demographics
- Recreation
- Planning and Collaborative Efforts

PHYSICAL
- Hydrology
- Soils

BIOLOGICAL
- Vegetation
- Fisheries
- Wildlife
- Amphibians

SOCIAL

CULTURAL RESOURCES

The McKenzie River drainage between river mile 42 and river mile 52 has not been thoroughly inventoried and the prehistory is not well known. Beginning in 1975 Bureau of Land Management personnel conducted cultural resource surveys on BLM administered lands in advance of potential surface disturbing activities. Beginning in 1977 a program of post-harvest cultural resource surveys was begun. Between 1975 and the present 2,400 acres (21.6%) of Bureau administered lands within the watershed have been surveyed for cultural resources prior to timber harvest. Post-harvest surveys have reexamined 316 acres (13.2%) of the final harvest acreage within the watershed. Approximately 3,200 acres located in the southeast corner of the watershed are administered by the USDA Forest Service, Blue River Ranger District. Forest Service personnel have surveyed 850 acres (26.2% of FS administered lands in the WAU) for cultural values in advance of potential surface disturbing projects between 1990 and the present.

The combined cultural resource surveys have resulted in the discovery and recordation of 6 prehistoric archaeological sites (5 on BLM administered lands), 16 isolated artifact locations (15 on BLM administered lands) and a single historic site (plane crash locality on FS administered lands).

A Class I literature review and synopsis of existing data for lands within the Eugene District, including those within the Bear/Marten WAU, was conducted by Heritage Research Associates during 1980 and 1981. The results were published in the University of Oregon Anthropological Papers series (Beckham, S.D.; R. Minor and K.A. Toepel 1981). Those interested in a detailed understanding of the cultural sequence in use in the Willamette Basin, aboriginal settlement patterns of the area, or information concerning the ethnographic life styles of the aboriginal inhabitants should consult this work.

Limited test excavations were conducted at a single site within the WAU. The Viny Maple site (35LA825) consists of a small lithic scatter on a ridge line immediately south of the McKenzie River. Artifacts recovered from the test excavations include a small number of biface and uniface tool fragments, obsidian debitage, and a single piece of basalt debitage. The nature of the assemblage recovered from the Viny Maple site is consistent with a location where a limited number of activities associated with the final stages of flaked stone tool manufacture or refurbishment were conducted. No temporally sensitive tool forms were recovered consequently the Viny Maple site is not assigned to a specific temporal period although it is known to be a prehistoric site (Southard 1992).

The 5 recorded sites located in the Bear/Marten WAU, which have not been tested (4 BLM, 1 FS), all appear to be small lithic scatters similar in nature to the Viny Maple site. Based on temporally sensitive flaked stone artifact styles recovered from the surface of the sites, one site has been assigned to the Late Archaic period and 2 sites are tentatively assigned to either the Early Archaic or Middle Archaic periods. The remaining 2 sites are known to be prehistoric but have not been assigned to a particular period.

No recorded archaeological site in the Bear/Marten WAU has been determined eligible for

listing on the National Register of Historic Places.
At the time of Euro-American contact in western Oregon (early 19th century) the area encompassed by the Bear/Marten WAU was within the territory of the Molala (Beckham; Stephen Dow 1976). The Molala occupied the higher western slopes of the Cascade Range. Very little is known about the Molala and their lifestyle; however, they apparently consisted of a number of small bands who practiced a highly mobile hunting and gathering economy. Winter villages consisting of a few related families were located in river valleys. During the other seasons of the year small family groups ranged widely throughout the mountains hunting and gathering seasonally available foods (Toepel and Beckham 1981).

By the middle of the 19th century the Molala, like the other native peoples of western Oregon, had undergone a drastic population decline due primarily to introduced diseases. By 1856 many of the Molala had been removed to the Grand Ronde Reservation in the Coast Range although a few remained in the southern Cascades. Members of this remnant group eventually ended up on the Klamath Reservation.

Euro-American settlement of the middle reaches of the McKenzie River proceeded slowly. A wagon road following the north bank of the river is shown on the plat map published at the completion of the rectangular survey of T. 16S., R. 3E. in 1871; however, no houses are shown on this or other early (pre-1900) plat maps of townships within the WAU. The earliest homestead entries in the WAU occurred in the late 1870s and early 1880s, but these entries were canceled within a few years. The earliest patented homestead entry occurred in section 34, T. 16S., R. 2E. in 1897. No additional homestead entries were patented in the WAU until 1908 when a single entry was patented. The next 2 decades saw increased homestead activity in the WAU.

The early settlers along the middle reaches of the McKenzie River practiced a subsistence lifestyle with little opportunity to earn cash money through labor or the sale of products. This began to change during the early decades of the 20th century as some timber began to be cut and driven to mills on the lower McKenzie and Willamette rivers. However, logging on an extensive scale did not occur in the area until the decades after World War II.

DEMOGRAPHICS

FINDINGS - The findings reflect changes between 1980 and 1990 from the 1980 and 1990 U.S. Bureau Of Census Data on Lane County Tract #0001, which covers the McKenzie River drainage except for Mohawk and Camp Creek drainage. This tract includes the Bear/Marten watereshed and other areas. For more information see Appendix C.

< The population has decreased by 8.4 percent, and has grown older. The median age has increased from 33.9 years to 39.7 years (a 17.1% increase). The median age is higher in the McKenzie corridor than in Lane County.

< Housing transiency has decreased; rent has increased drastically. The percentage of the population who live in the same house they did 5 years previously has increased from 46.6 to 52.6 percent. The median house value has increased by 14.11 percent. Rental prices have increased by 61.0 percent (not corrected for inflation). Median housing values are higher in the McKenzie corridor than the rest of the County, but median contract rents are lower.

- < The number of people working in Eugene and Springfield has increased. The mean travel time has stayed approximately the same (28.7 minutes - 27.4 minutes) The number of people working in Eugene has increased by 32.9 percent, and the number of people working in Springfield has increased by 23.0 percent.

- < The labor force has decreased by 7.6 percent, and unemployment has decreased from 13.1 to 7.3 percent.

- < Income has increased and poverty levels decreased slightly. The median income has increased by 68.3 percent and the per capita income has increased by 77.5 percent. Neither figure has been corrected for inflation. The percentage of families below the poverty level has decreased from 5.7 to 4.9 percent while County and State poverty levels increased. Poverty levels are much lower than countywide and statewide levels.

RECREATION

This section will answer the following questions:

What limits to management activities are there in the SRMA and Segment A?
What do recreationists want from the watershed?
Where should recreation use be encouraged and discouraged?
What changes can be expected in recreation use in the future?
What commodities, benefits, and values does this watershed provide for people?
How can the visual resource quality of the river corridor be maintained?

The major topics to be discussed are:

- , Fishing
- , Boating
- , National Wild and Scenic River
- , Visual Resources
- , Disperse Recreation

INTRODUCTION

The McKenzie River corridor is known for its scenic beauty and recreational opportunities. Motorists seeking recreational or scenic activities account for approximately 70 percent of the traffic along the McKenzie corridor with summer counts nearly double those in winter (LCOG 1997).

A 1991 recreational survey found the predominant recreational activities in the river corridor to be fishing, followed by boating, driving for pleasure, water play, picnicking, hiking/walking/running, and wildlife viewing (USDI, BLM 1994).

Public providers of recreation opportunities include the BLM, Eugene, Water & Electric Board, Lane County, the Oregon Department of Fish and Wildlife, and Oregon Department of Parks and Recreation. River access is also provided by Rosboro Lumber Company.

FISHING

The McKenzie is one of Oregon's most popular rivers for fishing. Fish include wild and hatchery rainbow trout, wild and hatchery spring chinook salmon, and summer steelhead. Of the survey respondents who indicated they were fishing, 58 percent fished from shore, 44 percent from a boat, and 13 percent while wading in the river (USDI, BLM 1994).

The recreational angling occurring in the Lower McKenzie contributes to the economy of the area. A June 1991 study by the Research Group for the Oregon Department of Fish and Wildlife, *Oregon Angler Survey and Economic Study* , considered what the economic contribution of an angler/day is to the local economy in several regions in Oregon. The study estimated that residents of the region contributed more than $24 per angler/day to the local economy (Willamette region). Nonresidents were estimated to contribute more than $14 per angler/day to the local economy. (The lower nonresident costs are due to having assumed their main equipment purchases were outside the Willamette region.) The total economic impact of fishing in the Willamette Region was in excess of $44 million in 1991 (USDI, BLM Vida 1996).

BOATING

From a 1983 Oregon Department of Fish and Wildlife study It was estimated that 36,208 nonangler recreational boaters floated the river between Blue River and Armitage Park during the 1983 trout season. This probably represented over 80 percent of the total number of such boaters using the entire river during all of 1983. In July, August, and September these river users outnumbered all anglers. Heaviest nonangling boating generally took place above Leaburg Dam and was associated with sunny days, weekends, and holidays (Oregon Department of Fish and Wildlife 1983).

From the 1994 BLM survey, 58 percent of the boaters used drift boats, 25 percent used rafts, and 8 percent used canoes and kayaks (USDI, BLM 1994).

A boater study was conducted on-site and through the mail with 652 boaters on the McKenzie River between Olallie Campground and Ike's Landing, during spring, summer, and fall 1996.

Boaters were contacted at 14 boat launches and each launch was sampled 6 times. Results from the 1996 McKenzie River Study include:

> Boaters stated their reasons for boating on the McKenzie were to do something with friends, enjoy the natural environment, see the scenery, relax, and feel close to nature.
>
> McKenzie boaters are less likely to seek a contemplative, wilderness-type experience or exciting and challenging white water. Rather, they seek a social, enjoyable float trip in a natural setting. This sentiment is reflected in respondents generally neutral or positive reactions to the presence of other boaters. Many boaters are attentive and sensitive to vegetation loss and erosion. These impacts detracted for more people than did social conflicts. Most boaters noticed the other attributes of the environment listed on the survey, including houses, clear cuts, ramp conditions, and lack of parking. Although half said parking and ramps have no effect on enjoyment, very few boaters said any of these conditions added. Parking detracted 46 percent, houses detracted 56 percent, and clear cuts detracted 74 percent.
>
> There does not appear to be an issue of waiting at put-ins. The number of encounters is not high, although many boaters spend large percentages of their time in sight of other boaters. This does not appear to be of great concern to many boaters.

Of 16 possible management actions, 6 were favored by a majority. Information received the most support (78%), followed by new toilet facilities (73%), boater education (62%), a new boat-in, bike-in, hike-in campground (59%), limiting recreational use if necessary to protect fish (52%), altering flows to protect fish (51%), and adding signs (50%). The most opposed were constructing new landings (60%), limiting the number of anglers (54%), limiting the number of boaters if most feel too crowded (51%), increasing the number of outfitter-guide trips (47%), charging a fee to offset management costs (44%), and limiting group size (42%).

There is strong support for environmental protection, and boaters think regulations are necessary for such protection. However, many boaters express criticism or distrust of government. This suggests that land managers could meet some resistance in trying to implement new programs, especially any that would involve regulations not based on environmental protection.

The McKenzie River is known among river users for its relatively consistent year-round flow. This consistent flow is in part due to dams that regulate water flow. Low water levels occur upstream and downstream of the WAU at certain times of the year due to declining runoff and water diversion projects. This contributes to concentrating boaters in the segment within this watershed analysis unit.

NATIONAL WILD AND SCENIC RIVER

A 12.7-mile stretch of the upper McKenzie River managed by the USFS is designated as a National Wild and Scenic River. An 11-mile, 1,194 acre, segment of the McKenzie River within the study area and managed by the BLM has been found suitable for study for inclusion in the National Wild and Scenic Rivers System. BLM policy is to protect and, where possible, enhance any identified outstandingly remarkable river values pending a subsequent suitability determination and/or designation decision by Congress. The corridor width for rivers found eligible or studied for suitability is generally defined as one-quarter mile on either side of the river (approximately one-half mile wide corridor). BLM's management protection requirements shall be applied to the entire river study area (identified river segment and corridor) except for private or State lands.

The highest tentative classification of this segment of the McKenzie would be "Recreational". Recreational river areas are those that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past. Parallel roads or railroads, existence of small dams or diversions can be allowed in this classification. A recreational river area classification does not imply that the river will be managed or prioritized for recreational use or development (BLM Manual 8351 - Wild and Scenic Rivers).

According to BLM Manual 8351 - Wild and Scenic Rivers, management standards for recreation river areas include the following:

Forestry practices including timber harvesting would be allowed under standard restrictions to avoid adverse effects on the river environment and its associated values.

Existing parallel roads can be maintained on one or both river banks. There can be several bridge crossings and numerous river access points. Roads, trails, and visitor areas must conform to construction and maintenance standards and be free of recognized hazards.

Interpretive centers, administrative headquarters, campgrounds, and picnic areas may be established in proximity to the river. However, recreational classification does not require extensive recreation development.

Recreation use including, but not limited to, hiking, fishing, hunting, and boating is encouraged in recreational river areas to the extent consistent with the protection of the river environment. Public use and access may be regulated and allotted where necessary to protect and enhance recreational river values.

Exploration and development of locatable minerals would be conducted in a manner that would prevent unnecessary and undue degradation on all river segments designated. Salable mineral development would not be allowed on designated river segments unless the authorized officer determines that impacts from a proposed development are acceptable or can be adequately mitigated. Leasable mineral activities would be subject to a controlled surface use special leasing stipulation.

In 1994 the BLM withdrew from mining 292 acres of public lands and 159 acres of non-Federal lands on the south side of the river for a period of 50 years to protect the Eagle Rock and Leaburg Lake sections of the McKenzie River.

VISUAL RESOURCES

Visual quality objectives set management objectives for visual goals for specified areas. There are 4 classifications of applicable visual quality objectives. As designated in the ROD they are:

VRM Class I - Preserve the existing character of landscapes. Management activities, except for very low visual-impact recreation facilities, are prohibited.

None in the Eugene District.

VRM Class II - Manage lands for low levels of change to the characteristic landscape. Management activities may be seen but should not attract the attention of the casual observer. Changes should repeat the basic elements of form, line, color, texture, and scale found in the predominant natural features of the characteristic landscape.

McKenzie River, Segment A corridor to W&SR - 1/4 mile from the river
McKenzie River SRMA
Existing and proposed recreation sites

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

BLM administered lands within a quarter mile of Rural Interface Areas (1-20 acre lots)

VRM Class IV - Manage lands for moderate levels of change to the characteristic landscape. Management activities may dominate the view and be the major focus of

viewer attention. However, every attempt should be made to minimize the effect of these activities through careful location, minimal disturbance, and repeating the basic elements of form, line, color, and texture.

All remaining BLM lands

DISPERSED RECREATION - Dispersed recreation opportunities in the analysis area include driving for pleasure, wildlife viewing, shooting, hunting, gathering forest products, and motorized vehicle use. Few of the roadways within the watershed allow for legal public access for recreational activities. Evidence of timber harvest is predominant outside of the river corridor area. The public has legal access rights to the banks of navigable rivers, which includes the McKenzie.

TRENDS

A 1990 EWEB recreational use study reported that because of concentrated use at key sites and seasons, capacity is exceeded 15 to 30 days each summer and demand for river access and facilities are increasing substantially within the study area (McKenzie Watershed Council Action Plan 1997).

The Wild and Scenic River plan (USDA FS and OSPR 1992) and McKenzie River RAMP (USDI, BLM 1994) project that use of the river will continue to increase as the populations of the Bend
and Eugene metropolitan areas grow, as tourism is promoted by the local communities, and as interest in white water recreation increases.

Efforts to protect threatened and endangered fish along the McKenzie have and will continue to affect recreational fishing patterns. Demand for fishing opportunities is expected to increase while wild fish populations are expected to continue to struggle with more pending protective legislation.

CONCERNS

Blending recreational use with residential use along the McKenzie will become an increasing challenge in the future as both demands continue to grow and more conflicts develop.

Maintaining the visual quality of the river corridor while providing for timber needs will be an ongoing concern and potential point of conflicting values.

Multiple agencies managing a relatively small concentrated use area will pose coordination challenges and a potential for inefficiencies and inconsistencies.

The coordinating groups such as the McKenzie Watershed Council, the McKenzie River Maintenance Partnership, and the establishment of the Central Cascades Adaptive Management Area hold promise for minimizing some of these potential conflicts.

PLANNING AND COLLABORATIVE EFFORTS

The following question will be answered in this section.

How can the BLM contribute to the goals of local planning efforts?

PLANNING EFFORTS - The following are some of the recent planning efforts completed in the basin that are more than project specific planning.

Upper McKenzie River Wild and Scenic Plan - The Forest Service completed a plan for the Upper McKenzie River Wild and Scenic segment and Oregon State Scenic Waterway in 1992. The plan describes an overriding objective of protecting and enhancing outstandingly remarkable values, including recreational, scenic, fisheries, geologic, and hydrological values (USDA FS and OSPR 1992). No formal recreation management plan has been developed for the river between Paradise Campground and Nimrod.

Draft Recreation Area Management Plan - A recreation area management plan identifies the management actions to be taken to implement the recreation management allocation decisions made in the ROD/RMP. The BLM released a draft recreation area management plan (RAMP) for the river corridor between Nimrod and Walterville in 1993. Response to the document identified a need for some modifications and further review. This recreation planning process may now be incorporated into a greater planning effort associated with this watershed called a landscape design. The landscape design will build on this watershed analysis and specific action items and priorities for multiple resource management.

CCAMA Strategic Guide - The Central Cascades Adaptive Management Area encompasses a part of the McKenzie River area near the town of Blue River and has the potential to affect river management. The CCAMA Strategic Guide was completed December 1996.

COLLABORATIVE EFFORTS - The McKenzie Resource Area is involved in collaborative efforts by working with several agencies and organizations. The Area Manager is a member of the McKenzie Watershed Council. There is also a BLM representative on the McKenzie River Maintenance Partnership. The BLM works closely with the State and Lane County on an on-going basis. The McKenzie Resource Area also works with the Forest Service in managing the land under the guidelines of the Adaptive Management Area concept.

MCKENZIE WATERSHED COUNCIL - The McKenzie Watershed Council was established in 1993 as an advisory body for the purpose of bringing residents, organizations, and government agencies together to take a proactive approach in addressing watershed management issues in the McKenzie River watershed. The mission of the council is “to foster better stewardship of the McKenzie River watershed resources, deal with issues in advance of resource degradation, and ensure sustainable watershed health, functions, and uses.” In 1997 the McKenzie Watershed Council completed their “Action Plan for Recreation and Human Habitat” that contains the council’s proposed goals and priority actions relating to water-based recreation issues and human habitat issues linked to the land base.

Some of the main concerns of the Watershed Council involve private landowners. For example, an issue of interest is riparian restoration and most of the riparian areas are privately owned. Water quality concerns caused by failing septic tanks and increased density of septic tanks is another concern. Water quality impacts of lawns and golf courses located at the waters edge is also an issue the Watershed Council wants to tackle (Baldwin 1995). The council has found that citizens are more likely to be interested in riparian restoration projects when the residents do not have to pay for the project. Projects are advertised through word of

mouth from property owner to property owner. As a result, most of the projects are currently concentrated in the Mohawk Valley.

Human Habitat Goals and Objectives

1. Manage growth and development within the watershed.
2. Maintain the rural character within the watershed.
3. Maintain the ecological function within the watershed.
4. Increase safety within the watershed.

Recreation Goals

1. Access and Facilities - Seek a balance to provide adequate river access and support facilities to enhance recreation user experience while protecting the river corridor environment.

2. Minimize Recreational Impacts - Minimize adverse recreational impacts within river corridors.

3. Maintain Balance with Nonrecreational Uses

4. Safety and River Ethics

Four priority actions for recreation were identified to help achieve the four recreational goals:

Action 1: Improve access along the McKenzie River corridor where appropriate.
Action 2: Improve facility design and maintenance.
Action 3: Develop and implement education programs focusing on river ethics and safety.
Action 4: Promote partnerships and citizen involvement efforts to address maintenance, funding, crime, safety, and recreational access issues.

LANE COUNTY - There are 2 Recreation and Public Purposes Leases for recreational facilities within the watershed. White Water and Marten County parks are leased by Lane County and are currently closed. These sites were closed during the early 1980s due to vandalism, budget constraints, and isolated locations in some instances. These sites were retained for future recreational opportunities when management conditions were favorable. The Draft McKenzie RAMP identified these sites for a return to BLM management.

Recently Lane County proposed to consolidate public park management in rural Lane County in the interest of improving efficiency and service. Lane County proposed that Armitage, Hendricks Bridge, Ben and Kay Dorris, H.J. Morton, and Jennie B. Harris State Parks be transferred to Lane County. In the draft proposal by Lane County it was also stated that, “the BLM should be contacted to discuss the possibility of exchanging Rennie’s and Silver Creek Landings on the McKenzie River for Lane County’s holding along the south bank of the river (Marten Rapids and White water). Lane County Commissioners approved this proposal in June 1997. Agency confirmation is still pending.

MCKENZIE RIVER MAINTENANCE PARTNERSHIP - The McKenzie River Maintenance Partnership manages 21 boat access sites within the river corridor from Armitage State Park on the west to Jennie B. Harris State Wayside on the east. Of the 21 sites, Lane

County owns or has management responsibility for 9 of the sites. The balance of the sites are owned or managed by BLM (2), EWEB (2), ODFW (5), and State Parks (3 - Harris, Morton, Dorris). The 3 State Parks are also considered Roadside Safety Rest Areas by ODOT and 50 percent of the cost of operations is paid by ODOT.

PHYSICAL

HYDROLOGY

This section will answer the following questions:

What is the current water quality? How can water quality be maintained?
How could our actions in this watershed impact peak flow and increase sedimentation?

The major topics are as follows.

- Water Quality
- Temperature
- Peak Flows
- Peak Flows and Rain on Snow

WATER QUALITY - The waters of the Bear/Marten Watershed Analysis Unit are generally in very good condition. The Oregon Department of Environmental Quality did an assessment of the McKenzie River and found it to have some of the highest water quality in the State based upon compliance with State water quality standards and the Oregon water quality index (The McKenzie Water Quality Report, September 1996). The clarity of the water in the McKenzie River and its tributaries is such that it is considered to be a recreational activity just viewing the river (Saundra Miles, BLM Recreation Planner - personal communication). The McKenzie Watershed Council and the Central Cascade Adaptive Management Area did surveys and found water quality to be of high interest to both the local residents and user groups.

BENEFICIAL USES OF WATER IN THE ANALYSIS AREA - The State of Oregon, as directed by the Clean Water Act and the EPA, is responsible for protecting the quality of rivers and other bodies of water in the public interest. How this is accomplished is defined in a section of the Oregon Administrative Rules (Chapter 340, Division 41) that lists the beneficial uses associated with each river and standards of parameters monitored. The Oregon Department of Environmental Quality is the State agency responsible for enforcing the standards. The beneficial uses associated with the McKenzie river are:

- Water Supply - Public, Private, and Industrial
- Irrigation and Livestock Watering
- Anadromous Fish Passage, Spawning, and Rearing
- Resident Fish, Aquatic Life, and Wildlife
- Hunting and Fishing
- Boating and Water Contact Recreation
- Aesthetic Quality
- Hydro Power Generation

There are 10 water rights on the main river for irrigation and 6 for domestic water use. Bear Creek has 5 permits for water rights for domestic use, and Rough Creek has 2 water rights for domestic use and 1 for hydro electric. There are 2 permits on unnamed streams - 1 for irrigation and 1 for domestic water use. There are also 5 water rights on springs in the WAU that are for domestic use.

In January 1996 the McKenzie Watershed Council developed an "Action Plan for Water Quality and Fish and Wildlife Habitat" for the McKenzie basin. Eugene Water and Electric board (EWEB) serves as the councils lead on water quality program. As part of this plan EWEB has been working with the Oregon Department of Environmental Quality (DEQ) to establish a watershed monitoring network composed of 7 water stations in the McKenzie basin. Upstream of the Bear/ Marten WAU is a station on the McKenzie River at McKenzie Bridge, river mile 68.1, and downstream of the WAU is a station on the McKenzie River at Hendricks Bridge, river mile 24.2. The WAU is between river mile 44 and mile 52. The plan proposed to monitor the water quality parameters defined in the Oregon Water Quality Index (OWQI). These parameters are temperature, dissolved oxygen (percent saturation and concentration), biochemical oxygen demand, pH, total solids, ammonia and nitrate nitrogen, total phosphorus, and fecal coliform. OWQI scores from 10 (worst case) to 100 (ideal water quality). To date there have been 2 reports produced by DEQ, September 1996 and February 1997.

The reports stated that the portion of river from Clear Lake downstream to Hendricks Bridge was relatively free from point or nonpoint source pollution. The OWQI rating for the station at McKenzie Bridge was 95 and the station at Hendricks Bridge was 94. They found some moderate levels of total phosphates from volcanic rock in the upper basin, and biochemical oxygen demand. Temperature was the only standard that did not come into standards.

TEMPERATURE - In January 1996 DEQ adopted new temperature standards. The new standards are to protect all phases of the salmonid life cycle including adult migration, spawning, and juvenile rearing. In a basin with salmonid fish rearing the temperature is limited to 64EF with salmonid spawning, egg incubation, and fry emergence temperatures not to exceed 55EF, and in waters that support bull trout 50EF is the upper limit.

The station at McKenzie Bridge has resident populations of bull trout; therefore, the 50 degree temperature standard is in effect for the full year. During the summer of 1995 the DEQ report stated that the 7-day moving average exceeded this standard 97 percent of the time and an 87 percent exceedence during the summer of 1996. The 7-day moving average did not exceed 55EF during either summer. There was no temperature problem during the winter months. The station downstream of the WAU, Hendricks Bridge, has a standard of 64EF in the summer and 55EF after September 1 when there are chinook spawning in this area. There were no violations of this standard during the summer of 1995 or 1996 but the 55EF standard for September was exceeded 100 percent of the time in 1995. Most of the watershed would be at the 64EF standard with only the main river at the bull trout level 50EF (Mary Hanson ODFW, Personal Communication). The exception would be Deer Creek and Marten Creek where chinook spawning evidence was recorded by the BLM, which means these streams would be at the 55EF standard (Karen Martin, BLM, Personal Communication).

The dams at Blue River and Cougar reservoirs also have created some temperature problems. The water in the reservoirs tend to stratify with the warmer less dense water rising to the top and the coolest water settling to the bottom. As the reservoirs are emptied, at Blue River in late summer and Cougar in the fall the cold water is drawn from the bottom of the reservoirs. This cold water is entering the system at a time when the streams are normally warming. As the draw down continues the warm water comes out in fall when the streams are normally cooling. The difference in flows is about 30 to 50 percent increase in summer and about the same decrease in late winter and spring. The draw down has also had a significant impact on the temperature and is thought to be the cause of the decline of Chinook Salmon in the McKenzie river (ACOE 1994). The Army Corps of Engineers (ACOE) has planned a project to add a Selective Withdrawal System (SWS) to the dams to help off set the temperature

problems the dams have created. This would be accomplished by drawing water from different levels to maintain more natural water temperatures. These projects are planned for 1998 through 2005 (ACOE 1994).

TRENDS - The DEQ study found that in the McKenzie River water quality was improving at the Coburg road station. This was the only station with a long-term record. Federal lands in the watershed will be managed under the guidelines of the Northwest Forest Plan, following the Aquatic Conservation Strategy objectives, and this is not expected to cause a change in water quality.

PEAK FLOWS - Peak flows can be effected by many variables depending on season and storm types. Peak flows in the McKenzie basin are also controlled by the dams at Cougar and Blue river. Cougar dam controls 202 square miles of drainage area and Blue River controls 88 square miles of drainage area. The total drainage area at Vida, which is at river mile 47.7, is 930 square miles (Dick Cassidy, COE, personal communication). This would have 31 percent of the drainage controlled by these dams. The dam on the Smith River that is controlled by Eugene Water and Electric Board (EWEB) is not used for flood control, only power generation (Everett Jordan, EWEB, personal communication). High Peak Flows such as those experienced in 1923 and 1945 would be impacted some by the presence of the dams.

In a recent event, February 1995, the dams were able to completely control the out flow and only minimum discharge was necessary to be released although the reservoirs were at about 75 to 80 percent of capacity (Dick Cassidy ACOE Personal Communication). The flow at Vida during this storm only reached 30,000 cfs, a little less than a 5-year storm. During the 1964 flood only Cougar reservoir, which controls about 22 percent of the drainage area, was in place. Peak flows were 58,000 cfs at Vida during this event. The peak flow for 1945 was 64,400 cfs and for the 1923 event it was estimated at 62,000 cfs.

HISTORIC FLOWS - Records have been kept by the U.S. Geological Survey (USGS) on the McKenzie River at Vida, river mile 47.7, since 1924. The extremes for this period were a maximum discharge of 64,400 cfs on December 28, 1945 and a minimum discharge of 1,260 cfs on November 7, 1930. Outside this period it was estimated that there was a flow of about 62,000 cfs in January 1923. In recent times there have been 2 smaller peak flows, one on February 7, 1996 and again on November 19, 1996. The February flow was 30,900, about a 5-year flood, and the November flow was 23,300, approximately a 2-year event.

PEAK FLOWS AND RAIN ON SNOW (ROS) - The Washington Forest Practices manual for watershed analysis states "The greatest likelihood for causing significant long-term cumulative effects on public resources via alteration of forest hydrologic processes is through increases in peak flows attributable to the influence of timber harvest on winter snow accumulation and melt rates during rain on snow events." Berris and Harr (1987) states "The majority of both landslides and high streamflows with attendant channel erosion, particularly in the western Cascade Range, have resulted from the rapid input of water to steep slopes during rain-on-snow (ROS) conditions."

Harr (1986) states "In most rain-on-on snow events rain commonly accounts for 70 to 90% of total water input, but under some weather conditions snowmelt can contribute over a third of total water input." A rain-on-snow event is a condition where there is rapid snow melt during a period of warm rain and windy conditions. Clear cutting allows more snow to accumulate and also speeds melting. This generally happens in the middle elevations,

approximately 1100 to 3600 feet. Areas below this level will generally get precipitation in the form of rain and above this elevation snow is cold enough that the additional heat is not enough to cause rapid melt (Berris and Harr 1987). This would be the most common scenario but actually the ROS conditions could go above this or down to sea level, depending on the particular storm, and the impacts could be as variable as the weather.

Berris and Harr (1987) did a study on the H.J. Andrews and found consistent increases in the snowpack and water equivalent in the clear cuts, sometimes up to 2 and 3 times greater. Changes in rates of melting were also noted as well as out flows from the clear cut areas. They had found a 21 percent increase in the outflow from the clear cut plot. In another study in western Washington Harr and Coffin (1992) the difference reported was as much as 138 percent. In this same study they found responses in young plantations to fit in between the clear cut and the older forest. They also found that maximum differences occurred when both temperatures and wind speeds were high.

In the Bear/Marten WAU, approximately 89 percent of the area is in a hydrologically mature state (greater than 30 years old). The amount of land owned by the Bureau of Land Management (BLM) and Forest Service (USFS) varies by subwatershed and by precipitation zone. Bear subwatershed has the highest percentage of land in the ROS zone, 44 percent, and the highest percent of federal ownership in the ROS zone, 80 percent. Therefore, federal actions could possibly influence the potential impacts from a ROS event. The Marten subwatershed has 38 percent of the total acres in the ROS zone. Of these ROS acres BLM owns 533 or 22 percent. Deer subwatershed, another large watershed, has 35 percent of its area in the ROS zone with 22 percent or 775 acres in federal ownership. Ennis has 34 percent of the total acres in ROS with 13 percent of the ROS acres in federal ownership. In Gale and Jimbo subwatersheds less than 10 percent of the acres are in the ROS zone, and in Gale only 3 percent of the land in the ROS zone is federally owned. Federal actions would have only the potential for small impacts in these subwatersheds.

WATERSHED	TOTAL ACRES	ROS ZONE ACRES	FEDERAL ACRES IN ROS ZONE
BEAR	2822	1233	988
DEER	9845	3460	775
DORRIS	2624	218	183
ENNIS	5434	1824	240
GALE	3803	1012	31
JIMBO	2738	248	154
MARTEN	6507	2455	533
RENNIE	2068	243	243

CONCLUSION - Cutting timber in the ROS zone does not automatically lead to an increase in peakflows. Many weather conditions have to come together to create a ROS event. This would have to happen during a period that the vegetation is in an immature state. The possible impacts to a single drainage could be lessened by staggering cutting over a period of time in the watersheds with more ROS acres.

Roads do not always lead to an increase in peak flows. They have to be connected to a stream channel to have an effect. In the Bear/Marten WAU only 12 percent of the roads were connected. As long as new roads are built in such a way that they are not connected to open stream channels, there should not be a large impact to peak flow from roads.

SOILS

This section answers the following questions:

Where in the watershed and on BLM lands do erosion processes (mass wasting, hill slope erosion, road-related erosion) have the greatest potential to deliver sediment to stream channels or other water resources?

What are the natural tendencies for landslides and debris torrents in riparian areas?

The soil section discusses the following:

< Geology of the area
< Soil Productivity and Erosion
< Erosional Processes and Sedimentation Delivery - Mass wasting and Hillslope erosion

Some information on the subbasins north of the McKenzie River is unavailable. This information will be obtained prior to starting the landscape design process.

GEOLOGY

Geology of the Bear/Marten WA area consists of Western Cascade Province Tertiary volcanics (7 to 34 million years old), as well as landslides, river terraces, and alluvium from the Quaternary period (within the last 1 to 2 million years) (see Geology map and Appendix F). Much of the area has been mapped as the Tuffaceous Sedimentary Undivided Series (Tu), an undifferentiated mixture of tuffaceous sedimentary rocks, basalt flows, tuff and tuff breccia. The following discussion will describe the geology of the subbasins with particular reference to those features influencing the stability of the slopes and character of the soils.

Gale, Marten, Little Bear, Deer, Ennis and Dorris Subbasins

These subbasins are composed of pyroclastic rocks (tuff, tuff breccia) and competent basalt and andesite flows, sills and plugs (Tub). In comparison to basalt and andesite, the pyroclastics weather quickly and deeply to form fine textured soils.

- The pyroclastics are often interbedded with the more competent flow rocks. As a result, the ridges and steeper slopes are derived from the harder basalt flows and the more gentle topography is derived from weathered pyroclastics.

- For the West Fork of Deer Creek, andesitic and basaltic rocks (Tba) are mapped as capping pyroclastic rocks on the upper ridges. This combination of the more competent andesitic and basaltic rock capping weaker pyroclastic material is apparent throught the analysis area, and results in steep headwall slopes and bedrock hollows.

- Scattered ancient, deep-seated landslides (Qls) have occurred in upper Marten, Gale and

East and West Fork Deer Creeks. In East and West Fork Deer Creek, these landslides have resulted in hummocky topography with disrupted drainage patterns.

Bear Crk and Jimbo Mt. Subbasins

- These drainages are dominated by an intrusive igneous rock (diorite) feature (Thi). Diorite is a medium-grained rock, and in turn, is intermediate in susceptibility to weathering, being less competent than basalt or andesite, but more competent than tuff. This type of rock weathers to form steep slopes, as typified by the topography in these subbasins.
- Jimbo Mountain is capped by a more competent layer of basalt and /or basaltic andesite.

SOIL PRODUCTIVITY AND EROSION

Maintenance of soil productivity is essential to ecosystem health. Most forest uses ultimately depend on a productive soil resource. In addition to serving as a medium for plant growth and biological activity, soils also function in the storage and movement of water through a landscape. Long-term soil productivity is the capability of the soil to sustain the inherent, natural growth potential of plants and plant communities over time. Just as soils in a landscape differ in their natural productivity, they also behave differently to various land use practices. Soils in the Bear/Marten Watershed Analysis Unit were analyzed in terms of their productivity and sensitivity to natural and human caused disturbance using the Resiliency Unit concept.

The Resiliency unit concept is a stratification of soils into Low, Moderate, or High resiliency categories across the landscape according to physical properties and processes that have evolved over time in response to climate, geology, geomorphology, and the biotic community. Resiliency units for the Bear/Marten watershed were created by combining soil map units listed by SCS in the Soil Survey for Lane County, Oregon. Each Resiliency Unit has soils with similar properties. Resiliency Units are based on such factors as soil temperature and moisture regimes, soil drainage, soil depth, soil coarse fragment content, texture, water holding capacity, organic matter content, nutrient capital, and permeability.

Soils in the High resiliency category are generally the most productive areas. They can sustain substantial manipulation and still maintain nutrient capital, inherent physical and chemical capabilities, hygrologic function, and natural rates of erosion. Soils in the Low resiliency category are the least productive. In general, they require protection and offer minimal opportunities for manipulating the surface vegetation without impairing inherent properties and processes, and accelerating the frequency and magnitude of erosional events. The soil resiliency map shows the locations of the soil resiliency categories in the analysis area. Table 1 below is a summary of the resiliency categories for this area.

Table 1 - Soil Resiliency Unit Summary for Bear/Marten WAU

RESILIENCY CATEGORY	ACRES	PERCENT OF WATERSHED ANALYSIS AREA
LOW	1,285	4%
MODERATE	15, 129	42%
HIGH	18,900	53%
MISC/UNKNOWN	522	1 %

TOTAL	35,836	

The Bear/Marten landscape is dominated by soils in the high and moderate resiliency categories (95% of the watershed). Soils in the high resiliency categories represent the most productive areas and occupy 53 percent of the watershed. These soils occur on gentle to steep topography, are deep (>40 inches), well-drained and highly permeable dark brown clay loams, cobbly clay loams and dark reddish-brown silty clay loams. These soils also have high nutrient levels, organic matter content, and plant available water. Consequently, they have a high potential for successful vegetative restoration.

Soils in the moderate resiliency categories occupy 42 percent of the watershed. In comparison, these soils are less productive because they are moderately-deep (20-40 inches) and/or have a higher coarse fragment content. In addition, this category includes soils occupying the cooler, higher elevation sites where the growing season is shorter.

Soils in the low resiliency categories occupy 4 percent of the watershed area. These areas generally occur on steep slopes and have shallow (<20 Inches), rocky soils associated with scattered rock outcroppings. This category includes Fragile sites such as rock meadows, often designated as Special Habitats. For soils in this category, nutrients and water are limiting factors; they are drought prone and, therefore, the least productive areas. Because of their low resiliency and productivity, these sites can be difficult to reclaim once soil and vegetation disturbance have occurred.

Alterations of the soils and associated vegetative cover have occurred from historic conditions. Land use in the landscape has been dominated by forest management activities in the uplands and conversion of lands to agricultural, urban, or domestic use in the McKenzie River Valley. These land use practices have affected the soils resource in several ways. Timber harvesting and broadcast burning have changed the amount of organic matter added to the system and how this material is cycled. Urban and road developments have resulted in soil removal and displacement and higher levels of compaction than under naturally occurring conditions. Roads and compacted areas have also influenced water storage and movement and the ability of the soil to support vegetation and biological activities. In comparison to other watersheds, little harvesting and road building have occurred on BLM managed lands in these watersheds.

EROSIONAL PROCESSES AND SEDIMENT DELIVERY

Erosion and the delivery of sediment to streams is a natural process. However, human and management activities can accelerate this process to the degree that water resource values are compromised. In watershed analysis, an erosion and sediment delivery analysis is conducted in order to determine if management activities have changed the frequency and spatial distribution of disturbance beyond the natural range of disturbance. The following questions will be addressed:

- Where in the watershed, and particularly on BLM managed lands, do erosional processes, i.e., Hillslope Erosion, Mass Wasting, and Road-Related Erosion, have the greatest potential to deliver sediment to stream channels or other water resources? (see Road section for road-related erosion.

- What are the natural tendencies for landslides and debris torrents in the analysis area?

For the Bear/Marten analysis area, the reference condition will be based on 2 sources of erosion, i.e., Hillslope and Mass Wasting. For the current condition, a third component, Road-Related erosion, will also be considered.

HILLSLOPE EROSION ASSESSMENT - Hillslope erosion occurs where detachable soils on moderate to steep slopes are exposed to rainfall and overland or surface flow. Sediments generated by surface erosion processes can affect water quality and aquatic habitat. The occurrence of overland flow can be increased by human activities that remove the protective duff layer and expose bare, mineral soil to weather, and by activities resulting in soil compaction. Factors determining the susceptibility of soil to erosion include type and amount of vegetation, topography, climate, and soil properties such as cohesiveness, infiltration rates, and texture.

The relative potential of hillslope related surface erosion for the Bear/Marten Watershed Analysis Unit was analyzed by developing a soil erosion potential map. The factors used in the GIS analysis were topography (slope steepness) and soil erodibility (soil K-factor). The K-factor is a relative measure of the erodibility of bare, freshly tilled soils. The assumption is that certain, easily detachable soils (low soil strength) occurring on steep slopes are most susceptible to surface erosion and overland flow. Climate and the presence of a protective vegetative cover were not included in the analysis. (The soil K-factor values were developed for agricultural conditions and have not been adapted for forest environments. Also, the K-factor values are for bare, tilled soil, a level of disturbance atypical for the forest environments of the analysis area. The erosion potential map can, therefore, be seen as a "worst case" scenario.)

The location of Soil Strength Classes (Strong, Moderate, and Weak), are depicted in soil resiliency map, and information on the acreage and percent of the analysis area are summarized in Table 1. Less than 1 percent of the watershed was predicted to have Weak soils with a high potential for detachability. The low strength soils include soils classified as fluvents and riverwash areas that, due to their proximity to moving water, are very weak and highly susceptible to detachment. The results indicate the vast majority of the analysis area, 80.5 percent, is occupied by soils with Strong soil strength and is consistent with the results of the Soil Resiliency Analysis.

Table 1 - Soil K-Factor Categories

Soil K Factor Category	Acres	Percent of Watershed
Weak (K<.25)	126	<1
Moderate (K=.25-.4)	6,459	18
Strong (K>.40)	28,856	80.5

The Slope class map indicates the location of each topographic class (Gentle, Moderate, Steep) in the analysis area. Approximately 12.5 percent of the analysis area is in the Steep

slope class (>60% slopes) (Table 2). These steeper slopes are found near ridge tops and adjacent to streams in the analysis area. The Gentle slope class (<30%) occupies 34.8 percent of the analysis area, with the remaining 52.7 percent in the moderate slope class (30-60%).

Table 2 - Slope Class Summary

Slope Class	Acres	Percent of Watershed
Gentle (<30%)	12, 456	34.8
Moderate (30-60%)	18,894	52.7
Steep (>60%)	4,491	12.5

The distribution of Hillslope Erosion Risk Classes of Low, Moderate and High, derived from the information from the Soil K factor and Slope Class maps, is shown in Hillslope erosion map. Only 1.2 percent of the watershed analysis area is in the High Erosion Potential Class (Table 3). Notable locations of these sites are river wash, which is susceptible to erosion due to its proximity to strong water flows, and steep slopes adjacent to streams, as well as rocky sites on steep slopes. In the analysis area, 19.9 percent of the soils are in the Moderate Erosion risk category. Moderate risk sites are found predominantly on moderate to steep slopes.

Table 3 - Hillslope Erosion Potential Class

Soil Erosion Potential	Acres	Percent of Watershed
Low	28,051	78.3
Moderate	7,143	19.9
High	413	1.2

Most of the analysis area, 78.3 percent, is mapped as being in the Low Hillslope Erosion Potential class. This is consistent with observations in the field, where surface erosion and overland flow are found to be uncommon in this landscape because the soils are strong and resist detachment, even under bare soil conditions. In addition, the presence of surface organic layers in the forest landscape provides a protective layer that minimizes the opportunity for soil particle detachment and overland flow. When soil is exposed and eroded, it is rarely delivered to the stream system due to the high permeability of the soils and the discontinuous nature of the exposed soil patches.

Where surface erosion is present in the forested portion of the analysis area, it is the result of harvesting activities such as yarding skid trails. Yarding trails in recently harvested units are

generally compacted and may result in overland flow. However, in Weyerhaeuser's Lower McKenzie Watershed Analyses, few yarding trails were found to deliver sediment to streams, which is consistent with field observations by BLM personnel. In addition, the harvesting activity that has taken place was changes in harvesting methods from ground based to cable yarding systems has reduced the potential for harvesting activities on steeper slopes to result in erosion. Relatively little harvest activity has taken place on BLM lands in the analysis area, and what has taken place has required the use of cable logging systems with at least partial suspension during yarding.

MASS WASTING ASSESSMENT - Mass wasting is the downslope movement of soil and rock material through a variety of landslide movement mechanisms. It is a natural process in the analysis area due to the presence of weak rock underlying more competent rock on steep slopes and, as compared to the other sources of erosion, the primary source of fine and coarse sediments to streams. Under natural conditions, creeks in the analysis area have had pulses of sediment and wood delivered over relatively short periods. The material generated by mass wasting events can have beneficial effects downstream by supplying structural components such as gravels, cobbles, and woody debris to stream channels. But acceleration of landslide delivery frequency can adversely affect channels and fish habitat. Of particular concern are management activities that increase the natural frequencies and magnitudes of mass wasting events and overwhelm the systems natural ability to process sediment.

Landslide movement types in the analysis area include shallow, rapid translational slides and deep-seated rotational slumps. These ancient, deep-seated rotational slump areas were identified using aerial photograph interpretation and are shown on the Geology map (Qls). These area are considered to have a moderate potential for mass wasting. The toes and landslide scarps of these features are typically unstable, the primary management concerns being activities, in particular road construction, that destabilize these features and increase the risk of landsliding.

The inherent potential for shallow landslide initiation in the analysis area was estimated by using a model that combines digital terrain data with information on near surface through flow (see Appendix G and Dietrich et al. 1993). The result is a Slope Failure Potential map that stratifies the Bear/Marten landscape into areas of Low, Moderate, or High potential for slope failure. The results indicate approximately 12.5 percent of the analysis area has a High potential, 23.4 percent a Moderate potential, and 60.6 percent a Low potential for slope failure. Preliminary field investigations indicate the following:

- In general, the areas predicted to have a High potential for slope failure are found on steep, convergent head wall locations and steep slopes adjacent to streams. Field surveys indicate these headwalls or hollows have slopes greater than 70 percent, and stream adjacent sideslopes are greater than 90 percent.

- This is consistent with information on known failure sites. In the BLM's TPCC (Timber Production Capability Classification) inventory, approximately 20 head wall/drainages in the Bear/Marten area were withdrawn from management activities and classified as Fragile due to the presence of indicators of slope instability, i.e., steep headwalls and slopes, relatively shallow soils overlying harder bedrock, tension cracks, and bare soil areas with scarps resulting from recent shallow landslide activity. The model accurately

identified these previously withdrawn areas, as well as 7 sites in the Bear Creek drainage initiated during the rain-on-snow/flood event of February 1996 as having a high potential for slope failure.

- Prediction of slope stability features using this model requires digital elevation data of sufficiently high resolution that the finest scale source-area basins can be identified. For the analysis area, the data for BLM lands is at a density of 6m whereas for other lands, the information is available at only 30m, the latter density not being accurate enough for the model (see Dietrich et al, 1993). This explains the imprecise mapping of the Slope Failure Map for the non- BLM lands.

- Approximately 3.5 percent of the analysis area was mapped as being "Out Of Range" (shown as black areas on the map). Limited investigations have found these locations to be very steep (> 100%) slopes and rock cliffs.

Insufficient field inventories of landslide activity in mature stands have taken place to allow an assessment of the influence of harvesting on shallow landslide initiation and debris torrent activity on BLM lands. However, roads located on steep, midslope locations appear to have a higher risk of landslides in these watersheds. Road-related landslides that have been identified all occurred on roads in steep, midslope locations, the roads often crossing at the base of a head wall or hollow (see Slope Failure Map). In general, these road-related landslides were associated with steep, bare raveling and failing cutbanks impairing road drainage, and with sidecasting of materials on steep slopes. As noted in the Road-Related Erosion analysis, most BLM roads in the analysis area are on stable, ridge top locations, with relatively little midslope road construction having taken place. A list of BLM roads with erosion and sediment delivery concerns can be found in the Appendix H.

ROAD-RELATED EROSION AND SEDIMENT ASSESSMENT - Erosion and sediment delivery to streams from roads can significantly impact aquatic habitats and other water resources. Whereas cutslopes and fillslopes will eventually revegetate following initial road construction, thereby reducing erosion from these sources, the road running surface remains unvegetated, and can continue to erode and provide sediment to streams for as long as the road is in use. Sediment from road surfaces is routed from the road prism to streams by flowing water in culverts, roadside ditches, and where road drainage failure has occurred, as overland flow. Although all roads can generate erosion, only some portions of roads have the potential to deliver sediment directly to streams. Important factors influencing delivery of sediment to streams are the amount and condition of the road prism that drains directly into streams, the level of log truck traffic a road is receiving, and the type of road surfacing present.

Gale Crk, Marten Crk, Deer Crk and Little Bear Subbasins

In 1994 Weyerhaeuser Company conducted a watershed analysis of the Lower McKenzie (South Side), which included the Gale, Marten, Deer, and Little Bear creeks Subbasins. The road-related surface erosion assessment in the Lower McKenzie Watershed Analysis was conducted using the method described in the Watershed Analysis Manual, Version 2.0 (1993, Washington Department of Natural Resources). In this assessment, an estimate of sediment production is determined by sampling roads for characteristics such as road prism, drainage system density, and traffic level in relation to how they influence sediment delivery to the

stream system. Other factors included in the analysis are differing conditions of the road surface (i.e., dirt, native gravel, pit run gravel, crushed rock, and asphalt), cut and fill slope vegetative cover, parent material, and age of the road.

The Lower McKenzie road erosion results are based on a road inventory that sampled approximately 28 percent of the total roads in the analysis area. Ninety-three percent of the roads are surfaced, with 57 percent pit run gravel, 30 percent crushed rock, and 5 percent paving. Road densities are comparable for the subbasins in question. An important factor in this assessment is the traffic levels used. For this analysis, road erosion and sediment yield calculations were based on the assumption that 15 percent of the roads would receive heavy logging truck traffic, and the other 85 percent would receive light log truck traffic.

The road erosion and sediment delivery analysis for the Lower McKenzie WA area led to the following conclusions:

- Road erosion is delivering **fine** sediment to streams at a rate less than that of natural background levels. (Natural background levels for the analysis area were derived using the method described in the Watershed Analysis Manual, and are based on soil creep rates.) Road sediment delivery rates for Gale, Deer, and Little Bear subbasins are all between 20 and 30 percent of natural background levels. The Watershed Manual guidelines indicate delivery rates that are less than 50 percent of background levels will probably not be detectable in the channel system.

- Fine sediment contribution from roads in Marten Creek subbasin were 60 percent of the estimated natural background level. This amount of sediment contribution is considered to be small, but may be chronically detectable in the stream network. The channel assessment for Marten Creek subbasin indicated the streams in this drainage have a high transport capability with the ability to transport this amount of fine sediment through the system.

- Although the fine sediment contribution from roads in these subbasins is below natural background levels, as part of the cumulative effects of fine sediment delivery to streams they can be locally significant, capable of affecting channel morphology and aquatic habitat.

ROAD-RELATED EROSION ANALYSIS OF BLM ROADS - In order to asses the contribution of sediment from BLM managed roads, the Washington Watershed Analysis Manual method of inventorying roads as described above was conducted on BLM roads in all subbasins in the Bear/Marten WA analysis area, except Gale Creek and Ennis Creek subbasins. Information was collected for gravel and paved roads. Native surface roads were not inventoried. Table 1 shows miles of road by surface type and road densities for each subbasin in the analysis area (see attached table). Approximately 23 miles, or 69 percent of the surfaced BLM roads in the subbasins, were inventoried. (Table 2 below shows the results of the inventory.)

The road erosion inventory of BLM roads has led to the following results and conclusions:

- Approximately 4.3 miles of the total 34.6 miles, or 12 percent of the BLM road miles have the potential to contribute fine sediment to streams. In general, the contribution of fine

sediment from BLM roads is small. This is directly related to the little administrative activity and, therefore, low BLM road miles present in these subbasins. In addition, many of the roads are on ridge top locations, and were built within the last 25 years when road specifications emphasized relief drainage and other features reducing the potential for road-related sediment delivery to streams.

- The greatest potential for sediment contribution from BLM roads is occurring in the Marten Creek, Little Bear, and Jimbo Mtn subbasins. In general, the potential contribution is from midslope roads that have high cutslope delivery rates (little relief drainage), little vegetative cover on the cutslopes, or a combination of these factors.

- BLM roads in the Bear Creek and Dorris subbasins are not contributing any fine sediment, and the contribution from BLM roads to the total fine sediment yield in the Deer Creek subbasin is negligible.

- Even though BLM roads in the Little Bear subbasin contribute half (55%) of the fine sediment yield from all roads in this basin, based on results of the Lower McKenzie WA, the contributions are significantly less than natural background levels. Nevertheless, it is interesting to note that most of the fine sediment yield in this basin is coming from one road (Powerline Road), which has virtually no relief drainage, resulting in a cutslope delivery rate of 67 percent.

- The contribution to total fine sediment yield from BLM roads in the Marten Creek subbasin is also small. However, the sediment is being generated on one midslope road (Marten Switch), which has very high cutbanks (20 feet high is not uncommon) that have very little vegetative cover. The cutbanks over much of the length of road are continually raveling, sloughing and failing, filling ditch lines and compromising the drainage capacity of the road. This is further complicated by the knowledge this road is located in a High Risk area for Mass Wasting (see Mass Wasting Potential Map).

- The fine sediment contribution from BLM roads in the Jimbo Mtn subbasin are also related to one midslope road (16-3E-33), which has cutbanks that are raveling and failing. In addition 3 road-related slides, 2 on this road, occurred on BLM roads in this subbasin as a result of the February 1996 floods.

Table 1 - Road Miles and Road Density by Subbasin									
	Bear Cr.	**Deer Cr.**	**Dorris**	**Ennis Cr.**	**Gale Cr.**	**Jimbo Mtn.**	**Marten Cr.**	**Little Bear**	**Totals**
Road Miles									
Miles - Total									
Native Surface (NAT)	0.7	7.0	2.5	0.0	5.1	1.5	4.3	0.0	21.1
Graveled/Rocked (ASC)	8.6	54.8	6.9	0.2	20.5	9.8	38.2	10.5	149.4
Paved (BST)	0.2	2.7	4.5	0.0	1.7	2.5	0.9	4.8	17.3
Tota l	9.5	64.5	13.9	0.2	27.3	13.8	43.4	15.3	187.8
Density - Total									
Native Surface (NAT)	0.2	0.5	0.6	0.0	0.9	0.4	0.4	0.0	
Graveled/Rocked (ASC)	1.9	3.6	1.7	0.0	3.5	2.3	3.8	3.2	
Paved (BST)	0.0	0.2	1.1	0.0	0.3	0.6	0.1	1.5	
Total	2.1	4.2	3.4	0.0	4.6	3.2	4.3	4.7	
Miles - on BLM									
Native Surface (NAT)	0.7	0.4	0.0	0.0	1.0	1.3	0.0	0.0	3.4
Graveled/Rocked (ASC)	5.4	1.8	2.6	0.0	1.8	3.6	4.3	10.1	29.6
Paved (BST)	0.0	2.7	0.0	0.0	0. 5	0.8	0.7	3.5	8.2
Total	6.1	4.9	2.6	0.0	3.4	5.7	4.9	13.6	41.2
Density - on BLM									
Native Surface (NAT)	0.2	0.3	0.0	0.0	0.6	0.8	0.0	0.0	
Graveled/Rocked (ASC)	1.4	1.3	1.7	0.0	1.1	2.3	1.0	3.3	
Paved (BST)	0.0	1.9	0.0	0.0	0.3	0.5	0.2	1.2	
Total	1.6	3.5	1.7	0.0	2.0	3.7	1.2	4.5	
Basic Data									
Total Acres	2,822	9,845	2,624	5,434	3,803	2,738	6,507	2,068	35,840
BLM Acres	2,435	894	1,013	21	1,075	981	2,699	1,932	11,050

Table 2 - Potential Sediment Yield From BLM Roads

Subbasin	Road Surface Type	Deliverable Length (miles)	Annual Sediment Yield tons/year	Percent of Total Annual Sediment Yield for Subbasin
Marten	Gravel	1.12	44.3	13%
	Paved	.05	.07	
Deer	Gravel	0	0	2%
	Paved	.08	.37	
Little Bear (Rennie)	Gravel	2.25	51.6	55%
	Paved	.05	.04	
Bear	Gravel	0	0	0
Jimbo Mtn	Gravel	.71	33.3	39%
Dorris	Gravel	0	0	0
TOTALS		4.3	133*	

* 4.3miles/133 tons/yr = 12% of BLM miles with the potential to deliver sediment to streams

VEGETATION

This section answers the following questions:

What Threatened and Endangered species exist in the watershed? What is the condition of their habitats?
What Survey and Manage (S&M) species have the potential to exist? Where do they exist?
What other special status species exist in the watershed?
What is the historical pattern? How has it influenced the current condition?
What are the natural disturbances? How could we manage to reflect what has been created in the current conditions?
What is the current and potential vegetation species' composition and distribution? Age class?
What vegetation types exist and what limitations are there for management actions?

This section includes the following topics.

- Forest Vegetation
- Forest Condition
- Survey and Managed Plants
- Riparian Reserve Vegetation

FOREST VEGETATION

Douglas-fir, *Pseudotsuga menziesii,* and western hemlock, *Tsuga heterophylla*, are the dominant forest trees in this region. Associated conifer species growing in this watershed are western red cedar, *Thuja plicata*, incense-cedar, *Libocedrus decurrens*, grand fir, *Abies grandis*, and Pacific yew, *Taxus brevifolia*. Pacific silver fir, *Abies amabilis* may be found at the higher elevations in this watershed and western white pine, *Pinus monticola*, has been seen in the watershed on a few occasions.

The most common hardwoods that are associated within the watershed are red alder,*Alnus rubra*, bigleaf maple, *Acer macrophyllum*, black cottonwood, *Populus trichocarpa*, vine maple, *Acer circinatum*, Pacific dogwood, *Cornus nuttalli*, Pacific madrone, *Arbutus menziesii*, and willow, *Salix spp.*

Common vascular plant species represented on the forest floor include salal, rhododendron, swordfern, vanilla leaf, Oregon oxalis, twinflower, and redwoods violet.

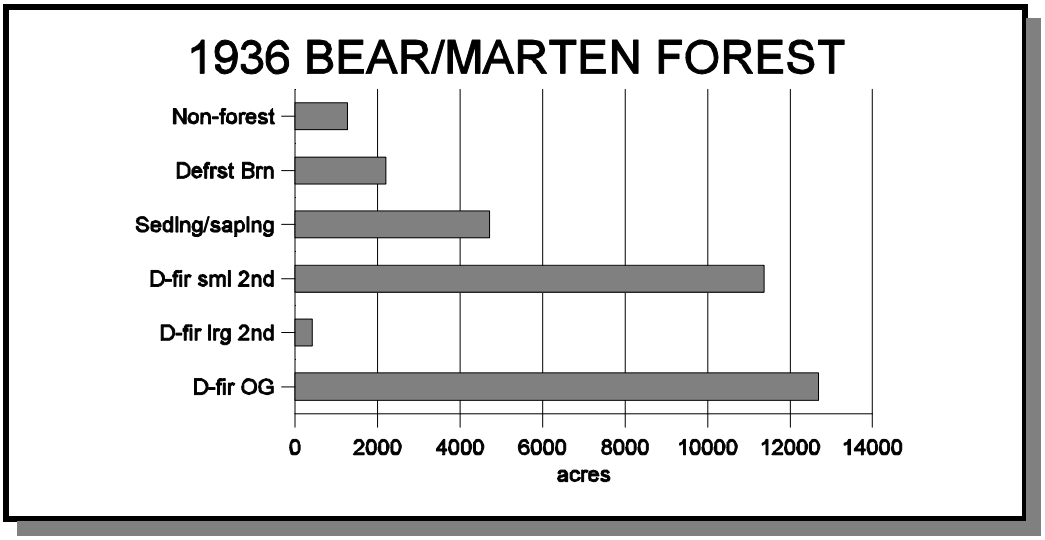
FOREST CONDITIONS

Fire and wind have been strong influences toward the developing characteristics of this watershed. The forest stands in this watershed are associated with a frequent catastrophic fire return rate of something less than 200 years. This may be due to the prevalence of "east winds" and the local geography around Finn Rock that creates a natural acceleration of the

wind velocity. Large stand replacement fires have played a major role in determining the natural vegetation of this local landscape, and BLM is currently supporting research to expand their knowledge of the fire history within this watershed.

Based upon the forest stand's year of origin, the last series of major fire events in the Bear/ Marten watershed occurred between 1850 and 1900. The fires were predominately mid-sized stand replacement fires. The forest stand structure shows varied patterns, ranging from many residual trees remaining to very few left. The present mature stands also have a wide range of structural components of snags and downed logs. A probable scenario is that a stand replacement type fire burned through an area creating snags, and over time large amounts of unburned material accumulated on the forest floor. Several years or decades later, subsequent fires burned in a mosaic pattern throughout the area and consumed snags, downed wood, and the duff layer more thoroughly than the first fire.

A primary causal agent for the fire frequency along the river valley may have been the activity along this major post settlement travel corridor. The reference conditions were taken from a 1936 forest cover map developed by the U.S. Forest Service. This map depicts a young forest developing after multiple fires close to the river and on the south slopes, with much older forests on the upper north slopes and in protected ravines. (See chart 1936 BEAR/MARTEN FOREST and map "1936 Forest Cover".)



Wind from winter storms have recently demonstrated its dynamic effects on the forest structure. This past winter, strong winds pushed over mature second growth timber in one and two acre patches. In some patches the majority of trees were windfalls and in other areas only selective trees within stands were windfalls. Observing the resulting windfelled trees, it has been theorized that strong, isolated down bursts of wind pushed the trees over in the small areas across the landscape.

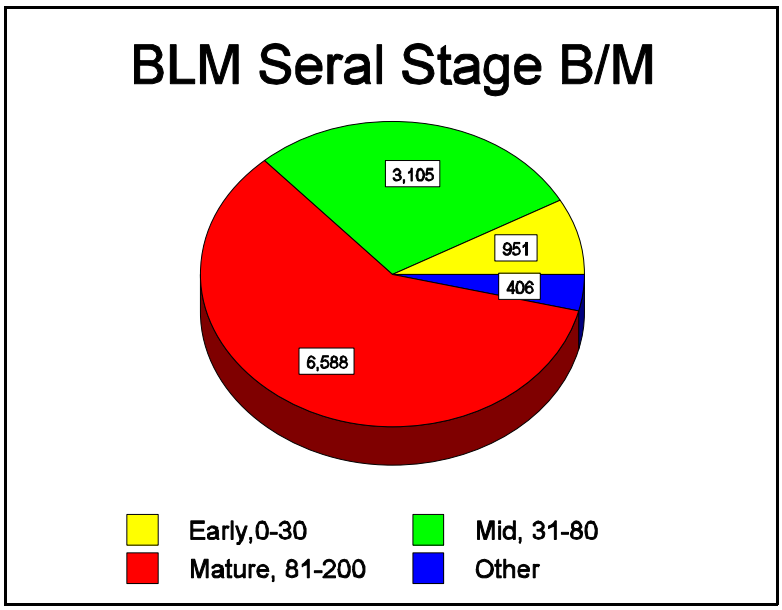
Forest diseases and insects are factors in this watershed that have demonstrated a minimal presence and have not influenced past or present management. A recent long-term drought period that occurred from 1976 to 1986 had some impact on forest. During the latter years of the drought, small groupings of trees died from stress brought about from this extended dry weather. Some of these trees were examined and were found to be killed by the *armillaria* root rot fungus, possibly as an indirect result of the moisture stress. Insect damages noted in the dead trees were identified from Douglas-fir beetle and engraver beetle attacks and were thought to be secondary vectors in the pockets of dying timber. No sites of laminated root rot, ***Phellinus weirii*** have been found or mapped on the BLM lands in this watershed.

The BLM ownership is 11,050 acres, 34 percent of the watershed. Some of the first harvest actions on BLM were at the lower end of the Marten ridge road, Rd. No. 16-2E-36.2, which was constructed in 1964 for a partial cut harvest in Section 01. The Hagen/Bear Creek road system, Rd. No. 16-3E-26.3 on the north side of the watershed was built in 1982 to develop the Bear Creek timber sales (see table Current BLM Age Classes in Bear/Marten and map "Current Forest Cover").

Current BLM Age Classes in Bear/Marten Watershed

Age Class (years)	Acres	Percent BLM Lands (11,050 Ac.)	Percent of Watershed (32,667 Ac.)
Recent Harvest	135	1.22%	0.41%
0 - 9	649	5.87%	1.99%
10 - 19	302	2.73%	0.92%
20 - 29	0	0.00%	0.00%
30 - 39	6	0.05%	0.02%
40 - 49	46	0.42%	0.14%
50 - 80	3053	27.63%	9.35%
81- 120	6073	54.96%	18.59%
121+	515	4.66%	1.58%
FOI Outs	271	2.45%	0.83%

Total	11050	100.00%	33.83%



SURVEY AND MANAGE PLANTS

Under the Eugene District ROD/RMP, many vascular and nonvascular plants and fungi species are to be managed to protect, manage, and conserve Federally listed and proposed species and their habitats to achieve their recovery in compliance with the Endangered Species Act, approved recovery plans, and Bureau special status species policies. The lack of information on the distribution, abundance, and habitat needs makes it difficult to predict the potential occurrence of these species. *Allotropa virgata* is the only survey and manage plants species that has the potential to occur in the watershed.

Allotropa virgata, (candystick plant) is a survey and manage component 1 and 2 species and is known to occur on BLM lands in this watershed. *Allotropa virgata,* is a nongreen mycotrophic species requiring an association between it, a fungus and another vascular plant (usually a tree or shrub) for establishment and survival. Its range is from British Columbia to the southern Sierra Nevada in California. While the species is widespread, it is rare throughout its range. The species is known to occur in closed canopy pole, mature, and old growth forests in *Pseudotsuga menziesii, Tsuga heterophylla, Abies grandis, Abies amabilis* and *Pinus contorta* vegetation series.

In the McKenzie Resource Area, it is known to occur in association with rhododendron (*Rhododendron macrophylla*), bear grass (*Xerophyllum tenax*), and huckleberry (*Vaccinium spp*.) vegetation types, on south slopes above 150 feet elevation. It does not appear to tolerate competition and typically occurs where there is little understory vegetation. The sites where it has been found in the McKenzie area are ridge lines with dry, well-drained soils, little understory and evidence of past fires (charcoal on the surface of the soil). Due to small, short-lived seeds and its obligate *mycorhizzal* relationship, large and relatively unfragmented habitat areas may be important to maintain species viability and promote genic exchange between populations.

Allotropa may not flower every year and may not emerge above ground every year. During its growing season the plant is very distinctive and easily identified. Little is known about this species' response to stand management. Populations where the overstory was harvested appear to have been lost. It is unknown whether it can reestablish following ground disturbing activities or how post-harvest burning affects this species. Potential habitat for the species occurs throughout the watershed, probably wherever the rhododendron/bear grass/huckleberry (RHMA\XETE\VA sp.) plant community occurs.

SPECIAL STATUS PLANTS

These 4 special status plants may occur in this watershed:

Cimicifuga elata, Bureau Sensitive species
Romanzoffia thompsoniana , Bureau Sensitive species
Happlopappus halli , Lane County T&E red list species
Githopsis speculariodes , Lane County T&E red list species

Cimicifuga elata (tall bugbane) is a Bureau sensitive species and is a northwest regional endemic forest species. In the Western Cascades, it occurs mostly in mixed Douglas-fir/bigleaf maple stands. The sites are always mesic throughout the dry season and frequently steep and rocky. This species is not restricted to a particular stand age. Plants growing in stands with an open canopy have a higher rate of reproduction (Kaye and Kirkland 1994). Potential habitat exists throughout the watershed, although there are no known sites within this watershed. Response of this species to stand management is mixed, having low survival in clear cuts, and surviving in areas adjacent to clear cuts and commercial thinnings.

Romanzoffia thompsoniana (Thompson's mistmaiden), a Bureau sensitive species, is a very small annual species and is a northwest regional endemic, apparently restricted to higher elevations of the Cascade Range. The species is known to occur on exposed rock outcrops with thin soils that are wet in early spring, generally on south and west facing slopes. Due to the extremes of this habitat it is generally found only with other species adapted to this type of habitat. Rock outcrops in this watershed are potential habitat for this species. As this species occurs in very fragile habitats, disturbance is the major threat. In the Eugene District only one site is known in the McKenzie Resource Area, a rocky bald in the Marten Creek drainage that is an odd assemblage of disjunct species - a unique site for the District. An annual, the population numbers can vary greatly from year to year depending on weather and physical conditions. As an annual the soil seed bank is critical to the species continued existence at this site. Sites should be buffered to prevent disturbance of the sites and to preserve the hydrologic and light regimes.

Also occurring at the same site as the *Romanzoffia* is *Happlopappus halli* (Lane County T&E red list species), another northwest endemic, restricted to dry slopes, ranging from the east end of the Columbia River Gorge to the Calapooia mountains south of Cottage Grove. Marten Creek is one of 2 sites on the Eugene District where *Happlopappus halli* is found. Again disturbance is the major threat.

Githopsis specolariodes (common blue cup), Lane County T&E red list species, is a species that may once have been common on the floor of the Willamette Valley but is now restricted to rocky balds. This species is an annual requiring open grasslands. On the Eugene District it occurs only in conjunction with Idaho fescue.

RIPARIAN RESERVE (RR) VEGETATION

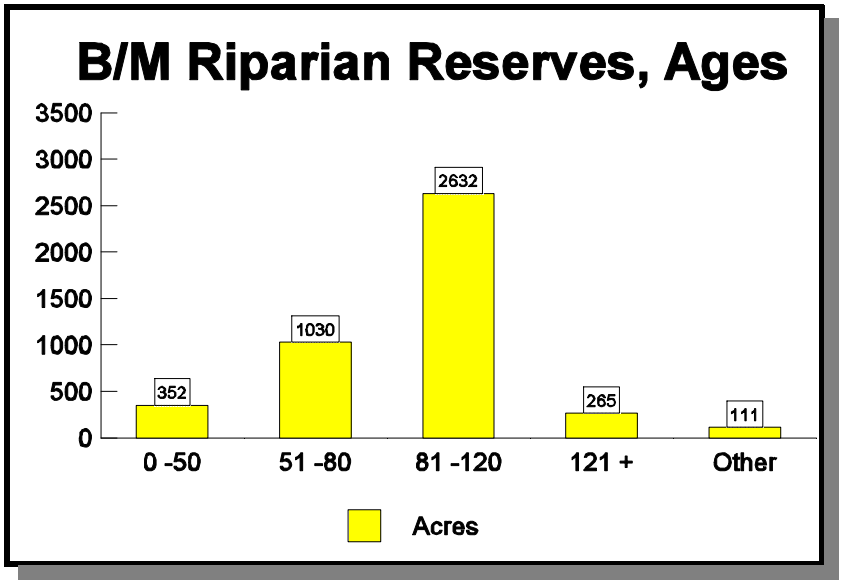
Riparian Reserves on federal lands managed under the Forest Plan are lands adjacent to streams where the riparian dependent resources receive primary emphasis. Riparian Reserves include that part of the watershed directly coupled to streams and rivers and that part of the watershed required for maintenance of hydrologic, geomorphic, and ecological processes that affect the standing and flowing waters. The SEIS sets interim widths for Riparian Reserves based upon 5 categories of streams and water bodies. The Bear/Marten watershed has 5 categories: fish bearing streams; permanently flowing, nonfish bearing steams; seasonally flowing intermittent streams, wetlands less than 1 acre, and unstable and potentially unstable areas. The SEIS states on page 9, "Riparian protection in Adaptive Management Areas should be comparable to that prescribed for other federal land areas . . .

However, flexibility is provided to achieve these conditions, if desired, in a manner different from that prescribed for other areas and to conduct bonafide research projects within riparian zones." To estimate the potential Riparian Reserve acres, the interim widths used for other land use designations were used. However, there is the possibility that the acres will be lesser or greater than what is estimated. There are 5,092 acres on BLM that are identified as potential Riparian Reserves within this watershed. This is based upon the standards and guides in the SEIS ROD for Federal ownership. The acreage for Federal lands is based upon using a site-potential tree height of 260 feet for the Riparian Reserve width (see Bear/Marten Riparian Reserve Map for a representation of the Riparian Reserve).

Riparian Reserves on federal lands are designated for the protection and enhancement of the aquatic ecosystem and adjacent upland areas that directly affect it. Interdisciplinary team projects will adhere to Best Management Practices (BMP) in the attainment of the Aquatic Conservation Strategy (ACS).

RIPARIAN RESERVE ACRES, BLM LANDS
Bear/Marten Watershed

Stand Age Years	Riparian Reserve Acres	Percentage of Riparian Reserve in Age Class
0 - 30	330	7.5%
31 - 50	22	0.5%
51 - 80	1030	23.5%
81 - 120	2632	59.9%
121 +	265	6%
Other	111	2.5%
TOTAL	4,391 acres	99.9%


B/M Riparian Reserves, Ages
3500
3000
2500
2000
1500
1000
500
0
352
1030
2632
265
111
0 -50
51 -80
81 -120
121 +
Other
Acres

FISHERIES

This section will answer the following questions.

Stream Channel Geomorphology

Where are stream reaches that are sensitive to disturbance?
How do we manage for them?
What is the channel condition/capacity?

Fish Species and Life History Requirements

What fish species exist in the watershed and what are their requirements?
What species have adapted and how do we manage for them?
What Threatened and Endangered (T&E) species exist in the watershed?
What can be done to manage proactively or minimize impacts to T&E species?
What Survey and Manage (S&M) species have the potential to exist? And where do they exist? *None*
What other special status species exist in the watershed?

Limiting Factors and Preliminary Ideas & Opportunities
(see also individual subwatershed Preliminary Ideas & Opportunities)

What are the critical limiting factors for fish in this watershed and what could we do to correct them?
What are the stream reaches that are most responsive to habitat creation (best for habitat improvement)?

Other Questions

What and where are aquatic invertebrates and other species that are indicators of water quality?

The major topics are as follows:

- Geomorphology
- Fish Species and Life History Requirements
- Aquatic Habitat

GEOMORPHOLOGY

- Where are stream reaches that are sensitive to disturbance?
  How do we manage for them?

  < **Source channels** (155mi/50mi BLM, see STR map) are the most sensitive to management caused disturbance. These are the steep headwall streams that are subject to slope failures resulting in debris torrents. Maintaining the stability of these channels is critical in this watershed because of the high degree of mass wasting here.

  < **Transport reaches** make up 32 percent (84 mi/18 mi BLM) of the channels in the

watershed (see STR map). These have varying degrees of sensitivity based upon valley confinement, substrate material, and riparian condition. Management activities should make sure that materials are able to freely move through these areas. Undersized/damaged culverts, and channel constriction by roads can lead to major maintenance problems.

< **Response Areas** - A smaller proportion of stream channels in this watershed function as response areas (21 mi/6 mi BLM) (see STRmap). This means that they are the areas that tend to collect sediment and large woody debris (LWD) most readily. They are considered to be "sensitive" using the WDNR (Washington Forest Practices Board 1995) method because they are subject to deposition from dam break floods and debris torrents that can drastically alter channel processes. However, these low gradient areas are also extremely resilient and are able to process material inputs efficiently. Many of these areas are Rosgen "B" type channels (see R map) that are considered to have a "low sensitivity to disturbance" (Rosgen 1996). This simply means that these channels are adapted to processing material and can handle a lot of disturbance. These are the best areas for potential fish habitat. Management activities can occur here with less serious potential impacts to the channel. However, because of the diversity of the fish community in these reaches, BLM must be sure that activities do not impact critical life history requirements. We must also remember that most response areas are associated with flood plains. Management prescriptions could be altered by flooding.

< **A Note on Sensitivity** - The difference in definition of "sensitivity" between the 2 methods can be confusing. The WDNR definition was developed to describe channel processes at the watershed or larger scale. The Rosgen method describes channels on a smaller "reach scale" (generally 500-5,000 feet'), is much more detailed, and is geared to evaluating fish habitat condition from a channel perspective. Scale is the key feature here. Management decisions involving potential impacts to stream channels will need to look at proposed actions at both scales.

, What is the channel condition/capacity?

< **Rosgen Channel Classification** - Rosgen channel classification separates individual stream segments into homogenous sections of stream (reaches). Similar stream reaches typically exhibit comparable valley and channel configuration, including values for variables such as channel entrenchment, width-to-depth ratio (W:D), dominant particle size, stream sinuosity, and gradient. Similar reach types, therefore, would be expected to exhibit similarities in function, such as flow, sediment/debris transport, and fish habitat (Rosgen 1996). Generalized surveys of the Bear/Marten stream segments likely to be fish bearing were conducted in the fall of 1996. Three primary channel types were identified, "Aa+", "A", and "B".

1. "Aa+" - These channels can be characterized as steep (>10%), entrenched (<1.4), debris transport channels. Aa+ channels have low width-to-depth ratios (<12) and low sinuosity (<1.2). They are most often found in headwater reaches, and correlate well with segments identified earlier as source and transport reaches. Waterfalls, chutes, cascades, and plunge pools are often characteristic of Aa+ channel types. Due to the steep nature of these channel types, they provide fish habitat only for cutthroat trout and sculpins. Approximately 85 miles of Aa+ channels were identified in the watershed (R map). This includes channels typed on the ground and other, non-fish bearing, channels that were typed using a GIS

gradient model (>10%). Aa+ channels do not generally respond well to habitat improvement efforts, with the exception of culvert work.

2. "A" - These channels are similar to Aa+ channels except that the gradient is <10 percent. Consequently, there are few waterfalls and cascades. The channels exhibit a "forced pool-riffle" morphology. Habitats are formed by the interaction of large structure elements (LWD and boulders) with the stream flow, rather than by the more geologic processes in Aa+ type channels. Approximately 3 miles of A type channels were identified in the survey (R map). Type A channels respond well to addition of LWD and cover elements.

3. "B" - These channels can be characterized as low to moderately steep (<10%) in gradient, moderately entrenched (1.4-2.2), riffle-dominated channels. B channels have moderate width-to-depth ratios (>12) and moderate sinuosity (>1.2). They usually are very stable, and most often are found as intermediate reaches flowing through narrow, gently sloping valleys. B channels correlate well with reaches identified earlier as transport and response reaches. Riffles, rapids, scour pools, and plunge pools are all characteristic of B channel types. This channel type typically provides good to excellent fish habitat for many species. Approximately 11 miles of B channel were identified in the survey (R map). These channel types respond well to all types of habitat enhancement projects.

OVERVIEW - The steep topography of this watershed and the high potential for landslides, has resulted in stream channels that have been repeatedly impacted by debris torrents and dam break floods. This is a natural condition and is expected to continue indefinitely. Three known debris torrents have occurred in the past 10 years (2 in 1996) that temporarily displaced fish populations on BLM land. At least 2 of these were management related. There are 16 known debris dams on fish bearing streams (BLM) in the watershed (see Fish Barriers map). All of these are a result of past upslope landslides. Some of these are over 100' long, and have accumulated large amounts of LWD and sediment behind them. At some point these debris dams will break and the channels down stream will, once again, be impacted. The goal for management should be to design work so that our actions do not accelerate the frequency, duration, or intensity of debris flows in stream channels.

A summary of sub-basin characteristics is presented below. Channel "sensitivity" is described at the reach (Rosgen) scale. See maps for reach locations (R map, stream maps) and channel function (STR map). Other information is in Table 1.

BEAR CREEK SUBWATERSHED

< **History** - The high number of debris dams in this basin indicate that mass wasting events have repeatedly impacted the stream channels. Because of the steepness of the terrain and the natural erodibility of the banks, this trend is expected to continue.

< **Current Condition** - The Bear Creek main stem is a "B" type transport channel and has a moderate sensitivity to disturbance. It is a fairly low gradient (5%), moderately confined, pool-riffle or forced pool-riffle system with cobble-rubble dominated substrate. System was described as "fairly intact" and isolated cutthroat trout were observed throughout. It is probable that this population is itself fragmented by the abundance of barriers in this basin. Recent debris torrents have scoured at least one tributary to Bear Creek (see Fish Barriers map) down to the main stem. There are series of debris dams within 200' of the confluence that may be passage barriers in low water. The cause of this event is

unknown.

MARTEN CREEK SUBWATERSHED

Marten Creek

- **<** **History** - No specific event related impacts to stream channels are known other than some erosion on upstream private land. However, the steepness of the terrain and the high amount of bedrock in the channel indicates that debris flows have impacted the channel. Also the valley shape indicates large scouring events in prehistory. Fire has also impacted the basin but it is not known how this may have affected the channel.
- < **Current Condition** - **BLM -** The Marten Creek main stem is a "B" type, response/transport channel. It has an overall low sensitivity to disturbance but appears to be :flashy" with respect to high water events. It is a low gradient (3%), mostly unconfined, pool-riffle or forced pool-riffle system. Substrates are a mix of cobble-rubble, with long stretches of bedrock and abundant spawning gravel in pool tails. System is intact and LWD is most prevalent in the upper reach mostly in jams.

  Private - The upstream portions of Marten Creek are moderately to tightly confined and range from 5 to 21 percent channel slope. Boulders and cobbles dominate and the stream functions primarily in a transport mode. The headwaters have been heavily logged. This should be a forced pool-riffle channel but lacks LWD (Weyerhaeuser 1994)

East Fork Marten Creek

- < **History** - Unknown

- < **Current Condition** - This is an A/Aa+ channel with a high sensitivity to disturbance. It is a tightly/moderately confined, forced pool-riffle area, and functions in a transport capacity. The lower section has a cobble rubble substrate and flow goes subsurface during the summer. The upstream reach is dominated by bedrock. The gradient is quite variable ranging from 2 to 35 percent; the most level area is in the center reach. A debris flow originating in a private clear cut has scoured the upper reach of this stream. Banks up to 80' from the channel were impacted. Erosion concerns are extremely high in this area as there is little riparian and the channel is already filled with debris. It is unlikely, however, that the debris will move farther downstream as it was stopped by low gradients. There are several debris jams in this area along with natural barriers to fish (see Fish Barriers map). Cutthroat trout (believed to be isolated) are present below the sluiced area.

GALE CREEK SUBWATERSHED (Gale Creek is actually a tributary of Marten Creek)

- < **History** - There have been at least 2 upstream mass slope failures that have impacted the channel (1982 and 1986). These did not cause extensive channel scouring or major riparian damage because the debris consisted of mostly soil and rock with little LWD. An old debris dam exists just upstream of BLM land.

- < **Current Condition** - **BLM -** Gale Creek is a "B" type channel that is an unconfined, forced pool-riffle system. It is a low gradient (3%), with low sensitivity to disturbance and functions as a transport channel. Substrates are a mix of cobble-rubble, with boulders. Some

gravels along with sand/silt are present in pools. This channel has high potential for habitat improvement.

Private - There is a waterfall upstream of the BLM boundary that blocks fish passage. All of Gale Creek functions in transport and is a boulder/cobble system (Weyerhaeuser 1994).

DEER CREEK SUBWATERSHED

Deer Creek

< **History** - A debris torrent resulting from a shallow rapid landslide occurred in West Fork Deer Creek some time between 1968 and 1984. During the winter of 1987-88 many small and large mass failures occurred upstream on private land following extensive logging. The material brought into Deer Creek created 2 large log jams on BLM land. Most of this material is now gone from the channel.

< **Current Condition** - **BLM -** The mile or so of the Deer Creek main stem flowing through BLM land is a "B" type channel with a pool-riffle morphology. It is low gradient (2%), has a low sensitivity to disturbance, and functions as a response channel. Substrates are mostly cobble-rubble. Most of the channel is naturally unconfined, but the mainline road has limited the stream's ability to freely move in the valley. High water events, however, have impacted the road. This channel has high potential and need for habitat improvement.

Private - Most of the basin is on private land upstream of BLM (although USFS manages a large segment of the East Fork). The streams are moderate to tightly confined with gradients ranging from 2 to 23 percent. Boulder cobble substrates dominate these transport/response channels. Forced pool-riffle and plane bed channel types are the most common (Weyerhaeuser 1994).

South Fork Deer Creek

< **History** - During the winter of 1987-88, a 1st order headwater tributary failed at a road in the SE corner of Section 16. This produced a debris torrent that flowed about 2 miles down S. F. Deer Creek and scoured out the valley bottom. The torrent was checked at constrictions along the way and 3 large debris jams accumulated that continue to store debris and sediment behind them.

< **Current Condition** - **BLM -** S. F. Deer Creek is an unconfined "B" type channel with a pool-riffle morphology. It is fairly low gradient (5%), has a moderate sensitivity to disturbance, and functions as a transport channel. Substrates are mostly cobble-rubble with some small and large boulders. Many pools have a fine silt coating. Some habitat work would be beneficial, but stability of the 3 debris structures should be evaluated first.

Private - The upper portion of S. F. Deer Creek on private land is fairly steep (10%), confined, and has a boulder/cobble substrate with a step-pool bedform. It functions as a transport channel and LWD is rare.

LITTLE BEAR SUBWATERSHED

< No historical information is available.

< **Current Condition** - One stream was surveyed in this watershed during 1996 (Power Creek). This stream is the first tributary of any size west of Deer Creek and supports a population of cutthroat trout. It is a moderately confined "A" type channel with a forced pool-riffle morphology. It has a moderate gradient (7%), a high sensitivity to disturbance, and functions as a transport channel. Substrates are mostly cobble-rubble. A BLM harvest in 1996 removed much of the riparian vegetation and destabilized stream banks for approximately 2,000 feet. The several small McKenzie River tributaries to the west of the surveyed stream are source or transport channels. Three of these are probably fish bearing (see Stream Maps).

DORRIS SUBWATERSHED

< No historical information is available.

< **Current Condition** - Rough Creek was the only stream surveyed in 1996. It is a moderately confined "A" type channel with a forced pool-riffle morphology. It has a moderate gradient (7%), high sensitivity to disturbance, and functions as a transport channel. Substrates are mostly cobble-rubble. Although good habitat exists for fish, none were present. Access to the McKenzie River is blocked by a waterfall. All streams (except Bear Creek) on the North side of the river are isolated from the river by very steep gradients or falls. These function primarily as source channels.

JIMBO MTN SUBWATERSHED

< No historical information is available.

< **Current Condition** - No surveys were conducted in this watershed, but gradients are quite steep and streams are isolated from the river. Silver Creek was impacted by a road related debris torrent during February 1996 that flowed into the McKenzie, destroying the boat launch. This has since been replaced. The channel was scoured to bedrock and recovery is expected to be very slow. It is likely that if any fish existed in the stream (unknown), they did not survive the torrent. Tributaries in this subwatershed function almost equally as source and transport channels.

Ennis Creek - Source channels make up 56 percent of those in the basin and transport channels make up 36 percent. Of the 35.9 stream miles (0.1 BLM), 28.3 are Rosgen type Aa+ channels. No other channel information is available for the Ennis Creek basin.

Table 1 - Bear/Marten Watershed Channel Geomorphology								Page 1 of 3
Stream	**Reach**	**Rosgen Type**	**Sensitivity to Disturbance**	**Channel Function**	**Channel Morphology**	**Confinement**	**Mean Gradient (%)**	**Fish Present**
Marten	1A	B3	Low	Response	PR	U	2	Yes
Marten	1B	B 3/4	Mod-Low	Response	PR	U	3	Yes
Marten	2	B 3	Low	Res-Trans	FPR	U	3	Yes
West Fork	1	B 3	Low	Res-Trans	FPR	C	5	Yes
Unnamed 2	1	A 3	High	Transport	FPR	M	2	Yes
Cascade Fork	1	A 3/1	Mod	Transport	Step-pool	C	8	No
Unnamed 4	1	A 3 a+	High	Source	Cascade	C	20	No
Unnamed 5	1	A 3 a+	High	Source	Cascade	C	18	No
East Fork Marten	1A	A 3 a+	High	Transport	FPR	C	15	Yes
	1B	A 3	High	Transport	FPR	M	6	Yes
	1C*	A 3 a+	High	Transport	FPR	C	17	No
Gale	1	B 3	Low	Transport	FPR	U	3	Yes
Unnamed 1	1	B 3 a	Mod	Transport	FPR	C	9	No

PR = Pool/riffle
FPR = Forced PR

U = Unconfined
M = Moderately confined

C = Confined
* = Sluiced out

Table 1 - Bear/Marten Watershed Channel Geomorphology								Page 2 of 3
Stream	**Reach**	**Rosgen Type**	**Sensitivity to Disturbance**	**Channel Function**	**Channel Morphology**	**Confinement**	**Mean Gradient (%)**	**Fish Present**
Bear	1	B 3 a	Mod	Transport	PR	M	5	Yes
Bear	2	B 3 a	Mod	Transport	FPR	M	5	Yes
Unnamed 1	1	A 3 a+	High	Source	FPR	C	12	Yes
Unnamed 2	1	A 4 a+	High	Source	PR	M	14	Yes
Unnamed 3	1	B 3 a	Mod	Transport	FPR	C	8	Yes
Unnamed 3	2	A 3 a+	High	Transport	Cascade	C	16	No
Unnamed 3, Trib. A	1	A 3 a+	High	Source	Cascade	C	22	No
Unnamed 3, Trib. B	1	A 3 a+	High	Source	FPR	M	15	No
Unnamed 4	1	A 3/1 a+	Mod	Transport	Cascade	U	14	No
Unnamed 4	2*	A 5/1 a+	High	Source	Step-Pool	C	17	No
Unnamed 4, Trib. A	1*	A 4/3 a+	High	Source	FPR	C	19	No
Rough	1	A 3	High	Transport	FPR	M	7	No

PR = Pool/riffle
FPR = Forced PR

U = Unconfined
M = Moderately confined

C = Confined
* = Sluiced out

Table 1 - Bear/Marten Watershed Channel Geomorphology								Page 3 of 3
Stream	**Reach**	**Rosgen Type**	**Sensitivity to Disturbance**	**Channel Function**	**Channel Morphology**	**Confinement**	**Mean Gradient (%)**	**Fish Present**
Deer	1	B 3	Low	Response	PR	U	2	Yes
South Fork Deer	1	B 3 a	Mod	Transport	PR	U	5	Yes
South Fork, Trib. A	1	A 1 a+	Mod	Transport	Step-Pool	M	16	Yes
Power Creek	1	A 3	High	Transport	FPR	M	7	Yes

PR = Pool/riffle
FPR = Forced PR

U = Unconfined
M = Moderately confined

C = Confined
* = Sluiced out

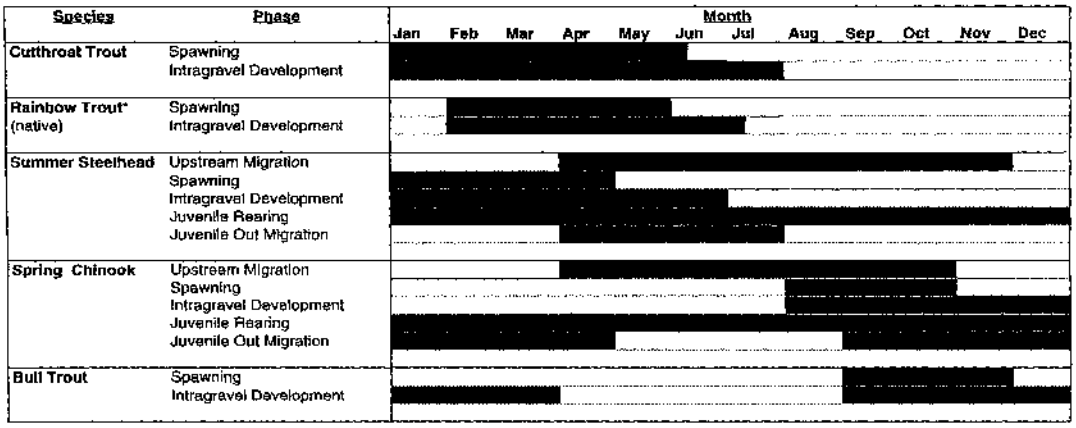
FISH SPECIES AND LIFE HISTORY REQUIREMENTS

What fish species exist in the watershed and what are their requirements?
What species have adapted and how do we manage for them?
What Threatened and Endangered (T&E) species exist in the watershed?
What can be done to manage proactively or minimize impacts to T&E species?
What Survey and Manage (S&M) species have the potential to exist? And where do they exist? *None*
What other special status species exist in the watershed?

There are 4 salmonid fish species in the watershed that may use streams on BLM land other than the McKenzie River: spring chinook salmon, rainbow/steelhead trout, cutthroat trout, and bull trout. Several species of sculpin are also present throughout. Speckled dace should inhabit lower Marten and Deer Creeks, and Marten Creek has some habitat potential for longnose dace. Surveys for non-salmonids have not been conducted at the species level (see Known Fish map and subwatershed habitat reports below for more detailed distribution information) (see Figure 1 for life history timing).

1. Spring Chinook Salmon (*Oncorhynchus tshawytscha*) - Status: Proposed threatened.

Chinook salmon are most likely to be found in larger streams and rivers 4th order or larger, with low gradients (<3%) and drainage areas >1900 acres (Armantrout 1995). Salmon streams in this watershed are the McKenzie River, Deer Creek, and Marten Creek. Chinook prefer diverse deep pool habitat with abundant woody debris or undercut banks for cover. The preferred temperature range for fry and juveniles ranges from 54 to 57EF (Figure 2). Temperatures above 61EF may cause abnormalities or stunted growth (Moring 1991). Spring chinook adults enter the McKenzie River between May and August (Figure 1). They hold in deep pools during the summer and spawn in the September/October when the first flushing rains come. They require clean 1-6" gravel to spawn and redds may be up to 12' by 6' in size. A female will lay about 4,500 eggs that hatch the following spring, with emergence 2-3 weeks afterward. Spring run juveniles stay in fresh water until their second or third year using side channels and well covered main channel areas for habitat. Spring chinook numbers have been steadily declining and in 1997 ODFW closed the McKenzie River to salmon fishing. They estimate <1,500 salmon will move upstream of Leaburg dam this season. Outmigrating juveniles are screened from turbines at Leaburg, but not at Walterville power stations. Traditionally there were literally millions of these fish in the McKenzie.



* Stocked rainbow trout are fall spawners.

Figure 1 - Timing of life history phases of salmonid species within the Bear/Marten Watershed (compiled from Behnke 1992, Healey 1991, Hutchison 1991, Howell et al. 1988, Nicholas, and Wydoski and Whitney 1979).

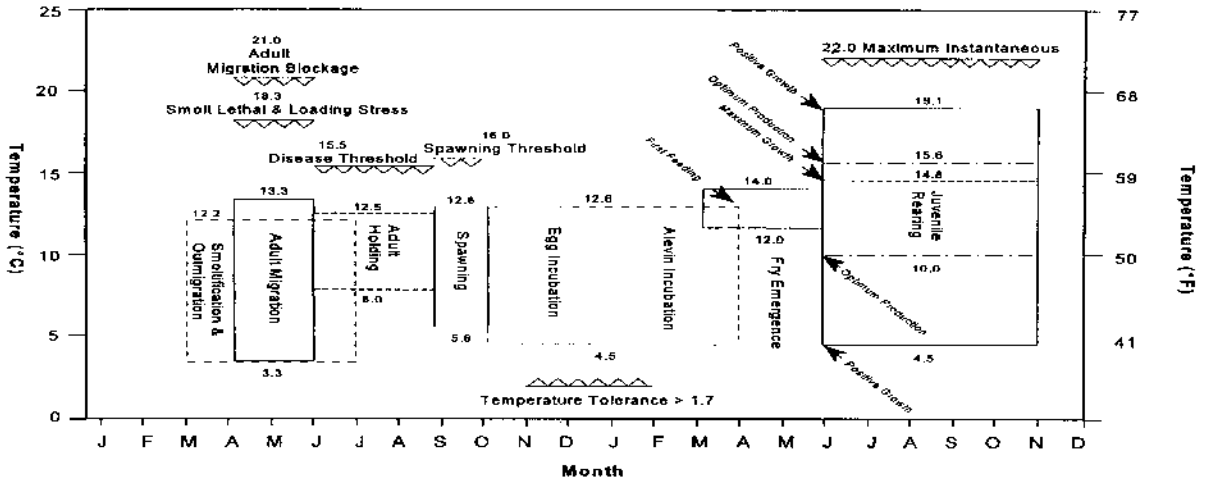


Figure 2 - Spring chinook salmon temperature requirements by life stage. From D. McCullough (ODEQ 1995).

2. Rainbow/Steelhead Trout (*Oncorhynchus mykiss*) - Status: In review.

The rainbow trout native to the McKenzie basin are referred to as "redsides" and grow to be quite large. Summer steelhead (ocean going rainbows) are introduced and most return to the hatchery at Leaburg Dam. Nonnative rainbow trout residents are the only rainbow trout anglers may keep. These are placed into the McKenzie River by ODFW several times during the summer fishing season. All other rainbows above Leaburg Dam must be released under current regulations. Rainbow/steelhead are most likely to be found in 2nd order and larger streams with low to moderate gradients (<7%) and drainage areas >235 acres (Armantrout 1995). These fish are found in Marten, Deer, S. Fork Deer, Gale, and lower Bear creeks and the McKenzie River. Ideal habitat for rainbow/steelhead trout consists of fast water streams with a high proportion of riffles to pools. Adults require deep, cool water (54 to 63E) pools.

Spawning occurs in the spring (Figure 1). Steelhead spawn in clean gravel, typically in pool tailouts, when the water temperature is 39 to -55EF. Females lay about 1,000 eggs per pound of body size (Barnhart 1991). Rainbows typically spawn in small, gravel dominated tributaries when temperatures are 50 to 60EF and lay from 200 to 900 eggs per pound of body size. Steelhead juveniles remain in freshwater for a year or more before moving to the ocean. Young fish spend most of their first year in riffles and well covered side channel habitats.

3. Cutthroat Trout (*Onchorhynchus clarki*) - Status: In review.

Cutthroat trout are widely distributed throughout the watershed and are found in all fish bearing streams. Typical cutthroat trout habitat is in 2nd order or larger streams with moderate to steep gradients (<17%) and drainage area >142 acres, although they have been found in 1st order streams during the winter. They prefer temperatures of 54 to 63EF. Spawning occurs in late winter/early spring (Figure 1), females lay up tp 1,700 eggs, and fry emerge in the summer. Some cutthroat may spend their entire life cycle in small sections of streams, while others migrate down to larger rivers to mature. In addition, distribution may vary with the season. Cutthroat often move downstream in the fall and back upstream in the spring (Meehan 1991). A population of "isolated" cutthroat trout inhabits the Bear Creek basin above the falls. ODFW has listed these as "isolated" although genetic studies have not been done. Another isolated population may exist on BLM land in East Fork Marten Creek.

4) Bull Trout (*Salvilinus confluentus*) - Status: Federal Candidate

McKenzie River bull trout (sometimes called "Dolly Varden") are the only remaining bull trout population west of the Cascades, and are found in the McKenzie River from Leaburg Dam to Tamolitch Falls. They are the top predator in the river system and feed primarily on chinook salmon juveniles. A critical limiting factor for bull trout is suitable spawning habitat. They spawn in the fall (Figure 1) and the eggs/fry require very cold (<43EF) water (Figure 3). All known spawning habitat is currently in 3 creeks on USFS land east of the Bear/Marten watershed. Food is also a limiting factor, as the salmon population is also steadily declining. While it has been commonly accepted that bull trout require cold water, recent research (David Bickford, USFS, pers. comm.) suggests that younger adults are much more tolerant and probably use the downstream areas of most accessible streams in the watershed. In addition, bull trout adults almost certainly travel into larger tributaries such as Marten and Deer Creeks in search of food. Protection is

also warranted for the south side of the McKenzie River where bull trout have been recently caught from the bank on BLM land.

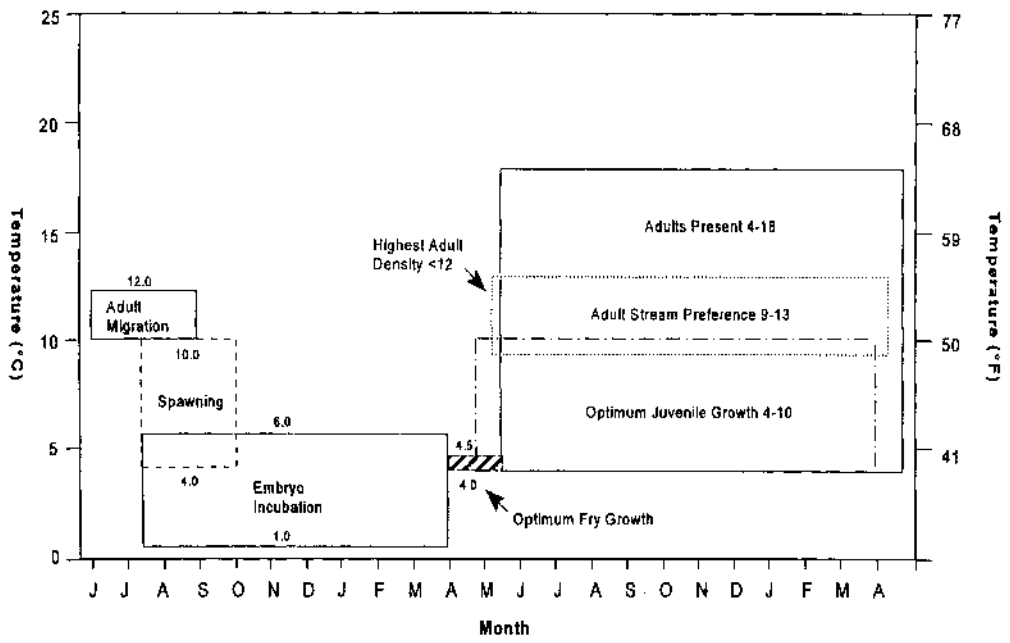


Figure 3. Bull trout temperature requirements by life stage. From D. Buchanan (QDFW) in ODEQ (1995).

Where is potential and known fish habitat? For species of concern?
Where do barriers to fish exist?
Where are there barriers to movement of materials within the channels?
What is the aquatic habitat condition? Trend?
What is the condition of habitats for T&E species?
What is the condition of the Riparian Reserve?
Where is LWD recruitment potential now?
Where do hardwoods occur? What kind?

REFERENCE CONDITION

Historic condition information is rare. Spawning gravel availability, substrate type, and temperature were reported for Deer, Marten, and Gale Creeks from 1959 stream surveys (Willis et al. 1960). However, the level of information is not sufficient to determine whether conditions were different from the present. Human activities were apparently late in impacting the WAU. No splash dam logging was done. It is unlikely that stream cleaning activities, if they occurred at all, were very limited in the WAU (Weyerhaeuser 1994; Dave DeMoss, BLM pers. comm.).

PACFISH guidelines recommend the following desired conditions for salmon streams (USDA/USDI 1994). These guidelines are a reference point for comparison. Because all natural systems vary, the numbers may or may not accurately reflect the channel condition. However, because the PACFISH standards cover the major elements needed for fish habitat, they can be used as a point of departure for determining trends and evaluating overall stream health. The interpretation of habitat condition, as presented in this document, was based on respective trends, rather than on actual numbers, except in cases where numbers were very far from the standard.

Table 2 - Summary of PACFISH Guidelines

Pool Frequency	Water Temp.	Large Woody Debris	Bank Stability	Width:Depth Ratio
Varies w/ stream width	<68^{o}	>80 pieces/mi. 24"dbh x 50' long	>80% Stable	<10:1

CURRENT CONDITION AND TRENDS

Overview - There are approximately 76 miles of potential fish habitat in the watershed (19 BLM miles) including the McKenzie River. Approximately 38 miles (15 BLM miles) are known to support fish (see Potential and Known Fish Distribution maps). Virtually all potential habitat (80%) on BLM land is being used. The other 20 percent is mostly in Rough Creek. Habitat in Rough Creek is the best in the watershed, but fish are not present and access to the McKenzie River is blocked by high gradient.

Almost 70 waterfalls or other natural barriers exist in the watershed (Fish Barriers map). Some are passable during high flows but many are probably permanent barriers. This means that fish populations are often fragmented. If this condition has persisted for long enough, genetically isolated populations result. There is reason to believe that at least one and probably more of these unique populations inhabit the Bear/Marten watershed. Only 3 culvert barriers currently exist in the watershed that are impediments to fish passage.

The overall condition of the habitat in fish bearing streams is better than in most other streams in the Resource Area, but not as good as one would expect from a watershed that has not been heavily logged. The number of pools is only 74 percent of that recommended by PACFISH and has declined by 15 percent in the last 10 years. There has been an enormous increase in the amount of LWD in the channels, but unfortunately most of it is found in large log/debris jams where it is not forming habitat. Water temperature data is limited to 2 summer surveys: USFS 1992 (Deer, S. Fk. Deer) and WEYCO 1994 (Marten, Gale, Deer). All were within acceptable limits, but Deer Creek may be getting too warm. In 1994 Deer Creek registered 67EF, one degree below the 68EF maximum set by PACFISH. Streambanks are generally stable throughout the watershed and, with a few localized exceptions, unstable areas are naturally caused. Width:depth ratios continue to exceed the standard throughout the watershed (Table 3). This may be a natural feature of this area. Streamside vegetation is generally in good condition and mature conifers are a dominant riparian type throughout most of the watershed on BLM land (Streamside Veg map).

BEAR CREEK SUBWATERSHED

< 19.9 stream miles (17.8 BLM); 4 fish bearing miles (3.8 BLM)
< **1987** - BLM surveys of the Bear Creek main stem conducted in 1987 found 61 percent of the PACFISH standard for pools and 33 percent for LWD. Bank stability was generally fair-poor. Width:depth ratio was also poor and riffle habitats outnumbered pools by 3:2. However, the riparian and overall aquatic system was considered to be "essentially intact" (Armantrout 1992) and degraded areas were naturally caused.

< By **1996** pools and LWD had increased to 84 percent and 193 percent (respectively) of PACFISH standards. Bank stability was considered excellent to good with moderate erosion potential, width:depth ratio had decreased, and there were equal numbers of pools and riffles.

< **Trend** - improving

< **Species** - Rainbow and cutthroat trout to the falls, above the falls an Isolated population of cutthroat. sculpins (spp unknown) are also present above and below the falls.

< **Barriers** - see map - too numerous to list - all natural

< **Riparian** vegetation along the main stem consists of an overstory of Douglas-fir approximately 100 years old, and bigleaf maple. Old growth is intermingled. Understory is red alder and vine maple with devil's club, salmonberry, and thimbleberry in the upper reach.

< **Streamside Vegetation** - Mature conifer throughout

< **LWD** - Low in lower portion, but recruitment potential good. Abundant LWD in upper reach, good recruitment also.

< **Preliminary Ideas & Opportunities** - Because of the general instability of the basin, maintain existing aquatic and riparian system. No project work needs at this time. Determine genetic characters of cutthroat trout, and identify species of sculpin above the falls.

MARTEN CREEK SUBWATERSHED

Marten Creek

< 55.3 stream miles (20.8 BLM); 8 fish bearing miles (5.1 BLM) includes East Fork Marten Creek

< **1987** BLM surveys of the Marten Creek main stem conducted in 1987 found 58 percent of the PACFISH standard for pools and 18 percent for LWD. Bank stability was generally good-excellent, and degraded areas were naturally caused. Width:depth ratio was poor and riffle habitats outnumbered pools by 5:4. Seventeen percent of pools were larger than 1,000 cu.ft. in size. The aquatic and riparian communities, including fish and amphibians were considered to be "unusually diverse" (Armantrout 1992)..

< By **1996** pool frequency had decreased to 34 percent of the standard and LWD had increased to 49 percent. Both of these are, however, far below the standard for a salmon stream. Bank stability was considered excellent to good, width:depth ratio did not change, and there were slightly more pools than riffles.

< **Trend** - Low numbers of pools and LWD and variation in trends may indicate habitat instability in this stream. This could be a natural condition.

< **Species** - Rainbow/steelhead, cutthroat, chinook rearing and winter refuge mostly, some spawning habitat available. High potential for bull trout foraging, winter refuge and young adult use in the lower reaches.

< **Barriers** - There are no barriers on the main stem.

< **Riparian** vegetation is intact with an overstory of 100-130 year old Douglas-fir with areas of bigleaf maple in the lower reach. The understory is red alder, bigleaf, vine maple, and miscellaneous brush species in the lower reach and mostly red alder in the upper reach. Two clear cuts in the upper reach (Marten Power TS 1996) have reduced the riparian severely.

< **Streamside Vegetation** - Mostly hardwoods, especially red alder in the lower reaches. Mature conifer in most of the rest of the basin. Minimal buffers on private land are assumed.

< **LWD** - Severe lack of LWD in the lower reaches. LWD, mostly in jams beyond 14,000 feet.

< **Preliminary Ideas & Opportunities** - Protect existing habitat, add LWD to banks to create side channels, cover, and edge habitat. Add log sills to trap gravels in bedrock dominated areas. Survey for bull trout and chinook salmon. Monitor

spawning activity of steelhead/redsides. Determine natural variation range for channel processes.

East Fork Marten Creek

< See above for stream/fish miles - combined with Marten Creek .

< **1987** BLM surveys of the east tributary of Marten Creek conducted in 1987 found 87 percent of the PACFISH standard for pools and 38 percent for LWD. Bank stability was generally excellent and degraded areas were naturally caused. Width:depth ratio exceeded the standard, and riffle habitats outnumbered pools by 5:4.

< By **1996** pools and LWD had increased to 153 percent and 250 percent (respectively) of PACFISH standards. Bank stability was considered poor and width:depth ratio had decreased The upper portion of this stream had been impacted by a recent debris flow originating in a clear cut on private land. Pools outnumbered riffles 6.5:5.

< **Species** - cutthroat trout, isolated cutthroat trout

< **Barriers** - falls, bedrock cascades, debris jams (see Barriers map)

< **Trend** - more pools and LWD, but much of it in debris dams and not creating habitat. Sediment inputs high. General trend degraded and unstable.

< **Riparian** overstory in the lower reaches is Douglas-fir, much of it >100 years old. The understory is predominantly bigleaf maple, with some hemlock and cedar mixed in. The upper reach has been recently clear cut on both sides with a 50 foot buffer of Douglas-fir/hemlock.

< **Streamside Vegetation** -Hardwoods, especially alder nearest the forks with mature conifer throughout most of the reach. Some young conifer upstream near private land. Minimal buffers on private land are assumed.

Note - This data is from 1995 aerial photos and reflects conditions before the sluice out in the uppermost reach of BLM. The riparian has been seriously degraded in this area.

< **LWD** - Recruitment good in the lower reaches, poor above. LWD in channel is mostly in debris dams below sluice area.

< **Preliminary Ideas & Opportunities** - Maintain current conditions. Determine whether the cutthroat trout here are genetically distinct.

GALE CREEK SUBWATERSHED (Gale Creek is a tributary of Marten Creek)

< 23.5 stream miles (6.2 BLM); 2.6 fish bearing miles (1.1 BLM)

< **1987/88** - BLM surveys of Gale Creek conducted in 1988 found 61 percent of the PACFISH standard for pools and 23 percent for LWD. Bank stability was generally good-excellent and degraded areas were naturally caused. Width:depth ratio exceeded the

standard and riffle habitats outnumbered pools by 5:4. Habitats were of low quality and lacked complexity.

< By **1996** pools and LWD had increased to 76 percent and 61 percent (respectively) of PACFISH standards. Bank stability was still good-excellent but width:depth ratio had increased. Pools outnumbered riffles 6:5.

< **Trend** - Overall improving, but stream is getting wider and shallower.

< **Species** - cutthroat, rainbow/steelhead

< **Barriers** - log jam and 50 foot falls at the upstream property line

< **Riparian** overstory is a mixture of bigleaf maple and Douglas-fir about 70 years old. The understory is predominantly alder.

< **Streamside Vegetation** - Hardwoods, mostly alder, line the stream for most of its length.

< **LWD** - Amount in stream low, poor recruitment potential.

< **Preliminary Ideas & Opportunities** - Increase complexity and stabilize the channel. Create pools, meander, and off channel rearing areas. Boulders, logs, on-site trees and other materials could be used. Full spanning structures are probably not necessary. Possible opportunity for riparian conversion to conifer in some areas.

DEER CREEK SUBWATERSHED

Deer Creek

< 79 stream miles (5.7 BLM); 12.3 fish bearing miles (1.6 BLM) includes S. F. Deer Creek.

< **1987** - BLM surveys of lower Deer Creek conducted in 1987 found 62 percent of the PACFISH standard for pools and 5 percent for LWD. Bank stability was generally good and degraded areas were naturally caused. Width:depth ratio was poor and riffle habitats outnumbered pools by 10:7. Average pool volume was >1,000 cu ft. Deer Creek was described as "a stream with high potential which is badly degraded" (Armantrout 1992).

< By **1996** pool habitats had decreased to 31 percent of the standard but LWD had increased to 20 percent. Bank stability was still good but width:depth ratio had increased. Pool/ riffle ratios did not change.

< **Trend** - Decreasing pool numbers, very low amounts of LWD, high temperatures, and a channel that is becoming wider and shallower indicate that Deer Creek is a system in trouble.

< **Species** - Rainbow/steelhead, cutthroat, chinook salmon spawning, rearing, winter refuge. Potential for bull trout foraging, winter refuge, and young adult habitat in the lower portion of the stream.

< **Barriers** - None on BLM, numerous upstream on private land (see map), all natural.

< **Riparian** vegetation on right bank/slope is altered by the road and some hillside harvest units. The mainline road runs through the riparian and in some places is immediately adjacent to the stream channel. Vegetation is mostly hardwood with an abundance of late seral bigleaf maple on the flood plain.

< **Streamside Vegetation** - The main stem is mostly hardwood; bigleaf maple, and young red alder. There is some mature conifer along the East Fork on USFS land, but most of the drainage has a young red alder riparian area. It is assumed that buffers on private land are narrow.

< **LWD** - Recruitment is extremely poor. Aside from the bigleaf maples, which often continue to live and provide habitat for fish and other aquatic organisms long after they have fallen down, there is little potential for LWD recruitment. Any habitat work will have to rely on materials from other sources. Because of the size of the Deer Creek basin, this will undoubtedly be a challenge. Material with root wads attached is recommended.

< **LWD** - **Preliminary Ideas & Opportunities** - Major restructuring of the stream using all types of roughness elements, especially trees with root wads attached. Creation of more off channel habitat. Possible localized conversion to conifer, although the late seral bigleaf maple community should not be harmed. It may be possible to encourage a few leaning maples to fall into the stream living.

South Fork Deer Creek

< see above for stream miles; included with Deer Creek

< **1987** - BLM surveys of S. F. Deer Creek conducted in 1987 (before the debris torrent in 1988) found 73 percent of the PACFISH standard for pools and 60 percent for LWD. Bank stability was generally good and degraded areas were naturally caused. Width:depth ratio did not meet the standard, and riffle habitats outnumbered pools by 5:3.

< By **1996** pool habitats had decreased to 64 percent of the standard. LWD had increased substantially, but most was in 3 large jams that create little habitat and may be barriers in low water. Bank stability was poor and width:depth ratio had increased. Pools and riffles were present in equal numbers.

< **Trend** - This channel is probably still unstable. The increase in pool numbers and ratio indicate improvement, but there is high potential for dam break floods in this channel.

< **Species** - Rainbow/steelhead, cutthroat - fish had recolonized the impacted areas within a week of the debris torrent.

< **Barriers** - Three large debris jams in the upper basin. May be passable for small fish.

< **Riparian** - Riparian age averages about 75 years old. The overstory is mostly Douglas-fir with bigleaf maple and occasional hemlock. Understory is bigleaf maple, alder, and vine maple.

< **Streamside Vegetation** - Mature Douglas-fir borders the channel on BLM land with more hardwood, especially alder, upstream on private land.

< **LWD** - LWD is extremely lacking in the channel aside from the 3 large debris jams. The amount of LWD in the jams is not known.

< **Preliminary Ideas & Opportunities** - Protect the channel and riparian. No project work is recommended at this time.

LITTLE BEAR SUBWATERSHED

< 15.4 stream miles (12.6 BLM); 4.9 fish bearing miles (2.6 BLM) includes McKenzie River.

< **1996** - Only one of the tributaries to the river in this subwatershed was surveyed (Power Creek). Pools numbered 143 percent of PACFISH standards and LWD was at 94 percent. Bank stability was poor, primarily due to the Marten Power timber harvest, and width:depth ratio exceeded the standard. Access to the river is blocked by a culvert, probably year round.

< **Small McKenzie Tributaries** - There are several other smaller (<4th order) streams that flow directly into the river from the south. Little Bear Creek is fish bearing. Two other streams (Unnamed #1 and #3) are probably used by cutthroat trout as winter refuge areas. Stream #3 is blocked to fish at the road by a culvert. There is a considerable amount of sediment entering these streams from the road ditch. No relief drainage was noted.

< **Trend** - No trend is suggested

< **Species** - McKenzie River: Cutthroat, rainbow/steelhead, spring chinook salmon, bull trout, sculpins, cyprinids, whitefish. Tributaries: cutthroat trout.

< **Barriers** - Two culverts under the mainline road block access to Power Creek and stream #3, probably all year round.

< **Riparian** - Most of the McKenzie River riparian in this area is a mix of hardwoods and mature conifer, with an understory of hemlock and alder. On the one surveyed tributary the riparian was mostly 70+ year old Douglas-fir on the east side and almost nothing on the west side for approximately 2000' in the Marten Power TS unit that bordered it. Below the unit and closest to the river, the riparian was mostly hardwood.

< **Streamside Vegetation** - See above.

< **LWD** - Recruitment potential is good on the east side of the surveyed trib, but poor along the west bank adjacent to the clear cut. LWD recruitment to the river is probably good. The smaller streams in the area were not evaluated but recruitment appears to be good.

< **Preliminary Ideas & Opportunities** - Maintain riparian and current condition. Replace culverts and address road drainage issues along the mainline road to minimize sediment inputs to the river.

DORRIS SUBWATERSHED

< 15.8 stream miles (5.7 BLM); 3.3 fish bearing miles (3.3 BLM), all in McKenzie River.

< **1996** - Rough Creek was the only tributary surveyed and is non-fish bearing. However, because of its excellent condition it may serve as a "reference" for desired condition. Rough Creek exceeded the PACFISH standard for pools by 103 percent and LWD by 400 percent. Bank stability also met the standard, but width to depth ratio did not. Pool-riffle ratio was 9:10.

< **Trend** - No trend is suggested

< **Species** - McKenzie River, see above.

< **Barriers** - All streams on this side of the river (except Bear Creek) are inaccessible to fish because of waterfalls and steep gradients.

< **Riparian** -The McKenzie Highway runs through the riparian and is adjacent to the river through most of this area. There are also a number of residences here, along with 4 boat landings. Some logging of small wood lots has been occurring for the last several years. Rough Creek is the only tributary surveyed in this subwatershed. Riparian vegetation in Rough Creek is uneven aged (110 years avg.) Douglas-fir with hemlock and cedar. Old growth is intermingled. Understory is mostly vine maple and then hemlock, bigleaf maple, and shrubs.

< **Streamside Vegetation** - Mostly hardwood with mixed mature conifer

< **LWD** - LWD abundant in Rough Creek and high recruitment potential. Excellent fish habitat, but no fish and no access to the river.

< **Preliminary Ideas & Opportunities** - Maintain existing conditions.

JIMBO MTN SUBWATERSHED

< 14.2 stream miles (5.2 BLM); 2.4 fish bearing miles (0.8 BLM). There are no known fish bearing streams in this subwatershed; all are blocked by gradient from the McKenzie.

< **Riparian** - The McKenzie Highway continues in the riparian. This and the steep rock cliffs divide the vegetation here and in Dorris between river and upslope quite sharply. No streams in this subwatershed were surveyed.

< **Streamside Vegetation** - Mostly hardwoods along the river. Silver Creek and 2 small tribs to the east had riparian areas dominated by mature conifer in 1995. Silver Creek still has some conifer, but trees immediately adjacent to the stream were lost in the flood in February 1996.

< **LWD** - Recruitment potential probably fair to good, but no data exists. Instream abundance levels is also not known.

< **Preliminary Ideas & Opportunities** - Maintain riparian and current condition to preserve water quality.

ENNIS CREEK SUBWATERSHED

< There are 12 miles of potential habitat for cutthroat trout and 5 miles for rainbow trout. Only 0.1 mile is on BLM land. The riparian there is mature conifer. No other information is available for this subwatershed.

Table 3 - Bear/Marten Watershed Fish Habitat Condition & PACFISH Comparison							
Stream	**Year**	**Pool Frequency**		**Water Temp (< 68° F)**	**Bank Stability (> 80%)**	**LWD # PC/mi (> 80 ppm)**	**Width: Depth (< 10:1)**
		Actual # per mile	**% of PAC Standard**				
Marten	1987	45	58	---	Y	14	19
	1996	19	34	58-63[1]	Y	39	19
East Fork Marten	1987	75	87	---	Y	30	14
	1996	87	153	---	N	215	12
Gale	1988	39	61	56-62[1]	Y	18	16
	1996	55	76		Y	49	18
Bear	1987	46	61	---	N	26	18
	1996	66	84	---	Y	193	12
Deer	1987	32	62	57-62[2]	Y	4	22
	1996	16	31	57-67[1]	Y	16	25
South Fork Deer	1987	126	73	57-64[2]	Y	48	13
	1996	58	64		N	33	19
Mean Totals	1987/ 1988	61	86	---	Y	23	17
	1996	50	74	---	Y	545	17.5
• POWER	1996	92	146	---	N	94	13
• ROUGH	1996	60	103	---	Y	329	12

( ) = PACFISH Standards
[1] = From Weyco summer 1994 (McKenzie R. 52-58°F)
[2] = From USFS summer 1992
• = Not included in totals

LIMITING FACTORS AND PRELIMINARY IDEAS & OPPORTUNITIES(see also individual subwatershed Preliminary Ideas & Opportunities)

, What are the critical limiting factors for fish in this watershed, and what could we do to correct them?
, What are the stream reaches that are most responsive to habitat creation (best for habitat improvement)?

< One of the most important issues that affects fish habitat at various life history stages in this watershed is lack of usable LWD in the stream channel. Wood functions in formation of fish habitat in several ways including: 1. pool formation, 2. overhead and instream cover, 3. hydraulic refuge in winter, 4. formation of side-channels, and 5. storage of spawning gravels. Addition of LWD in the form of whole trees, preferably with root wads attached could improve habitat.

< Distribution of LWD wood is also an issue. At present, most of the wood in the watershed is in large debris jams (see Fish Barrier map) that create little habitat, and may present barriers to fish, especially during the summer. These jams have a very high potential to become dam break floods that would scour the channel and remove additional habitat. Management decisions should consider slope stability, soil type/ depth, and hydrologic regime before building roads or planning regen harvest in this watershed.

< Populations of cutthroat trout isolated by natural barriers may be vulnerable to displacement from debris torrents and dam break floods in East Fork Marten, upper Deer, S. Fk. Deer, and Bear Creeks.

< Because of tight confinement and high gradient, most of the watershed would not be expected to have much side channel development. This limits winter refuge and juvenile rearing habitat. The greatest potential is on lower Marten and Deer Creeks where side channels would be expected, but are not present.

< Redd scour potential is moderately high in Marten and Deer Creeks and moderate in Gale Creek. Increases in peak flows could result in bed mobilization.

< High stream temperatures in Deer Creek could be a problem. However, because presumably this problem originates on private land upstream of BLM, there may be little we can do. Temperature monitoring could determine whether BLM land contributes to this problem.

< Marten and Deer Creek main stems are WDNR "response" areas and have the highest potential for habitat improvement. These are low gradient Rosgen "B" type channels that are generally unconfined to moderately confined. Habitat improvement could include flood plain reconnection, side channel habitat creation, and riparian conversion to conifer. Gale Creek, a "B" type transport channel, is also a good candidate for habitat improvement.

OTHER ISSUES AND/OR CONCERNS

, What and where are aquatic invertebrates and other species that are indicators of water quality?

< Macroinvertebrates were surveyed in 1991 in Marten and Bear Creeks. Exact locations of sample areas are not known.

Marten Creek - Both sample sites had sediment tolerant species indicating some organic enrichment and sedimentation. The observed number of shredders in the community indicated a riparian habitat in good to fair condition and invertebrate diversity was good. A low macroinvertebrate biomass would limit the number and size of fish that could be supported, but clean water taxa indicated suitable spawning substrate. The stream was evaluated as being in good condition, but could be better. There may be opportunities to improve water quality and instream habitat quality (USDI BLM 1991).

Bear Creek - One site was sampled. There were some indications of sediment and organic enrichment, but other clean water taxa indicated a fairly good water quality and good instream substrate. The number of shredders indicated a riparian habitat in good condition and invertebrate diversity was good. The low biomass of macroinvertebrates could limit fish production. A high BCI indicated that Bear Creek was close to meeting its potential. Existing conditions should be maintained.

Note: Small sample sizes and numbers limit the usefulness of this survey. Additional surveys could be done to confirm or enhance this information.

, How do we maintain and restore the timing, variability, and duration of **flood plain** inundation and water table elevation in meadows and wetlands?

< Recommend addition of LWD to unconfined, response type stream reaches to reconnect channel with flood plain. This would also create off channel habitat for fish (winter refuge and juvenile rearing).

Questions deferred to the landscape design

, Where is it possible to consider adjusting RR?
, What specific areas could benefit from vegetation treatment?
, Where and how can we manage for LWD recruitment?
, How could stand density management be used to convert Riparian Reserve stands to Late-Successional old growth? Is this needed in the watershed? If so where could this occur?

The Wildlife Section will answer the following questions.

SPECIAL STATUS SPECIES

What Threatened and Endangered species exist in the watershed? What is the condition of their habitats?
What Survey and Manage species have the potential to exist? And where do they exist?
What other special status species exist in the watershed?

RIPARIAN/AQUATIC

What S&M species and species of local concern are protected by Riparian Reserves Strategy 1 that exist in Bear/Marten Watershed? Strategy 2?

The Bear/Marten WA for Wildlife will focus on the following 4 issues/values as follows:

- Special Status Species
- Wildlife Associated with the ACEC
- Roads
- Aquatics

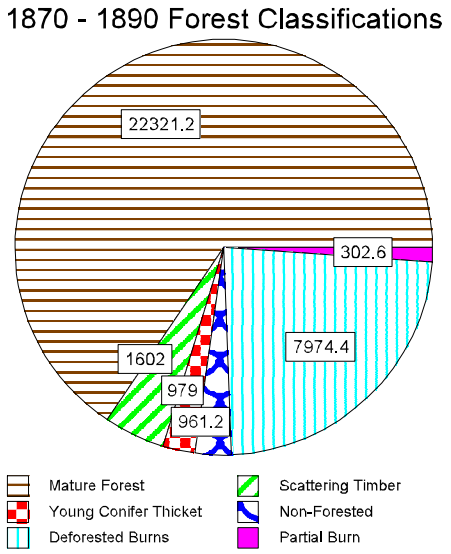
REFERENCE CONDITIONS

Reference conditions for wildlife species that existed within the Bear/Marten watershed are associated with the condition of the habitat that existed. Information on general forest conditions that occurred in the Bear/Marten watershed for a period from 1870 to 1890 indicate that approximately 65 percent of the lands were in mature forest. Table A shows the estimated acreages and percent of forest classifications during this period.

Table A - Acres and percentages of forest classifications - 1870 to 1890 Bear/Marten Watershed

Forest Classification	Mature Forest	Scattering Timber	Young Conifer Thickets	Nonforested	Deforested Burns	Partial Burn	Total
Acres	22321.2	1602	979	961.2	7974.4	302.6	34140.4
Percent	65	5	3	3	23	<1	100

The amount and distribution of the mature forest in the watershed allows for occupation of interior forest associated species at higher numbers than current conditions. Furthermore, there was very little fragmentation of the landscape, but there was edge associated with recent



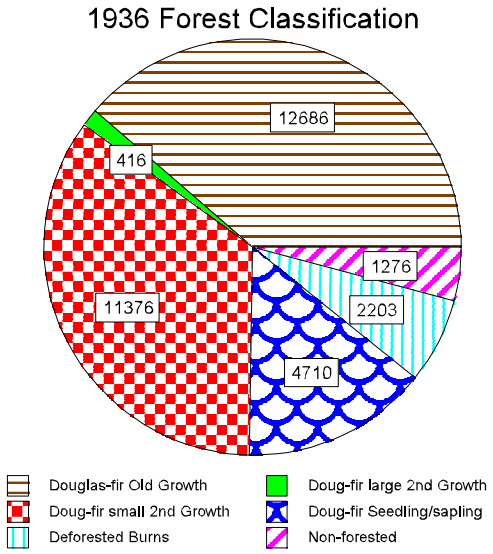
burns and partial burns that provided a diversity across the landscape. Wildlife species like the marten, fisher, and spotted owl occupied habitats that were optimal for these species' life history needs. Additionally, the water quality of Bear Creek, Marten Creek, Gale Creek, and the other creeks in the watershed were optimal for wildlife species that need high water quality streams for their life history needs (e.g., harlequin duck). Other species of wildlife that require open and or brushy areas (i.e., mountain quail, great gray owl) would not have as much habitat available to them as current conditions allow. However, overly large areas are not preferred by these species as moderately open areas.

As an example, an analysis of the suitable spotted owl habitat for reference conditions indicate that approximately 20 pairs of spotted owls could have occupied the watershed with suitable amounts of habitat within the provincial home ranges of each pair (approximately 1158 acres).

Information collected on estimated acres of forest classifications in 1936 is depicted in Table B. The majority of the forests were in old growth conditions and were in the southern end of the watershed. The fragmentation of the landscape was moderate. Large blocks of the different forest classifications were present which provided landscape diversity with moderate amounts of edge. These conditions were still optimal for many interior forest wildlife species with numbers of these species probably decreasing compared to the 1870 to 1890 conditions. Other species of wildlife associated with open forests and younger aged forests probably increased until these areas began to grow in. Conditions in 1936 provided a wider diversity of habitat types and still provided areas of contiguous habitat for interior forest wildlife species and openings for those species not relying on interior forest.

Table B - Acreages and percentage of 1936 Forest classifications
Bear/Marten Watershed

Forest Classification	Douglas-fir Old Growth	Douglas-fir large 2nd growth	Douglas-fir small 2nd growth	Douglas-fir seedling/ sapling	Deforested Burns	Nonforested	Total
Acres	12686	416	11376	4710	2203	1276	32667
Percent	39	1	35	14	7	4	100



CURRENT CONDITIONS

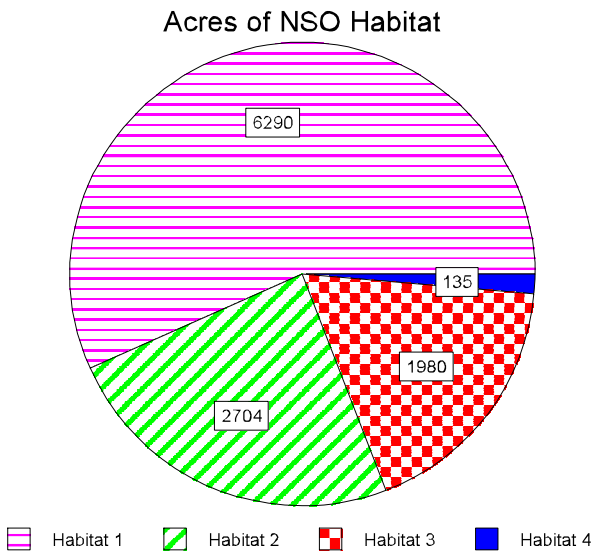
SPECIAL STATUS SPECIES

Key Questions
What Threatened and Endangered species exist in the watershed? What is the condition of their habitats?
What Survey and Manage species have the potential to exist? And where do they exist?
What other special status species exist in the watershed?

The following is a list and account of special status wildlife species and their habitats that are known to be or have the potential to be located within the Bear/Marten Watershed.

SPOTTED OWLS - There are 10 spotted owl sites located within the boundaries of the watershed. Five of these sites are located on BLM lands and have 100 acre core areas designated for each. A total of 509 acres has been allocated for these unmapped Late-Successional Reserves. Of the remaining sites, 4 are located on USFS lands and 1 is located on private lands within the watershed boundaries.

Northern spotted owls have been located within the boundary of the watershed since surveys to locate them began in 1975. Of the 5 BLM sites, 3 are known to have been occupied by a pair of owls within the last 5 years and 2 of the sites have had single individuals located during that time. However, there has been no known reproduction from any of the owl pairs located at these sites.



The amount of suitable habitat for spotted owls located within the watershed is depicted in Table 1. Habitat 1 is that which is suitable for nesting. Habitat 2 is that which serves as roosting, foraging, and dispersal habitat, but does not contain the necessary components or structures for nesting. Habitat 3 is forest lands that can become suitable habitat some time in the future. Habitat 4 is lands that will never become habitat for spotted owls (Spotted Owl Habitat).

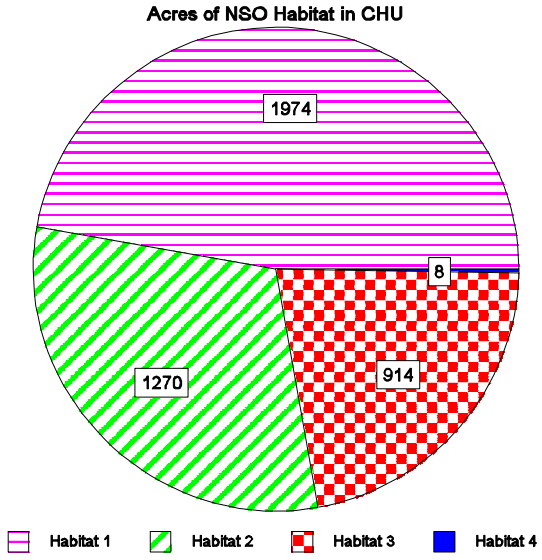
Table 1 - Acres of Northern Spotted Owl Habitat Within Bear/Marten Watershed On BLM lands and That Percentage of BLM lands

Habitat Class	Habitat 1	Habitat 2	Habitat 3	Habitat 4	Total
Acres	6290	2704	1980	135	11,109
Percent	57%	24%	18%	1%	100%

In the northern portion of the watershed, encompassing Bear Creek, a northern spotted owl Critical Habitat Unit (CHU) has been designated by the U.S. Fish and Wildlife Service (Spotted Owl Habitat). The size of this CHU is approximately 100,700 acres the amount of land in Bear/Marten watershed within the CHU is approximately 4595 acres, or 4.5 percent of all lands in the CHU. The total amount of BLM lands within the CHU in the Bear/Marten watershed is approximately 4165 acres, or 91 percent of CHU designated land in the watershed. The total amount of spotted owl habitat (Habitats 1, 2, 3, or 4) within the CHU on BLM lands is listed in Table 2.

Table 2 - Acres and percentage of spotted owl habitat on BLM land within CHU

Habitat Class	Habitat 1	Habitat 2	Habitat 3	Habitat 4	Total
Acres	1974	1270	914	8	4165
Percent	47%	30%	22%	<1%	100%



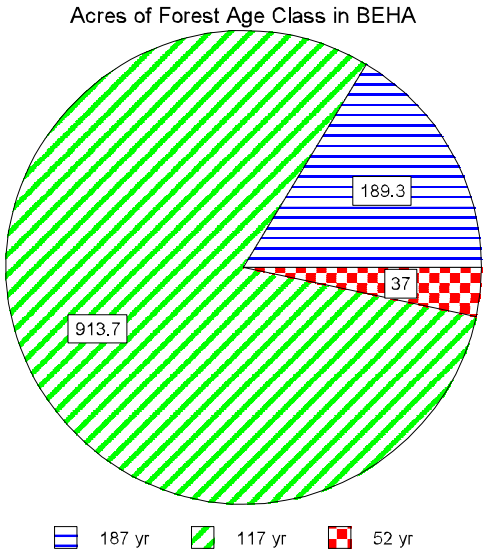
Bald Eagles - There are approximately 1140 acres of BLM lands designated in the Bear/Marten watershed as Bald Eagle Habitat Area (BEHA) (Bald Eagle Habitat Area map). These lands are designated for the management and maintenance of habitat for bald eagle nesting and roosting. All actions within these lands are to be developed to enhance or maintain the structural characteristics necessary for bald eagle nesting and roosting.

Bald eagles are not confirmed in the watershed boundaries at this time; however, a nesting pair of eagles is located west of the watershed boundaries and another nesting pair is located farther upstream from the watershed boundaries on USFS land.

Table 3 shows the amount of acres by age that are within the BEHA. Forests in the 117 and 187 year old ages are suitable for nesting bald eagles. Those forests 52 years old are potential bald eagle habitat.

Table 3 - Age, Acreage, and Percentage of Forested Stands Within the BEHA in the Bear/Marten Watershed

Age	187 year	117 year	52 year	Total
Acres	189.3	913.7	37.0	1140
Percent	17	80	3	100



Great Gray Owl

The great gray owl has been identified as a protection buffer species in the ROD (C-21), and required mitigation for this species involves buffers around meadows and a 1/4-mile protection zone around known nest sites. The potential for this species to exist within the Bear-Marten watershed is moderately high with the contiguous older forests and open areas greater than 10 acres in size.

The habitat requirements of the great gray owl for nesting is specific to elevation and proximity to open areas. Older forest lands, 80 years old or older, within 300 meters of and opening that closely mimics meadow conditions, are habitat conditions highly associated with nesting great gray owls.

There are approximately 23,580 acres of land above 1700 feet in the watershed (all lands). Of those acres approximately 5,821 acres are BLM lands. The amount of suitable nesting habitat for great gray owls on BLM lands in the watershed is approximately 1160 acres (Great Gray Owl Map).

Great gray owls have been located on USFS lands to the east of the watershed and locations throughout the State have indicated that this species is expanding its range westward.

Wildlife Species Associated with Proposed ACEC

American Marten/Pacific Fisher

The marten and fisher both require habitat that is late successional coniferous forests. Studies have indicated that both species have shown an avoidance of non-forested areas greater than 10 acres in size. The marten is associated with higher elevations, high volumes and densities of large diameter (>20 inches) down woody debris and snags close to streams. The fisher is also associated with large volumes of large diameter down woody debris, and snags, but at lower elevations (<1000 meters, west of the Cascades) and shows a high use of riparian areas. Coarse woody debris is the major factor for marten and fisher life history needs. It has been suggested both of these species have evolved in areas where windthrow and fire is a normal disturbance factor (Ruggiero, 1994).[1]

These species were addressed in the proposed ACEC because of the high probability that they may exist in the area. With the contiguousness of the older forests throughout the watershed there is a moderate to high probability that these species exist in Bear-Marten. The amount of interior forest that exists within the watershed on BLM lands is approximately 5344 acres. There are 4 distinct areas that interior forest is identified the best in the watershed (Interior Forest Map). The Bear Creek sub-watershed contains approximately 1991 acres, the Marten Creek and Gale Creek sub-watershed which contain approximately 3243 acres, the Toms Creek sub-watershed which contains a 67 acre and a 29 acre stand, and the Eagle Rock area along the McKenzie River which contains approximately 14 acres of interior forest. Interior forest was delineated as starting 600 ft within those stands 45 years of age and older. This stand age is assumed to have tall enough trees to provide a screen for interior forest condition to exist at 600 feet within the stand. Those areas in the Bear Creek, Marten Creek, and Gale Creek sub-watersheds are large enough to provide habitat for many species of wildlife dependent upon interior forest conditions. This analysis does not take into account thinning operations that may have occurred in the area, roads, or river and powerline corridors.

<u>Logs and Snags</u>
Both the fishers and martens require logs and snags for many of the life history needs. Primarily as food and resting sources. Therefore, the condition of these habitat components in the watershed is critical to the existence of these species in the watershed.

Data was collected on 1048 logs from 38 plots in 13 locations within home ranges of spotted owls in the watershed. Data for all logs and 2 size classes are represented in Table 4. Approximately 91% of all logs have a large end diameter of less than 20 inches, and only 9% of all these logs have a large end diameter of 20 inches or greater. Densities for all logs calculated to approximately 112 logs per acre. The average small end diameter for these logs is approximately 8 inches with the average length of these logs approximately 19 feet. The average decay class of these logs is a decay class 3. This indicates that there are not many logs that have been recently added to the system to replace the existing down woody debris resource. The larger sized down woody debris ($20 inches) will remain longer and stay within the system until there is other newly introduced down wood to replace this resource, however, these logs have a higher degree of decay. Many wildlife species will use this down wood resource for resting, foraging, travel, protection, nesting, and other life history needs. The importance of down woody debris as a resource to wildlife is still be discovered and becoming more of a factor.

Table 4. Log measurements and densities collected in spotted owl home ranges in Bear-Marten watershed.

Size Class	# Logs	Avg Small Dia (in)	Avg Large Dia (in)	Avg Length (ft)	Avg Decay Class	Approx. Densities	Avg. Linear Ft per Ac
<20"	950	7.9	9.8	19.4	2.9	101/ac	1968.9
$20"	98	23.4	30.3	29.5	3.6	10/ac	307.5
All Logs	1048	9.4	11.7	20.4	3.0	112/ac	2276.4

In addition to the log component, information on the snag component was collected. This habitat component is used for denning and resting sites by martens and fishers, but is considered as habitat for primary cavity nesting wildlife species for management purposes. Data collected on 277 snags indicate that the average d.b.h. of snags in the watershed is approximately 15.3 inches and the average height is approximately 37 feet. Most of these snags (178) fell into the size class of <15" dbh, which are not used as extensively by wildlife species as larger snags. Densities of snags in the watershed for three size classes are shown in Table 5. The average decay class of these snags is between the 2 and 3 decay class. Snags of this size and decay class do not survive long. Average life span of a snag this size and decay class is approximately 15 to 20 years. Newly created snags reach decay class 2 and 3 in approximately 10 to 15 years (Brown et. al., 1985)[2].

Table 5. Snag sizes and densities from data collected in the Bear-Marten watershed.

Size Class	# Snags	Avg. DBH (in)	Avg. Ht (ft)	Approx. Densities
<15"	178	8	40	38/ac

$16", #19"	18	17	42	4/ac
$20"	81	31	30	9/ac

The next two tables represent the densities and averages for logs and snags within 3 age classes present in the watershed. These data were separated in these categories for the purposes of determining where snags and down logs may be created in the watershed in the specific age classes. The plots were collected in only two sub-watersheds in the Bear-Marten watershed, therefore, it is difficult to determine possible habitat creation efforts by sub-watershed.

Table 6. Log data represented by age class.

Age Class (yrs)	Size Class	# Logs	Avg Sm. Dia. (in)	Avg. Lg Dia (in)	Avg. Length (ft)	Avg. Decay Class	Approx. Densities	Avg. Linear Ft per Ac
<80	<20"	124	5.8	7.8	21.5	2.4	71.7/ac	1565.2
	$20"	7	20.8	24.7	29.5	3.4	4.0/ac	121.6
$80, #119	<20"	682	8.3	10.2	19.9	2.9	120/ac	2383.6
	$20"	73	23.1	31.2	32.4	3.4	12.8/ac	414.4
$120	<20"	144	8.1	9.6	15.7	3.7	72.9/ac	1130.3
	$20"	18	25.6	29.1	17.8	4.4	9.1/ac	160.8

Table 7. Snag data for age classes within watershed.

Age Class (yrs)	Size Class (in)	# Snags	Avg. dbh (in)	Avg. Ht. (ft)	Approx. Densities
<80	<15	46	7.1	37.9	51.1/ac
	$16, #19	1	16.1	6.5	1.1/ac
	$20	7	23.2	19.7	2.0/ac
$80, #119	<15	95	8.6	41.4	33.9/ac
	$16, #19	15	16.4	38.1	5.4/ac
	$20	66	30.7	30	5.8/ac
$120	<15	37	7.7	37.1	41.1/ac

	$16, #19	0	0	0	0
	$20	10	31.3	52.8	2.5/ac

The previous information indicates that there is a small number of large logs ($20" on the large end) in the watershed. This is probably a function of the forest stand age and composition in the watershed. However, the average linear feet per acre in the most abundant age class in the watershed (80 to 119 yrs) is well above that planned for retaining after timber harvest activities (414 vs. 240).

The number of snags per acre in the different age classes indicates that there are enough snags >15 inches dbh in the 80 to 119 age class to meet 100% population of the cavity nesting wildlife species, which require 4.2 snags/acre. However, in the <80 and $120 year old age classes the amount of snags present can support approximately 30% to 70%, respectively. The amount of snags within the 16 to 19 inch dbh in the 120 year old age class is very low or non-existent. This area and the <80 year old age class would be the best areas to begin snag creation projects.

This data is only a small sampling of the watershed and additional information gathered on these habitat components would aid in the determination of amounts of snags and logs in each of the age classes in the watershed, and where habitat component creation projects can be best applied.

Harlequin Duck

The harlequin duck was previously designated as a Candidate 2 species by the USFWS and was considered as Bureau Sensitive because it was listed as a Candidate. The harlequin was not included as a Candidate species in the latest restructuring of the list and is now considered as a Provisionally Bureau Sensitive species because it has no other federal designation or reason for being Bureau Sensitive.

The harlequin relies on clear cold streams for feeding and breeding purposes. Marten Creek, Gale Creek and Bear Creek are high potential areas for breeding harlequins. Surveys along Marten Creek in 1997 have documented a pair of harlequins using this stream.

Protection of the riparian areas and maintaining the quality of the water in the streams is the primary factors for use of the area streams by harlequins. Streamside habitat along Marten, Gale, and Bear Creeks on BLM lands in the watershed is high enough in quality to attract nesting harlequins to these streams. In addition, surveys to locate harlequin ducks and the source of food that they require while in these inland streams (a caddisfly spp.) has indicated that the water quality is high enough for feeding purposes.

Northern Pygmy Owl

The northern pygmy owl is a Bureau Tracking species in Oregon. Its primary habitat is mature forests that contain high densities of large snags (>20" dbh) for nesting and roosting. With the amount of interior mature forests in the Bear-Marten watershed, this species has a high probability of being present in the watershed, and in numbers high enough that would not raise concern for the species.

Mountain Quail Northern, Saw-whet Owl, White-footed Vole

The mountain quail is listed as special status species in the latest databases, however, the current status is still under question. This species is considered as a State Threatened species east of the Cascades, but is common on the west side. The mountain quail uses overgrown cleared areas and burns in coniferous forests. Although there are relatively small amounts of this habitat type on BLM lands in the watershed, the surrounding private lands offer greater amounts of acreage.

The saw-whet owl is not listed as a special status species in any of the latest lists and databases. These birds use dense coniferous forests and rely on cavities in snags and dying trees for nesting and roosting. Because of the contiguous dense coniferous forests in the Bear-Marten watershed the amount of habitat available to saw-whet owls is wide-spread. Saw-whet owl numbers in the watershed are highly dependent on the densities of large snags.

The white-footed vole is listed as a Provisionally Bureau Sensitive species in Oregon because of its former listing as a Candidate species. Relatively little is known of this species and the small amount of data collected has indicated that this vole prefers riparian habitats. The white-footed vole utilizes down woody debris as food sources, protection, and travel ways, thus the importance of high densities of this resource to this species of wildlife is relatively high. As indicated previously, the amounts of down woody debris in the watershed is moderately high and species requiring this resource are in better condition in this watershed than in most watersheds on the district.

Bats

There are 5 special status bat species located in the watershed. These species require smaller open areas for foraging, primarily near a water source, and require specific components of a forest for roosting and maternity colonies. Snags provide a roosting and maternity resource for these bats species, as well as, caves and mines, wooden structures, bridges (mostly cement or wooden), and large decaying stumps in clearcuts. However, bats species are highly susceptible to human disturbance and micro-climate conditions. Many areas that look suitable for bats are situated in a manner that does not provide the proper temperature, wind currents, or other variables that are necessary for bats use.

With the number and densities of snags located in the watershed, there is a high potential for these species of bat to occur in the watershed. Foraging would occur on the major streams or over the McKenzie River in the watershed. Roosting would normally occur on south exposed areas where sun reaches the roost location for more than 8 hours in a day. During the winter months these bats species migrate south to warmer climes.

TRENDS

Most of the forest management activity in the watershed has occurred on private lands. This forces many of the species of wildlife that are dependent upon late-successional forests into forests located on BLM lands. Presumably there will be very little activity on private lands in the near term future because of the young forests that presently exist. Therefore, most of the activity in the watershed will occur on BLM lands in areas that have not been disturbed for approximately 100 years. Depending on the level and intensity of the activity planned in the watershed, wildlife species located in the watershed can be affected lightly or heavily. Highly mobile species, like most birds and larger mammals, will be impacted less as they are able to move to adjacent habitat. Those species that are less mobile, like smaller mammals and wildlife with specific life history needs (i.e. bats), are more likely to be affected by forest management activities in the watershed as the habitat that these species depend upon is altered.

Many species of wildlife are dependent upon snags and down wood. These wildlife species will be impacted by specific activities that deplete or increase these resources. Depending on the specific activity in the watershed, these resources can be increased through ecosystem management prescriptions. Because most of the snags and down wood occurs on BLM lands in the watershed the impact to this resource is relatively high and concentrated on these lands. These resources will be protected within the riparian areas, however, these components elsewhere are highly susceptible to disturbance through forest management activities.

Because of the concentration of late-successional forests and the habitat components that are associated with this forest the relative impacts to species associated with this habitat type is higher than if there were additional habitat on adjacent ownership. Trends on species dependent upon late-successional forest can only decrease as activities occur on BLM lands in the watershed.

ROADS

Roads generally impact large mammals like elk, deer, bear and cougar. Primarily from the disturbance caused to these wildlife species by the use of the road system from the public. Roads can be gated to reduce disturbance caused by the public. However, gated roads do not count as closed roads when doing a road density analysis.

The miles of open road in the watershed in 1936 was very minimal and associated with roads along the McKenzie River. Currently, there are approximately 187.8 miles of road in the watershed on all lands, with 41.2 miles on BLM lands. The amount of road miles on private lands reflects the amount of forest management activities that have occurred on private lands in the watershed in the past 2 to 3 decades. Road densities in the watershed are approximately 3.3 mi/mi^2 for all lands in the watershed, and approximately 2.4 mi/mi^2 on BLM lands. These are still lower road densities than most other watersheds on the Resource Area, and because of the gates located at the beginning of Mt. Hagen road and Gale Creek road, which access the major BLM ownership in the watershed, the impact to wildlife in these areas is less than in areas without gates.

To improve the effectiveness of habitat for elk, deer, bear, and cougar, the density of roads in any given watershed should be at a minimum. Oregon Department of Fish and Wildlife (ODFW) suggest that for maintaining population levels (primarily elk) a maximum road density of 2.0 to 2.5 mi/mi² be attained. These numbers are attainable on BLM lands, however, road decommissioning would have to be implemented on private lands for densities to decrease substantially watershed wide.

Roads are only one variable that impact habitat effectiveness to many wildlife species. The amount and arrangement of cover, hiding, and foraging habitat also impacts wildlife. Roads can be managed to improve habitat effectiveness

RIPARIAN/AQUATIC

Key Questions to be answered by following discussion:

c. *What S&M species and species of local concern are protected by Riparian Reserves Strategy 1 that exist in B-M? Strategy 2?* [Where can adjustments to interim riparian reserve boundaries occur without detrimental impacts to species of concern?]

Riparian reserves are highly important parts of ecosystems to many wildlife species. According to Brown et.al. (1985) there are approximately 175 species of wildlife in western Oregon that use forested riparian areas for at least one of their life history needs. Many species of wildlife use these areas for migration and dispersal corridors. Telemetry data gathered on a pair of spotted owls in Gale Creek showed a high use of the riparian areas by these owls for traveling to the other side of a ridge, even thought there was suitable contiguous habitat up to the top of the ridge and down the other side.

Marten Creek has been identified as having a population of tailed frogs and recently occupied by harlequin ducks. Both species are associated with high quality water systems in areas that are protected along the riparian corridors. Tailed frog tad-poles require clean streams for feeding as they use a suction to attach themselves to rocks in the stream. Siltation in streams makes it difficult for these species of amphibians to remain attached to the rocks. Harlequin ducks nest along these streams and feed on a specific caddis-fly larvae. Encroachment upon these ducks' nests will cause them to abandon the nest, and disturbance to the quality of the stream will impact the abundance to their food source.

Without site specific analysis of where riparian reserve boundaries a proposed for adjustment, it is difficult to determine the impacts of these adjustments to the wildlife species using these areas. Adjustments to increase the width of the riparian reserves are normally beneficial to species of wildlife using riparian areas. However there are approximately 114 wildlife species that require open areas (grass/forb/brush) near streams for breeding purposes that would not benefit from wider riparian areas. Typically these species are not those listed as species of concern.

CONCERNS

Key Questions to be answered by following discussion:

a. What can be done to manage proactively or minimize impacts to T&E species?

Concerns for wildlife in this watershed are associated with planned activity levels in the remaining interior forests. The BLM lands in the watershed amount to approximately 31% of the watershed with the remaining amounts primarily in private ownership with short rotations and intensive forest management objectives. With the higher amounts of interior forests (90 to 100%) existing on BLM and some USFS lands in the watershed, the impacts to species depending on this habitat type will be proportionally higher than in most watersheds on the Area. This watershed is unique to the Eugene District in that there are species of wildlife that occupy the watershed that have limited distribution or are not present elsewhere in the district.

The Harlequin Duck and Tailed Frog are known to occur in the watershed and are designated as Special Status Species by the Bureau and the State of Oregon. The American Marten and Pacific Fisher are both Special Status Species with the Bureau and State of Oregon and are suspected to occur in the watershed. All of these species have very specific habitat requirements that limit their distribution and abundance throughout their range. The Bear - Marten watershed is one of the very few locations on the District, and possibly throughout these species' range in western Oregon, that contain those habitat requirements unique to these wildlife species. Additionally, this watershed provides a "bridge", in the Mt. Hagen area, to older more intact forests on USFS lands providing an exchange of genetic diversity and a refugia for some wildlife species. Cutting off this bridge can extirpate some species of wildlife from the watershed, especially the less mobile species.

Additional concern for the watershed is the lack of surveys in the watershed for species of concern and those wildlife species associated with the proposed ACEC. Without information on the distribution and abundance of these species in the watershed, it is unknown if these species should remain a concern related to the ACEC proposal, and what and where activities can occur without detrimental impacts to these species.

1. Ruggiero, L. F.; Aubry, K. B.; Buskirk, S. W.; Lyon, L. J.; Zielinski, W. J. 1994. *The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine in the Western United States.* Gen. Tech. Rep. RM-254. Fort Collins, CO: Rocky Mountain Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture; 183 p.

2. Brown, E. R. 1985. *Management of Wildlife and Fish Habitats in Forest of Western Oregon and Washington - Part 1*. E. Reade Brown - Tech Ed. U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. Portland OR. 332p.

INVERTEBRATES, AMPHIBIANS, AND REPTILES

INVERTEBRATES - SURVEY AND MANAGE

The only Survey-and-Manage animals that are of concern for both the Eugene District and for this key watershed analysis are 4 species of mollusks. However, no mollusk surveys have been done within the Bear-Marten Key Watershed. Therefore, there are no known sites that need to be managed under survey strategy 1 (manage known sites). When mollusk surveys are done (under strategy 2, which is to survey prior to ground-disturbing activities and then manage any discovered sites), then there is a strong possibility that sites may be discovered and will need to be managed.

Mollusk management recommendations are in preparation (draft) at this time. Surveys for mollusks "must be completed prior to ground disturbing activities that will be implemented in FY 1999 or later" (ROD 1994, page C-5). The present version of the mollusk survey protocol (version 1.9) requires 2 surveys that are spaced at least 3 weeks apart.

Survey-and-manage mollusks that could be present in this watershed are the following:

Megomphix hemphilli , the **Oregon Megomphix**
Pristiloma arcticum crateris, the **Crater Lake Tightcoil**
Prophysaon coeruleum , the **Blue-gray Taildropper**
Prophysaon dubium , the **Papillose Taildropper**

The **Oregon Megomphix**, *Megomphix hemphilli* , is a small and secretive land snail. This Survey-and-Manage species is not known to occur within the Bear-Marten Key Watershed but there is a reasonable possibility that it is present. This snail seems to be especially favored by the forest floor conditions under bigleaf maple trees. In the absence of bigleaf maples this snail sometimes has been found in the leaf mold under hazel bushes or alongside coniferous woody debris. As suggested by known sites (and as defined in the terrestrial mollusk survey protocol, version 1.9), the suspected elevational range is limited to lands below 3000 feet (below the zone of persistent snow pack), which includes almost all of the Bear-Marten Key Watershed. The nearest known location for this species is about 2 airline miles to the west (on BLM land in T. 17S, R. 2E, section 5). The Oregon Megomphix is on List 1 of the Oregon Natural Heritage Program (ONHP 1995), so it is also a Bureau Sensitive species.

The **Crater Lake Tightcoil**, *Pristiloma arcticum crateris*, is a problematical subspecies. This minute snail was not included in a review of "Invertebrates of special status or special concern in the Eugene District" (Applegarth 1995). New information about this snail led to a revision of its suspected range (stated in the terrestrial mollusk survey protocol, version 1.9), which includes those lands of the Eugene District that are east of Interstate Route 5 and above 2000 feet elevation. Within the Bear-Marten Key Watershed, those lands above 2000 feet elevation account for roughly a third of the BLM lands, roughly half of the Forest Service lands, and roughly half of all lands together. However, this species has not been detected among the hundreds of specimens collected during protocol surveys in the BLM Eugene District in the spring of 1998. Thus far all of the adult specimens represent 2 other species of Tightcoil snails, and the immature cannot be reliably identified. At this time there is considerable doubt

about the presence of this species in the Bear-Marten Key Watershed or in any other part of eastern Lane County. Preliminary mollusk survey results from the Willamette National Forest (Middle Fork RD) have not detected this species. The Crater Lake Tightcoil is on List 1 of the Oregon Natural Heritage Program (ONHP 1995), so it is also a Bureau Sensitive species.

The **Blue-gray Taildropper**, *Prophysaon coeruleum* , seems to be the only blue slug in western Oregon. There is a possibility that this species may be a complex of several closely related species, but the Survey-and-Manage mandate would probably continue to apply to the products of any taxonomic subdivision. During protocol surveys in the BLM Eugene District in the spring of 1998 this small slug was found at many locations. Although no formal mollusk surveys have been conducted in or near the Bear-Marten Key Watershed, this species is probably present and possibly common within this watershed. In contrast to certain other Taildropper slugs, which are often found on riparian vegetation (e.g., skunk cabbage), this slug seems to be an upland species that is often associated with leaf mold and woody debris under forest trees, both hardwoods and conifers. Slugs are difficult to detect when they are dormant, so surveys should be conducted in the wet and mild parts of the year, mid-March through mid-May, and November through December. The Blue-gray Taildropper is on List 2 of the Oregon Natural Heritage Program (ONHP 1995) and, therefore, is treated as a Bureau Assessment species.

The **Papillose Taildropper**, *Prophysaon dubium* , is species of slug that was known from relatively few locations in Northwestern forests (as shown by the range map for this species in the Riparian Reserve module — RRTT 1997, page 174). During protocol surveys in the BLM Eugene District in the spring of 1998 this small slug has been found at multiple locations. Although apparently not as common as the Blue-gray Taildropper, the Papillose Taildropper seems to be widespread and is probably present within the Bear-Marten Key Watershed. Observations suggest this species may be favored by the presence of hardwood trees. This slug has been found in rotten hardwood logs, in leaf mold near hardwood trees, and between patches of moss on the lower trunks of bigleaf maple trees. This species is on List 2 of the Oregon Natural Heritage Program (ONHP 1995) so it is a Bureau Assessment species.

INVERTEBRATES - SPECIAL STATUS

Hemphill's Hydrobiid, *Pristinicola hemphilli* , is a small aquatic snail that is also called the Pristine Springsnail. This snail inhabits spring-fed streams in the Cascade Range and the Columbia Basin. Within the McKenzie watershed this rare snail is known from one location, which is on the South Fork of the McKenzie River about 15 miles southeast of McKenzie Bridge (Hershler et al. 1994). The majority of records for this species are from east of the Cascade Range. As implied by the name of the genus, this species inhabits perennial seeps and small springs that are relatively pristine and free of mineral silt. Snails in this species seem to be photophobic and are usually found adhering to the submerged parts of basalt cobbles. They tend to be absent from larger springs, especially if other aquatic snails are present. Although this species is on Oregon Natural Heritage Program (ONHP 1995) List 3 and, therefore, only a Bureau Tracking species, there is a possibility that it may be elevated to a higher level in the future. Because there are several spring-fed streams within the Bear-Marten Key Watershed (one example is in the SW/4 of the SW/4 of section 7, T 17 S, R 3 E), there is a reasonable possibility that this species could be present within this watershed.

Piper's Gazelle Beetle, *Nebria piperi*, reaches the southern end of its range in Lane County where there is one record from along the McKenzie River at 4 miles east of Blue River. This rare beetle seems to exist in scattered colonies and could easily occur within the Bear-Marten Key Watershed along both the McKenzie River and the major tributaries. This is a species that is currently on Oregon Natural Heritage Program (ONHP 1995) List 3 and, therefore, a Bureau Tracking species, but in the future it could be elevated to a higher status. This small, metallic-purple beetle inhabits the margins of rocky streams, especially where there are open areas of rocks and cobbles, either with or without shading canopy.

Hatch's Snail-eating Carabid Beetle, *Scaphinotus hatchi*, is only known from the vicinity of Waldo Lake in eastern Lane County and Windigo Pass in Douglas and Klamath counties. Although its known habitat is open subalpine forest above 5000 feet elevation, where it seems to be associated with grouse berry, *Vaccinium scoparium*, there is a small possibility that this rare beetle could occur within the Bear-Marten Key Watershed, especially at higher elevations. Land snails certainly seem to be more abundant at lower elevations. Presently this beetle is on List 3 of the Oregon Natural Heritage Program (ONHP 1995) and, therefore, it is a Bureau Tracking species, but as a rare species it could become elevated in status.

Caddisflies. There are a number of Caddisflies that are BLM Special Status species. All are Bureau Sensitive species because they were former C2 candidates for federal listing. The distribution of these Caddisflies has not been systematically explored, and one or more of these Special Status species could be present within the Bear-Marten Key Watershed. The extent to which this area may be serving as a refuge for these relatively rare Caddisflies, especially those that favor spring-fed streams, ought to be explored by a Caddisfly expert. These rare Caddisflies and their possible ecological associations are as follows:

Apatania tavala, Cascade Apatanian Caddisfly -- shaded rocky streams at higher elevations
Ceraclea vertreesi, Vertrees's Ceraclean Caddisfly -- rivers, possibly including the McKenzie
Eobrachycentrus gelidae, Mount Hood Primitive Brachycentrus Caddisfly -- higher elevations
Farula reapiri, Tombstone Prairie Farulan Caddisfly -- spring-fed streams at higher elevations
Limnephilus atercus, Fort Dick Limnephilus Caddisfly -- ponds and quiet backwaters
Ochrotrichia vertereesi, Vertrees's Ochrotrichian Micro-caddisfly -- swift streams and rivers
Oligophlebodes mostbento, Tombstone Prairie Oligophlebodes Caddisfly -- streams and rivers
Rhyacophila unipunctata, One-spot Rhyacophilan Caddisfly -- streams at higher elevations
Tinodes siskiyou, Siskiyou Caddisfly -- all streams and rivers at intermediate elevations

The remaining invertebrates that are special status and that are known or possible within the Eugene District are unlikely to occur within the Bear-Marten Key Watershed.

AMPHIBIANS AND REPTILES - SPECIAL STATUS

There are no Survey-and-Manage species of amphibians in or near the BLM Eugene District (technically, no surveys will be needed according to the draft protocol because there are no distributional records from within 25 miles of the Bear-Marten Key Watershed). Several amphibians and one reptile are BLM Special Status or Tracking species, and they are known or are potentially present in this key watershed. These species are:

Aneides ferreus, the **Clouded Salamander** (known to be present)
Batrachoseps wrightorum, the **Oregon Slender Salamander** (possibly present)

Rhyacotriton cascadae, the **Cascade Salamander** (known to be present)
Ascaphus truei, the **Tailed Frog** (known to be present)
Rana aurora, the **Red-legged Frog** (known to be present)
Clemmys marmorata, the **Western Pond Turtle** (possibly present)

The **Clouded Salamander**, *Aneides ferreus*, is known from a number of locations within the Bear-Marten Key Watershed. This upland salamander is scarce or absent in most parts of the Eugene District but seems to be moderately common on Marten Ridge within this watershed. The distribution of this salamander seems to be governed by the distribution of Douglas-fir, although it will utilize a variety of objects for cover (micro habitat), including woody debris, loose bark (on or off logs), loose rocks, and manufactured objects (including trash). This salamander is generally scarce throughout its range and seems to be declining in number and distribution. The preparation of sites for tree planting by the burning of logging slash may be a contributing reason for its decline. At present this species is on List 3 of the Oregon Natural Heritage Program (ONHP 1995) but is given (and biologically should have) Bureau Assessment status by the Oregon-Washington Special Status Species Policy (IM OR-91-57, attachment 4-1).

The **Oregon Slander Salamander**, *Batrachoseps wrightorum*, is not known from within the Bear-Marten Key Watershed but it is well-known from the vicinity of Hidden Lake (about 11 km to the southeast), and was recently discovered on the north side of George's Knob (about 24 km to the northwest). Although the Hidden Lake area is in the zone of persistent snowpack at about 3320 feet elevation, the George's Knob site is in the zone of transient snowpack at about 1320 feet elevation, so the Bear-Marten Key Watershed is bracketed both geographically and in terms of elevation. This salamander is on List 1 of the Oregon Natural Heritage Program (ONHP 1995) and thus is a Bureau Sensitive species. This species is limited to scattered locations on the west slope of the Oregon Cascades (it is Oregon's only endemic amphibian), and it seems to be intolerant of logging, even moderate thinnings. This species is the subject of a special working group and recent research efforts. For the Eugene District there is a high risk of contributing to the need to federally list this species. Surveys for this species should be conducted prior to ground-disturbing projects within the Bear-Marten Key Watershed.

The **Cascade Salamander**, *Rhyacotriton cascadae*, is known to be present in the Bear-Marten Key Watershed. This highly aquatic salamander lives in small, stable, perennial streams on the west slope of the Cascade Range, from the Middle Fork of the Willamette River north into southern Washington State. Although published range maps suggest this species occupies a broad area, ecologically it may be limited to a narrow band that is below the zone of persistent winter snow pack and above the lower hills where lower rainfall results in less reliable and more widely spaced streams (roughly this is between 1000 and 3000 feet elevation). Wherever headwater streams become silty or eroded (the original streambed is covered or washed away), this salamander tends to die out. Cascade Salamanders are long-lived and slow to develop, spending 4 to 5 years as an aquatic larva before transforming into an air-breathing adult. This species is on List 3 of the Oregon Natural Heritage Program (ONHP 1995) so presently it is a Bureau Tracking species but it could be elevated to Bureau Assessment species.

The **Tailed Frog**, *Ascaphus truei*, has been found at multiple locations within the Bear-Marten Key Watershed and is a species of special concern within this watershed. Within other parts

of the Eugene District this primitive frog has been found in relatively few streams during recent amphibian surveys (Applegarth 1994). Although the Eugene District is near the center of the species' range, which extends into most of the rainforests of the Pacific Northwest, this unusual amphibian is seldom common, often locally absent, and seems to have an increasingly fragmented distribution. The shaded range maps in field guides (Leonard et al 1993) incorrectly imply this species has a continuous distribution, and the map in Csuti et al. (1997 page 23) represents forests and not the actual Tailed Frog distribution.

At all known locations in the Eugene District, the numbers of adult Tailed Frogs seems to vary from a few dozen down to apparently isolated individuals. This small frog need roughly 10 years to mature and possibly can live as long as 20 years. Some of the apparently isolated individuals may represent nonviable populations -- the dying remnants of populations that have become isolated from neighboring populations. Fragmentation and isolation of populations makes them more vulnerable to extirpation. In the Bear-Marten watershed, adult tailed frogs have been found on a ridge top road (BLM Road No. 16-2E-36.2). They illustrate that tailed frogs can move across ridges to recolonize adjacent drainages. The Tailed Frog populations in the Bear-Marten watershed have the potential to function as a metapopulation that can recolonize adjacent drainages after a fire or debris torrent causes local extirpation.

In general, amphibians seem to be relatively sensitive to environmental changes, and the widespread decline of amphibian populations has become the recent focus in debate and research. In the review by Bunnell et al. (1997, page 41) there is a bold-face statement that "available data do not suggest habitat loss is the cause for frog and toad declines in the Pacific Northwest," but in the fine print their statement is restricted to ranid frogs and toads (which excludes the Tailed Frog), and (on page 33) they state that "increased sedimentation may abrade the food source of diatom feeders (tailed frogs), hamper respiration, or fill substrate interstices thus removing habitat." During the day, especially in fish-bearing streams, tailed frogs and their tadpoles conceal themselves under rocks. Increases in the movement of fine mineral sediments seems to be a major reason for the decline of Tailed Frog populations. Streams affected by the 1980 eruption of Mount St. Helens had low tadpole densities that were proportional to the loss of watershed forest and the degree of stream embeddedness (the extent to which the spaces between rocks are filled by sand and silt). Streams close to the volcano had much silt, no trees, and no tailed frogs (Hawkins et al. 1988).

Reduction of the upslope forest also may have a negative impact on the Tailed Frog. Although many publications describe the habitat of this species as rocky streams, at least at elevations below the zone of persistent snow pack, juvenile and adult tailed frogs leave the streams and move upslope during the winter. This phenomenon seems to have been first reported by Putnam (in Slevin, 1928, page 82) and can be observed by slowly driving paved roads at night during the early winter rains (personal observations in Bear-Marten and other watersheds). Bull and Carter (1996) concluded that stream characteristics are more important than landscape characteristics in predicting tailed frog abundance, even though mean numbers they found in streams decreased as timber harvest increased. They speculated that moderate timber harvest may be tolerated by tailed frog populations as long as a no-cut buffer is retained and the integrity of the stream structure (the cobble and boulder habitat) is retained.

The decline of Tailed Frog populations has been noted by many authors. No epidemic pathology has been reported for this species, it is not vulnerable to UV-radiation (it is generally

nocturnal and lives under relatively closed forest canopies), and it coexists with predatory fishes (Nussbaum et al 1983, page 150). The Tailed Frog is one of the amphibians most likely to be harmed by loss of late seral forests (USDI 1992 page 396, SAT 1993 page 414).

The cumulative effect of logging in this and other inhabited watersheds could contribute to the need to Federally list this species as Threatened or Endangered. This possibility of being listed is enhanced by the taxonomic distinctiveness of this species, which is the only living representative of the family Ascaphidae (or Leiopelmatidae) in North America (the only living relatives are the native frogs of New Zealand). The impact of logging within the Bear-Marten watershed on local Tailed Frog populations is difficult to predict, and for that reason the conservation of this species was one of the reasons the ACEC proposal was prepared (and extensively supported by regional authorities on this species). If logging is conducted in this watershed, the sequencing of cuts should be planned to minimize the impact to this species (i.e., begin cutting at the low end of each drainage, and reserve some inhabited tributaries as refuges until the absence of negative effects is shown). Because this species was a former candidate for federal listing (Category 2 per USFS 1994), its present status is Bureau Sensitive.

The **Northern Red-legged Frog**, *Rana aurora aurora* , is known from the McKenzie River flood plain near the mouth of Marten Creek. This medium-sized frog is generally an inhabitant of low-gradient streams with flood plains wide enough to allow the formation of side-channel ponds that can serve as breeding sites. The Northern Red-legged Frog seems to be surviving in many parts of the Eugene District and seems fairly tolerant of logging practices. This frog seem to be most limited by the availability of fish-free ponds that do not freeze over in the winter. The closely related California Red-legged Frog, *Rana aurora draytonii* , has disappeared in much of its range, apparently because of habitat loss and exotic predators (bullfrogs and fishes), and it was recently listed as a Threatened species. Because the Northern Red-legged Frog was a former candidate for federal listing, its present status is Bureau Sensitive.

Western Pond Turtle, *Clemmys marmorata*, is not known from the Bear-Marten watershed but there are reports of turtles being sighted as far east as Blue River. If any are present they are likely to be limited to the McKenzie River and adjacent flood plain. The Western Pond Turtle is at home in both streams and ponds, and wandering individual turtles could travel through this area. This watershed is poor turtle habitat because of the generally dense forest, which does not favor nesting or basking, and the recreational use of the McKenzie River (turtles have keen eyesight and are easily alarmed by the sight of people). Because this species was a former candidate for federal listing (Category 2 per USFS 1994), its present status is Bureau Sensitive.

CHAPTER 5
Synthesis and Recommendations

SYNTHESIS

Synthesis is the examination of the different resources, processes, and human activities and discussion on how they are interrelated. In Current Condition and Reference, Chapter 4, how resources are interrelated with other resources was discussed by individual resources. This chapter evaluates the three key components:

1. Interrelationships of Special Status Species and Upland Habitat
2. Roads
3. Riparian Reserve Areas -Their condition, the needs of the species that use it, and recreation

RECOMMENDATIONS

A list of recommendations was conceived using the information from the synthesis section and management direction. They are suggestions or guidelines as to possible projects based on the information that is available. Through further investigation on the ground or by new information, suggested projects may not occur or new ones may be added.

These recommendations are not decisions. Further site-specific field work and analysis are needed before a decision can be made; and an Environmental Assessment will be prepared where appropriate to adhere to the National Environmental Policy Act (NEPA).

These guidelines serve as a bridge from the watershed analysis to the landscape design that will further define and prioritize the recommendations and highlight drainages that may need work. However, field work will be required to determine if a project should be considered beyond the watershed analysis process.

1. INTERRELATIONSHIPS OF SPECIAL STATUS SPECIES AND UPLAND HABITAT

SYNTHESIS

Fire and wind are 2 natural disturbance regimes that have dominated the development of the present forest habitat, which provides habitat for a variety of species. Most of the Federal forest stands in the watershed developed after a series of fires that occurred between 1850 and 1900. As for the wind, the topography in the McKenzie Basin changes at Bear-Marten Watershed. From the east, it goes from being a wide basin to a narrow area with steep topography. This change has an affect on the way wind moves through the watershed and also has affected how past fires behaved in the watershed.

The fire and wind regime seems to have modified the watershed making the forest stand wind resistant and streams quick to respond from consequences of fires. This conclusion was reached because of the water quality and the amount of diversity of species in the watershed. Although the upper part of Marten Creek has been harvested, the water quality and species diversity is quite good. The presence of some species such as harlequin duck in the riparian area indicates good water quality. The species diversity appears to be higher than in other nearby watersheds.

The difference between past fires and clear cuts is that fire disturbances were mosaic and left a

range in habitat conditions. Past clear cuts left few if any down logs or snags. Therefore, clear cuts did not have the same effect as fires. Future regeneration harvest leaves down woody material and provides for the needs of wildlife species. In some places, the fire regime has resulted in a range in the size and amount of the down woody material and snags.

Wind influences the spread of fire, and also contributes to creating pockets of blowdown and snags. Blowdown pockets seem to occur on the west side of Marten Creek and on the northern part of the Bear Creek area.

The history of fire and timber harvest has resulted in an unusually large contiguous block of late-successional forest. While wind has created a higher level of down wood and snags in this watershed, past fire and little harvesting on BLM administered lands has created a large, mostly contiguous, block of older forest.

OTHER FACTORS AFFECTING SPECIAL STATUS SPECIES- The dominance of conifers, topography, soils, and openings interact with the habitat needs of species. The following is a summary of habitat needs for those species that are given special status or attention by the BLM. More information is contained in the Current Condition, Chapter 4, under Wildlife.

, The Oregon Megomphix needs down wood and bigleaf maple for habitat and is most likely to be present on lower slopes and terraces with damp and well-drained soils - places that favor bigleaf maples.

, The Bear-Marten watershed has many steep slopes that are a lower quality of habitat for Survey and Manage mollusks. However, there is still a possibility that Survey and Manage mollusks exist on steep slopes.

, Great gray owls need meadows or openings provided by small clear cuts. Additionally, these meadows or openings need to be surrounded by forest. There are not that many meadows, however, where there are clear cuts that could function as meadows for great gray owls.

, Thirty years ago Federal lands were not suitable for spotted owls. However, the Northern Spotted Owl has probably shifted from private lands to Federal lands over the past 30 years since little harvesting has occurred in recent years and the stands have grown into suitable spotted owl habitat.

, Bats use small forest openings near water to feed on insects, and they also need roosting trees where the sun reaches the roost location for more than 8 hours a day. The current harvest practice of “leave trees” and creating snags could help provide roosting habitat in the watershed.

, This watershed has a high amount of down wood and snags, and coarse woody debris is the major factor for marten and fisher needs.

CONCLUSION - Fire and wind have played a role in developing the Bear-Marten watershed capable of supporting a wide diversity of species. However, during the present century, suppression has kept fire out of the ecosystem of the present forest, and over the years fuels have been allowed to build up on unharvested areas. The presence of the highway, recreationalists, and residents contribute to ignition sources for fire. Unlike fire, however, wind continues to create pockets of down wood and snags. This will continue so there is a need for maintaining retention trees in harvest units and for providing coarse woody debris habitat for special status species.

RECOMMENDATIONS

1. **Fire** has played a role in the development of the watershed. To better understand this role a Fire History Study was completed. This information will be used during the landscape design process when the fire history regime will be studied with the possibility of mimicking historic

fire patterns.

2. **Wind** - Retention trees need to be carefully chosen so they do not blow down. A possibility is to top trees designated for snag retention but keep a green crown so the tree will remain standing.

3. **Spotted Owls**

   < Place harvest units from the edge of the block of BLM administered lands inward

   < Create large (120 acres) harvest units to reduce the fragmentation caused by having small 40 acre units scattered across the landscape; consider clumping 60-70 percent of retention trees

   < Create down wood within 300 acres of owl nests to increase suitable habitat features for owl forage.

4. **Alternative Regeneration and Thinning Prescription Suggestions for the Uplands** should be considered as a way to address the following concerns:

   < windthrow protection
   < visuals from the river corridor
   < dispersal and travel corridors
   < testing the number of leave trees needed to prevent blowdown in a residual stand
   < maintaining interior habitat

   Opportunities to consider these concerns exist in the landscape design and during the planning phase of site specific projects.

5. **Bald Eagles**

   The habitat is in good condition. In the Bald Eagle Habitat Areas, nest trees could be selected and crown to crown competition could be removed from the nest trees. This would maintain the nest dominance and allow the crown to continue to develop.

6. **Snag Creation and Down Woody Material**

   The following situations are where snags and down woody creation could be considered.

   < Areas that are deficient in snags
   < Areas where retention trees may blow over if not made into snags soon after/during harvest
   < Older large maple patches for mollusk needs

   Special habitats and maple patches are areas that would benefit the most from management activities to create snags and down woody material. Since the Bear-Martin Watershed has a higher down woody content in some subwatershed than other watersheds, consider increasing the down woody debris. Consider surveying Marten Creek and other areas in the watershed that have not been surveyed for snags and down woody material.

DISPERSAL CORRIDOR - During the development process of the District RMP, Land Use Allocations known as Connectivity were designated throughout the McKenzie Resource Area. These areas are designed as “stepping stones” for late-successional forest related wildlife species for dispersal or migration between Late-Successional Reserves and across Matrix lands. The Adaptive Management Areas (AMA) because of the objectives does not have Connectivity blocks. During the landscape design process the team should look at the need to maintain a dispersal/migration corridor across Bear-Marten Watershed that will serve the same purpose in this watershed as those intended for the Connectivity Land Use Allocation across the rest of the

Resource Area.

2. ROADS

SYNTHESIS

In general, roads have the potential to negatively impact fisheries, soils, wildlife, and water resources. The mechanisms for impact are generally the result of (1) high road densities in upland and riparian locations that create barriers and increase disturbance of wildlife, (2) roads notably connected to the stream network (i.e., lacking proper drainage) with the potential of increasing peak flows and delivering road-related sediment to streams, and (3) road locations, (i.e., midslope and headwalls) and road construction practices (i.e., sidecasting) that compromise the natural stability of slopes and increase the risk of landslides and debris torrents.

Road density in the watershed is 3.3 mi/sqmi for all lands, and 2.4 mi/sqmi for BLM administered lands. These road densities are lower than those for other watersheds as a result of the limited administrative (i.e., harvesting) activity that has occurred in the area. In addition, the majority of road building activities have taken place within the last 20 years when road practices included measures, such as relief drainage, to reduce road-related sediment delivery to streams, and avoided practices such as side casting and midslope locations that increase the risk of mass wasting. The majority of the BLM roads are on ridge top locations, and roads on midslope locations generally have adequate relief drainage.

The combination of low road miles, the majority of which are on stable locations, and having adequate relief drainage have led to the following conclusions on the influence of BLM roads on resources:

< In general, the potential for surface erosion and sediment delivery from roads is below natural background levels. Concerns are related to old roads with inadequate relief drainage.

< Road-related mass wasting is of greater concern and is linked to a few midslope roads on steep terrain with raveling and failing cut slopes, which have experienced several failures.

< The concern for road-related increases of peak flows is low, again because all but a few old roads have adequate relief drainage.

< The overall impact of roads to wildlife is low. The road densities on BLM lands are within the ODFW recommended range for big game (elk) species. The following factors mitigate the impacts of roads in the watershed on big game.

- high amount of hiding cover
- steep terrain that limits the interaction of people and wildlife
- limited amount of roads in the riparian areas
- Private roads are gated except during hunting season on the weekends.
- fewer noticeable signs of people
- limited recreational use of the roads

RECOMMENDATIONS

The overall impact of BLM administered roads to resources in the Bear-Marten Watershed area is relatively low. However, all impacts, in particular those related to increased peak flows and sedimentation of streams, are cumulative in nature and, therefore, efforts should be made to ensure the potential for impacts remains low. The following are general recommendations to consider for road management in this watershed:

1. Bear and Marten Creeks were designated as key watersheds because of their high water quality, sensitive fish stock, the quality of the riparian habitat, and the presence of special status amphibians. The Forest Plan also requires a no net increase in road miles; therefore, some roads may be decommissioned to build roads elsewhere.

2. Avoid if possible building mid-slope roads because of the high maintenance needs and mass wasting potential.

3. Prior to road building on mid-slope roads the analysis would include the following

   < Geo-technical review of proposed road locations
   < Long term cost of maintenance needs for each alternative
   < Cost analysis of various logging methods

4. Mid slope roads that are candidates for decommissioning would require a multi-step, long-term process to ensure they are stabilized to full closure. This means decommissioning may require several actions such as revegetating slopes above the road before decommissioning.

5. Analyze the need for stabilization of currently unstable road locations

RECOMMENDATIONS BY Subbasin

Gale Creek Subbasin - Road No. 17-2E-2 is a dirt road located along and crossing the main stem of Gale Creek. Although not included in the road inventory, it is suspected that the road is delivering sedimentation to the stream. Access to much of this area is provided by other roads; therefore, it is recommended that Road No. 17-2E-2 be considered for decommissioning.

Marten Creek Subbasin -There are several spurs roads that could be decommissioned. This would be based on whether the roads are needed for harvesting in the future (within the next XX years). Decommissioned roads would reduce existing roads so roads could be constructed elsewhere and still meet the no net increase in roads requirement.

Marten Creek mid-slope (Road No. 17- 2E- 1.2) - This road has had several cut slope failures in the past. Decommissioning the road would reduce long-term mass wasting. If the road is not needed for future administrative needs, consider the following.

< research recently completed road decommission projects to gain knowledge on the various techniques that are available
< revegetate and stabilize the cut slopes
< monitor the progress of vegetation on the cut slopes
< identify areas with side cast and determine the mass wasting risk
< fully decommission the road or portions of it only after the cut and fill slope have been stabilized.

If the road is needed, harvest units so that as harvesting is completed, portions of the road can be decommissioned starting from the end of the road. Due to high cut banks and erodible soils producing a lot of ravel, this road should have culvert and ditch cleaning performed twice a year, blading once a year, and brushing every 2 to 3 years.

Little Bear Subbasin

Power Line Road (Road No. 16-2E-36.1) - Approximately 50 percent of the Powerline road is hydrologically connected to the stream network. This is considered to be a high amount and has the possibility of increasing peak flow. In addition, this road is contributing sediment to the streams. This road is in need of maintenance and/or renovation to reestablish ditch lines and

add relief drainage. This road is used by EWEB and BPA, which provides opportunities for cooperative work. To address the sedimentation and maintenance concerns the following are recommended:

< Normal maintenance of cleaning culverts and ditches and possibly some surface blading; maintenance should occur once a year.
< culvert replacements
< construct cross drains
< Contact EWEB and BPA about their needs for the road and type of maintenance needed

Goodpasture Road **-** This road is located parallel to the McKenzie River. It crosses several streams that enter the McKenzie. The road is used by recreationists and private landowners. Goodpasture Road is controlled by the County until the gate in section 9. There is an agreement between Lane County and WEYCO that WEYCO maintains the road when they use it. Lane County wants all users to maintain the road but BLM cannot spend funds to maintain a county road. There is an opportunity for cooperative work between County, WEYCO, and the BLM. To address the sedimentation concerns the following is suggested:

< inventory the road to gather information for a sedimentation analysis
< construct cross drains
< replace existing culvert for fish bearing stream - This would address maintenance/replacement needs and provide a natural fish bottom.
< work with the different users for proper maintenance of the road

Deer Creek Subbasin - Most of the BLM roads are in good condition. Section of Road No. 16-2E-36.2 in T.17S. R.3E., section 17, has steep cut slopes that have failed in the past. The recommendation is to stabilize the cut slopes. This restoration work could be done at the same time as the Marten Creek mid-slope road.

Bear Creek Subbasin - All the BLM roads in this drainage are on ridge top locations and in good condition. There is a fire road that, if not needed, could be decommissioned.

Road No. 16-3E-26.3 - A portion of this road is mid slope with eroding cutbanks and lots of ravel. A slide occurred during the 1996 floods, which may have been caused by inadequate maintenance. This road should have drainage checked at least yearly with maintenance every year or a minimum of every other year.

Jimbo Mtn. Subbasin

Road No. 17-3E-33 - This road experienced 2 failures during the February 1996 floods. The decision to decommission or restore this road has been delayed until the watershed analysis is completed. The following information is needed to help determine the future of this road:

< cost of fixing and maintaining the road
< income from the timber harvesting
< cost of alternative methods to accessing units
< feasibility of alternative methods
< mass wasting risk/delivery length
< harvesting potential
< impacts to resources and people
< field review the length of the slides

It is recommended that the gate at the junction of Road Nos. 16-3E-34 and 17-3E-4 be kept closed for safety proposes.

3. RIPARIAN RESERVE AREAS - THEIR CONDITION, THE NEEDS OF THE SPECIES THAT USE IT, AND RECREATION

SYNTHESIS

The SEIS sets interim widths for Riparian Reserves based upon 5 categories of streams and water bodies. The SEIS states on page 9, "Riparian protection in Adaptive Management Areas should be comparable to that prescribed for other federal land areas . . . . However, flexibility is provided to achieve these conditions, if desired, in a manner different from that prescribed for other areas and to conduct bonafide research projects within riparian zones." The interim widths used for other land use designation were used for the Bear-Marten watershed until the landscaped design process is completed. It is possible that the landscape design process would recommend Riparian Reserve buffers that are different than the interim widths.

Riparian areas and the creeks that run through them are important migration/dispersal corridors and habitat for terrestrial wildlife, amphibians, and fish in the Bear-Marten watershed. They also provide recreational opportunities for the public, especially along the McKenzie River. The quality of these Riparian Reserves are the key to the high water quality in the watershed. There are usually large trees and scattered openings in these riparian areas, and this diversity of structure and vegetation provides thermal cover and foraging opportunities for wildlife on or near the creeks with cover for protection. Additionally, with the low level of human disturbance within the riparian areas in the watershed, their value to wildlife is high.

Approximately 48 percent of the Bear-Marten watershed is in the Interim Riparian Reserves. The overall condition of the vegetation is good to excellent. A large portion of the Riparian Reserves contains older trees than those found in other watersheds with little human impact and excellent understory development.

There are some culverts that are referred to as shotgun or water fall culverts because they act as barriers to fish and amphibians. Shotgun culverts shoot the water out at high speed while the water fall culverts are 2 feet or more above the stream channel.

The McKenzie River corridor, specifically the McKenzie River, is a major focus point for recreation activities in this watershed. Recreation activities are mostly limited to the river and adjacent lands. The river provides for activities such as boating, fishing, picnicking and wildlife viewing. The river corridor in this watershed has had very few harvesting activities. Ospreys and bald eagles nest and roost adjacent to the river and feed in the river, and provide excellent wildlife viewing opportunities. The scenery, wildlife, fishing, and boat access provide quality enjoyment to users on the McKenzie River.

There are several special status fish species that use this watershed - bull trout, spring chinook salmon, and populations of isolated cutthroat trout. The north bank of the McKenzie River is mostly steep with many waterfalls. Bear Creek is the only stream on the north side of the watershed where fish can enter from the McKenzie River. Bear Creek has a 9 foot waterfall, approximately ½ mile from the mouth, that blocks fish passage. Above the falls there is an isolated population of cutthroat trout that are believed to be genetically distinct. Bear Creek has a history of debris torrents and there are many debris jams in this basin. The south side of McKenzie River (Gale, Marten, Little Bear subbasins) has the best potential for management ***enhancement*** activities in Riparian Reserves. The major streams on the south side offer river access and miles of barrier free fish habitat. Deer and Marten Creeks are used by special status species. There is not enough information on Ennis Creek to make any recommendations (i.e., tailed-frogs, red-legged frogs).

RECOMMENDATIONS

Some of the recommendations were developed from key questions used to address the ACSO. The recommendations were developed for the following reasons:

< The potential to provide corridors for wildlife to move between Riparian Reserves over

major ridges.

- < Impacts associated with recreation and management activities may impact T&E species, look for ways to minimize impacts.
- < Identify and address where there may be management related fish passage barriers
- < Identify areas to maintain or increase levels of large woody debris and snags within the Riparian Reserves.
- < Identify ways to protect/maintain resources and provide enjoyable recreational experiences
- < Identify where there are opportunities to improve in stream habitat for fish
- < Identify what can be done to maintain water quality and to minimize increasing peak flows
- < Consider how and where to manage for quality recreational opportunities

This section is organized by discussing recommendations at the watershed level and then discussing recommendations by sub-basin.

MAINTAINING WATER QUALITY AND PEAK FLOWS

- < Concentrate recreation use at managed sites along the McKenzie River. This would minimize the impacts to wildlife.
- < Provide sanitation facilities at high use recreation sites.
- < Determine if the amount of sedimentation that is coming from the Goodpasture Road is a problem.
- < Time timber sale harvesting so as to minimize increased affects on peak flow.
- < Survey for aquatic invertebrates and other species that are indicators of high water quality. Once these species are known to be present, monitoring these species can occur as a way of monitoring water quality.

AMPHIBIANS

- < Provide dispersal corridors over ridge tops to minimize impacts to tailed frogs and other species of wildlife from timber harvesting or other management activities. The regeneration harvest should be a low priority in these stands with commercial thinning or density management as alternative harvest prescriptions.
- < Consider doing a mapping and field exercise on a subbasin to test how adjusting the Riparian Reserves (expanding and decreasing) is possible given the need to protect the headwall. This could be done prior to or during the landscape design process.
- < Working from the bottom of drainages to the top, sequence timber sales to minimize impacts to tailed frogs.
- < Reserve or delay activities in the headwaters of East Fork Marten Creek. This would be done to provide a control area and refugia for tailed frogs. It would act as a control area because, as harvesting occurs elsewhere in the watershed, the impacts of harvesting on the tailed frogs could be monitored. The East Fork Marten Creek was selected because it has the least amount of harvesting compared to other areas in the watershed.
- < Replace shotgun and water fall type culverts

Recommendations by Subbasin

Gale Creek - The streamside vegetation is mostly hardwoods. This is probably the result of a natural disturbance. Cutthroat trout, steelhead, and rainbow trout use this creek. This stream has had debris torrents in the past. Recommendations are based on the need to maintain/understand the natural conditions and to provide refugia for fish and aquatic wildlife during debris torrents.

- < Field review Gale Creek to see what vegetation manipulation is needed, if any
- < Develop side channels and create refugia
- < Conduct stream enhancement on low gradient section only.
- < Improve flood plain connectivity

Marten Creek - The streamside vegetation for the main stream is mostly conifers. There are 2 sections of the stream dominated by alders. One is on the floodplain near the mouth, and the other is farther upstream where it appears that a debris torrent came down a tributary and removed the vegetation. There are no barriers to fish on the main stem. In addition to cutthroat and rainbow/steelhead, chinook salmon spawn and rear in the lower reaches of the main stem. These reaches also have a high potential for bull trout foraging, winter refuge, and young adult use. The East Fork is important for amphibians, and has a cutthroat trout population that may be genetically isolated.

< Further evaluation of this system is needed to determine where and what type of restoration projects are needed . The use of models such as the Umpqua model to determine "range of natural variability" may help in making the determination of the projects needed. The following are list of actions that are possible if it is determined that some restoration is needed.
  - Develop side channels and refugia
  - Create additional spawning and rearing habitat for chinook salmon
  - Stream habitat enhancement - possibly fall trees into the creek as part of riparian development, as appropriate.

< Maintain cool water temperatures
< Protect cold water springs - temperature is critical to bull trout
< Survey for bull trout and chinook salmon; survey for steelhead spawning
< Determine genetic status of cutthroat in the East Fork. and species of any other fish presence.
< Monitor spawning activity of steelhead/redsides

Deer Creek - The riparian on BLM land is mostly hardwood with a large component of late seral bigleaf maple. Deer Creek has more potential habitat for chinook and bull trout than any stream in the watershed. There are no barriers in the main stem. There are some barriers on the south fork. The 1996 flood removed most debris dams and large wood from the main stem. In the south fork, the flood did not affect the debris dams. In addition to cutthroat, and rainbow/steelhead, chinook salmon spawn and rear in the main stem up to the East Fork/West Fork junction. Deer Creek also has a high potential for bull trout foraging, winter refuge, and young adult use.

< Main stem accessible for major stream enhancement effort - high priority
< Plant conifers if appropriate
< Consider manipulation of bigleaf maple community by addition of cottonwoods
< Protect and maintain conditions on the South Fork
< Major restructuring of the stream using all types of roughness elements, especially trees with root wads attached.
< Creation of more off channel habitat.
< It may be possible to encourage a few leaning maples to fall into the stream and to remain alive.

Little Bear - The riparian is a mix of hardwood and mature conifer and is in good condition. Only one of the many streams in this subbasin has been surveyed. All of the streams flow directly into the McKenzie River. Two of these streams support fish year round; two others act as refugia in the winter. The heavy use and maintenance on the County road are causing problems with sediment delivery to streams. There are 2 culverts that are fish passage barriers.

< Fix culverts on fish-bearing streams
< Evaluate the amount of sediment being delivered by County road and consider options such as: replace culverts and construct drainage features
< Maintain riparian condition.

Bear Creek - This drainage has had a lot of debris torrents over the years. It is an area that receives mass movement naturally. The debris torrents have brought wood into the system. The main stem is a transport system and not the best place to put a road across. Bear Creek is the only fishbearing stream on the north side of the river in this watershed. There are isolated populations of cutthroat and sculpin above the waterfall.

< Determine the genetic status of the isolated cutthroat (co-op with ODFW/OSU)

- < Determine species of sculpin above the falls (co-op with ODFW/USFS)
- < Protect and maintain existing conditions.
- < Strongly discourage building roads across the main stem of Bear Creek to maintain amphibian movement and prevent culverts from being plugged.

DORRIS SUBWATERSHED

Rough Creek - This drainage has some of the best fish habitat in the watershed. However, there are no fish in Rough Creek. Access to the river is blocked by a waterfall.

< Protect and maintain existing conditions.
< Could be used as a ”reference” stream - an example of excellent fish habitat.

Jimbo Mtn. - Maintain riparian condition

PRIORITY FOR INSTREAM WORK BY DRAINAGE

Gale Creek

PRIORITY FOR ROAD WORK BY DRAINAGE

Little Bear Creek drainage

MCKENZIE RIVER

The McKenzie River is a valuable and significant resource for fish, wildlife, and people. The following recommendations are based on the need to maintain the environmental quality of this resource while providing for recreational access and human needs.

The BLM will manage the McKenzie River in this area primarily for day-use activities. Dispersed camping will not be prohibited, but campgrounds will not be constructed and some vehicle access to the river bank areas may be discouraged. Recreational use should be encouraged at developed and designated sites where use can be planned and sanitation facilities provided. A high priority should be placed on maintaining or improving the visual quality of the river corridor as viewed from the river and adjacent highway.

Several factors contribute to the recommendations. This segment of the McKenzie River has numerous residences and private property on both sides of the river, both up and down stream. It is also located within an hour's drive of a large urban area with an extended rural interface area along the McKenzie River.

Numerous campgrounds are located upriver from this area on USFS lands. Mixing overnight recreation use with residential use pose significant challenges. Campgrounds near urban areas often have problems with increased crime and vandalism, occupancy by the homeless, and high maintenance and management costs. Operation by campground hosts or concessionaires would only partially offset these problems and would not be a viable option for campgrounds accessible only by river or trail.

Also of high concern is the need to preserve the wildlife habitat and snag trees along the riverbank. Campground construction and maintenance require a high degree of hazardous tree control. Preserving the nesting trees in this section is not only important for the ospreys and eagles, but for the wildlife viewing opportunities they provide. (Eagle Rock was identified as an important habitat for certain species of plants and raptors.) Establishing a campground in the vicinity could encourage undesirable recreational use of this natural feature.

Sites for development and improvement for day-use activities should be identified during the landscape planning process with interdisciplinary involvement. A high priority will be placed on maintaining or improving the visual quality of the river corridor as viewed from the river and adjacent highway. Recreational use will be encouraged at developed and designated sites where use can be managed and sanitation facilities provided.

Recreation Sites

< Improve signing of public lands that have legal public access and are desirable and appropriate for recreational use
< Develop safe and appropriate parking areas
< Design high use sites to protect riparian environment and channel use
< Monitor condition of high use sites for environmental degradation
< Provide and maintain scenic vistas where compatible with other resource concerns
< Seek the return of Whitewater and Martin Rapids parks to BLM management and actively manage and develop for day use
< Seek land acquisitions of private industrial river-front land and properties along Deer Creek

Wildlife Protection and Enhancements

< Provide recreation opportunities that are compatible and complimentary to present uses but control number of sites.
< Consider existing snags for osprey, bald eagle, and cavity nesting wildlife, when developing new recreation sites - a limited resource along the river receiving high use by many wildlife species.
< Promote the value of the area for wildlife to encourage the public to tread lightly on the land
< Concentrate recreation use along river banks in specific areas to minimize impacts to wildlife
< Keep public from spreading out and creating dispersed recreation conditions
< Provide snags in the Riparian Reserves
< Discourage recreational use of Eagle Rock to protect potential T&E and Survey and Manage plant and wildlife locations by using an interpretive approach to educate and inform the public.
C Promote potential bald eagle nesting within the Bald Eagle Habitat Areas by falling subordinate trees next to dominant trees to promote growth on dominant overstory trees with the felled trees providing down woody debris.

Water Quality Maintenance

< Provide reasonable sanitation at concentrated use sites
< Monitor high use areas for resource damage and if it is evident look for alternative sites that allow for providing sanitation facilities

Visuals

< Management activities must reflect the VRM class II designation - activities must blend into the natural features
< Develop a river visibility map that includes tree heights to assist with planning management activities near the river corridor.
< Field verify that timber sales cannot be seen from the river

Public Involvement and Coordination

< Continue to participate on the McKenzie Watershed Council and McKenzie River Maintenance Partnership.
< Contact adjacent landowners to discuss possible projects
< For road improvement projects, contact people along the road corridors.

APPENDIXES

APPENDIX A
QUESTIONS FOR THE LANDSCAPE DESIGN

These were issues identified during the watershed analysis process. However, they will be answered during the landscape design.

1. ACEC - Portions of the watershed are in a potential Area of Critical Environmental Concern (ACEC). The recommendation that this area be considered as an ACEC occurred prior to the Northwest Forest Plan (NFP). Some of the management direction in the NFP would cover the needs of the species that were considered in the recommendation for ACEC designation.

The issue: Is the ACEC designation still warranted?

Is special management needed to protect relevant/importance values that are not already protected with existing management? - **BALANCING COMMODITY**

2. COMMODITY PRODUCTION AND MAINTAINING ECOLOGICAL INTEGRITY - The land use allocations, existing resources, and the topography of the watershed offer challenges in managing this area for a variety of objectives, i.e., Key Watersheds, Bald Eagle Habitat Areas, Scenic Outs, Potential ACEC, and Proposed Wild and Scenic River. In addition, these watersheds are expected to contribute to the District's Timber Sale Program. The land use designation of Key Watersheds requires a no net increase in roads. Unlike other watersheds in the Resource Area, Bear/Marten is not a heavily roaded watershed and the existing road system may not provide adequate access for timber management. This, combined with the Adaptive Management Area (AMA) designation provides opportunities and challenges to examine different ways to accomplish certain goals.

***The issue is balancing commodity production while maintaining the ecological integrity*.**

FOREST MANAGEMENT

a. How can we work with private industrial forest owners and small private landowners to meet management objectives?

b. What level of fire management is appropriate in the AMA?

c. Where can silvicultural prescriptions be used to help do riparian restoration work?

Are there opportunities to combine restoration projects with timber sale projects?

d. Where can alternative logging occur?

e. How much acreage and volume can be harvested in the WA? What is the timber harvest schedule?

f. How can commodity production fit the ecological capability of the land?

g. What is the rotation age and can it be changed?

h. What vegetation types exists and what limitations are there for management actions?

ROADS MANAGEMENT

a. What is the impact of existing roads?

b. Where do we want roads?

c. Where do we want to decommission roads? Specifically consider the lower Jimbo Road.

d. How long can temporary roads exist in the key watersheds? *(Develop guidance)*

e. What areas can be harvested from existing roads? *(Will need a map of potential harvesting areas.)*

AMA OPPORTUNITIES - What learning opportunities exist in the AMA (Adaptive Management Area)? (Develop recommendations)

3. ACS OBJECTIVES

The Aquatic Conservation Strategy (ACS) is a key component in the NFP. The ACS was developed to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within them on public lands. Watershed analysis, watershed restoration, Riparian Reserves, and key watersheds are the 4 components in the ACS. There are 2 key watersheds in the Bear/Marten Watershed unit.

The issue is how the BLM uses watershed analysis and watershed restoration projects to guide management in the Riparian Reserves and key watersheds to meet the goals of the ACS.

The questions below relate to the ACS objectives on page b-11 of the Standard and Guidelines in the Pacific Northwest Forest Plan. The objectives are not restated here but are referenced by number see the end of this section for description of objectives.

Objective 1

c. How could stand density management be used to convert Riparian Reserve (RR) stands to late-successional old growth? Is this needed in the watershed? If so,

where could this occur?

Objective 2

c. What barriers exist in the Riparian Reserves' terrestrial portion that impede movement of terrestrial organisms

Objective 5

c. What are the opportunities to decommission and repair roads to reduce sedimentation?

Objective 9

b. Where is it possible to consider adjusting Riparian Reserve? Where can the Riparian Reserve boundaries be adjusted without detrimental impacts to species of concern?

3. HABITAT

With the extent of the contiguous terrestrial habitat that exists within this watershed, and the wildlife species associated with these habitats, Bear/Marten is a unique watershed in the McKenzie Resource Area. Many wildlife species occupying the watershed do not have the disturbances associated with other portions of the Resource Area because of less miles of roads, the blocked Federal ownership, the uniform stands of forested habitats, the proximity to old growth forest stands on Forest Service lands, and the minimal amount of forest management that has occurred within the watershed.

The issue is maintaining a range of habitats for species living in the watershed.

i. Where should alternative regeneration and thinning prescriptions be applied? In uplands and riparian areas?

n. What opportunities are there for dispersal corridors from Bear Creek to the Late-Successional Reserve (LSR)?

o. How should BLM manage bald eagle habitat areas?

p. What areas are best for snag creation and Down Woody Debris (DWD)?

q. Are there areas where BLM could manage for different levels (above 40% minimum) of cavity nester populations?

r. What is the current condition of DWD and snags in the area? What areas would benefit most from management actions?

Note: n - r were partially addressed in the Synthesis and Recommendations - Chapter 5.

Additional Questions for Landscape Design Team

< What is the economic balance point with using alternative logging method?

< Landscape Design team should revisit the question about temporary roads.

The following questions were not answered in the watershed analysis

< Are there areas where BLM could manage for different levels of cavity nester populations? This is a site specific question

< How will BLM manage special habitats?

BIN NOTES

Timber harvesting upslope from springs - Marten Creek - western slope

May need to extend Riparian Reserves upwards to consider unstable ground - protect headwall integrity

< Bear Creek - Need to field verify

APPENDIX B
DEMOGRAPHICS

US Bureau of Census Data - 1980 and 1990
Lane County Tract #0001

POPULATION

The population of Lane County Tract #0001, where the Bear/Marten Watershed lies, declined from 5,381 people in 1980 to 4,929 in 1990, a percent change of -8.4 percent. As **Table 1** shows, the population aged from 1980 to 1990. Residents over 65 constituted 16.8 percent of the total population in 1980 and 20.3 percent in 1990; the median age changed from 33.9 to 39.7, an increase of 5.8 years. The population also aged in Lane County – those over 65 years of age grew from 9.6 of the population to 13.1 percent. However, the percentage of those over 65 is greater in the study area than in the county as a whole.

Table 1 – Age

	1980	%	Lane County	1990	%	Lane County
Population	5,381		275,226	4,929		290,866
18+	3,952	73.4%	73.3%	3,761	76.3%	75.6%
65+	902	16.8%	9.6%	999	20.3%	13.1%
Median	**33.9**	-	**28.8**	**39.7**	-	-

Source: U.S. Census Bureau

Table 2 shows that population also became slightly more diverse. In 1980 there were 195 nonwhite residents, 3.6 percent of the population; while in 1990 there were 213 nonwhite residents, 4.3 percent. In 1980, the percentage of nonwhites in the study area (3.6%) and Lane County (3.7%) were very similar. However, in 1990 the percentage of nonwhites grew to 7.2 percent in Lane County, but only 4.3 percent in the study area.

Table 2 – Race and Ethnicity

	1980	%	% Lane County	1990	%	% Lane County
White	5,276	96.4%	96.3%	4,798	95.8%	92.8%
Black	12	0.2%	0.5%	16	0.3%	0.7%
American Indian, Eskimo, and Aleut	25	0.4%	1.0%	37	0.7%	1.1%
Asian and Pacific Islander	37	0.7%	1.2%	61	1.2%	1.9%
Spanish Origin	90	1.7%	2.1%	82	1.6%	2.4%
Other	31	0.6%	-	17	0.4%	1.1%

Source: U.S. Bureau of Census

EDUCATION

Elementary and High School enrollment has decreased from 1,113 students in 1980 to 840 students in 1990, a -24.5 percent change. College enrollment has also increased by 29 students. Education levels increased. The population in this tract became more educated between 1980 and 1990. The percentage of high school graduates increased from 77.1 to 82.7 percent and the percentage of college graduates grew from 14.3 to 18.8 percent. (See **Table 3**) Lane County experienced similar growth in the number of high school graduates, but has a high percentage of college graduates in both 1980 and 1990.

Table 3 – School Enrollment and Educational Attainment

	1980	1990	% change
Enrolled Nursery school	60	66	10.00
K-12	1,113	840	-24.53
Enrolled College	147	176	19.73
Completed High School	2,724	2,906	6.68
% HS Grads	77.1%	82.7%	-
% HS Grads - Lane County	77.6%	83.0%	-
% College Grads	14.3%	18.8%	-
% College Grads - Lane County	20.4%	22.2%	-

Source: U.S. Bureau of Census

HOUSING

Housing transiency decreased between 1980 and 1990. **Table 4** shows that in 1980 only 46.6 percent of the population lived in the same house as they did 5 years earlier. In 1990, 52.6 percent of them lived in the same house. Median housing values increased, but not at a much lower rate than rents increased (not corrected for inflation). Rents increased over 60 percent, median income also increase almost 70 percent, (see **Table 8**); however, housing values only increased a by 14.1 percent making property in the McKenzie River corridor more affordable. Median housing value increased even less in Lane County (5.8%) and housing values are significantly less in Lane County than in the McKenzie corridor. However, rent is significantly higher in Lane County.

Table 4 – Housing

	1980	1990	% change
Same house 5 years before	46.6	52.6	12.9%
Median housing value	$74,400	$84,900	14.1%
Median housing value - Lane County	$62,200	$65,800	5.8%
Median contract rent	$195	$314	61.0%

	1980	1990	% change
median contract rent - Lane County	$253	$418	65.2%

Source: U.S. Bureau of Census

EMPLOYMENT

Unemployment has declined since 1980 when 13.1 percent of the population was unemployed while only 7.3 percent of the population was unemployed in 1990 (**Table 5**). However, the size of the labor force declined from 2,346 to 2,168 people, a difference of 178 workers. The decrease of the labor force correlates with a decrease in population and an increase in the percentage of residents of retirement age. Unemployment figures correlate with unemployment in Lane County in 1990. The State of Oregon had lower unemployment than either Lane County and the McKenzie corridor in 1980 and 1990.

Table 5 – Labor Force

	1980	1990
Labor force	2,346	2,168
% of persons 16+	56.4	56.1
Unemployed	308	158
% Unemployed	13.1	7.3
% Unemployed - Lane County	12.5	7.1
% Unemployed - Oregon	11.5	6.2

Source: U.S. Bureau of Census

The average travel time to work actually decreased between 1980 and 1990 by 1.3 percent; however, the people working in Eugene and Springfield increased from a total of 940 people in 1980 to 1,210 in 1990 (**Table 6**). Mean travel time for residents in the McKenzie corridor is 5.3 minutes longer than the mean travel time for residents of Lane County in 1990.

Table 6 – Journey to Work

	1980	% of Employed	1990	% of Employed
Mean travel time	28.7	-	27.4	-
Mean travel time - Lane County	-	-	18.1	-
Persons working in Eugene city	548	26.9%	728	36.2%
Persons working in Springfield	392	19.2%	482	24.0%

Source: U.S. Bureau of Census

While the labor force declined by 1.4 percent from 1980 to 1990, the number and percentage of employees in the following occupations increased: executive, administrative, and managerial; technicians and related support; protective service; service, except protective and

household; machine operators, assemblers, and inspectors; and transportation and material moving (**Table 7**). The most significant increases were in technician and related support and service, except protective and household. Private household industries declined from 24 in 1980 to 0 in 1990, a percent change of 100 percent. Other large decreases in employees were in farming, forestry and fishing, and precision production, craft, and repair.

Table 7 – Occupation and Selected Industries

	1980	% of employed	1990	% of employed	% change
employed persons	2038	-	2010	-	-1.4%
executive, administrative, and managerial	241	11.8%	295	14.5%	22.4%
professional specialty	268	13.2%	228	11.3%	-14.9%
technicians and related support	20	1.0%	74	3.7%	270.0%
sales	182	8.9%	159	7.9%	-12.6%
administrative support, including clerical	263	12.9%	216	10.7%	-17.9%
private household	24	1.2%	-	-	-100.0%
protective service	29	1.4%	32	1.6%	10.3%
service, except protective and household	178	8.7%	270	13.4%	51.7%
farming, forestry, and fishing	185	9.1%	124	6.2%	-33.0%
precision production, craft, and repair	331	16.2%	263	13.1%	-20.5%
machine operators, assemblers, and inspectors	65	3.2%	121	6.0%	86.2%
transportation and material moving	120	5.9%	128	6.4%	6.7%
handlers, equipment cleaners, helpers and laborer	132	6.5%	100	5.0%	-24.2%

ECONOMY

Table 8 shows that the median income has changed by 68.3 percent from 1980 to 1990 and the per capita income has increased by 77.5 percent (not corrected for inflation). While median income was lower in the McKenzie River corridor than both Lane County and Oregon in 1980, income rose at a faster rate between 1980 and 1990 than both jurisdictions. Per capita income in the McKenzie corridor was higher than in Lane County and Oregon.

The number of families living under poverty levels declined from 92 to 71 families, and the percentage of families declined from 5.7 to 4.9 percent while poverty levels increased in both Lane County (8.5% - 9.4%) and Oregon (7.7% - 8.7%).

Table 8 – Income

	1980	1990	% change
median	$18,383	$30,929	68.3%
median - Lane County	$19,481	$30,763	57.9%
median - Oregon	$20,027	$32,336	61.5%
per capita	$8,537	$15,151	77.5%
per capita - Lane County	$7,302	$12,570	72.1%
per capita - Oregon	$7,557	$13,418	77.6%
families below poverty level	92	71	-22.8%
% families below poverty level	5.7%	4.9%	-
% families below poverty level - Lane County	8.5%	9.4%	-
% families below poverty level - Oregon	7.7%	8.7%	-

MCKENZIE WATERSHED COUNCIL

Federal agencies have recognized the need to include the citizens in natural resource management decisions (Baldwin 1995). As agencies move away from top-down management styles, they have tried to implement the following strategies:

Cdeveloping partnerships with communities
Cusing watershed boundaries for analysis and planning
Cusing human landscape in analysis and planning

The McKenzie Watershed Council represents a partnership between federal agencies and the communities in the McKenzie River corridor. The organization's purpose is to help address watershed management issues and provide a framework for cooperation among key interests. The Council's mission is:

> *To foster better stewardship of the McKenzie River watershed resources, deal with issues in advance of resource degradation, and ensure sustainable watershed health, functions, and uses.*

Although the Watershed Council would like many citizens to be involved, there currently is a heavy agency presence. There is also inconsistent representation in that some members are more in touch with their constituents than others (Rolph 1996). The following citizen involvement strategies have been tested and have shown varying degrees of success: a speakers network, open houses, a newspaper insert, a booth at the Lane County Fair, and a newsletter (Baldwin 1995).

Some of the main concerns of the Watershed Council involve private landowners and so citizen involvement is key to watershed implementation of goals. For example, an issue of interest is riparian restoration and most of the riparian areas are privately owned. Water

quality concerns caused by failing septic tanks and increased density of septic tanks is another concern. Water quality impacts of lawns and golf courses located at the waters edge are also an issue the Watershed Council wants to tackle (Baldwin 1995). The council has found that citizens are most likely to be interested in riparian restoration projects when the residents do not have to pay for the project. Projects are advertised by word of mouth from property owner to property owner; as a result, most of the projects are currently concentrated in the Mohawk Valley.

HUMAN HABITAT GOALS AND OBJECTIVES

The McKenzie Watershed Council prepared an action plan identifying goals and objectives for Recreation and Human Habitat. A sub-committee developed and refined the goals by focusing on issues previously identified by the council and other groups. They considered the issues and chose to focus on those that would be critical or timely for the Watershed Council to address, and then limited their scope of work to those issues that linked the land base of the watershed. A task group of advisors was assembled to explore the issues and make recommendations about the role that the council should play. The council accepted the subcommittee's recommendations and approved the scope of work and technical advisors began identifying existing conditions, defining desired conditions, and then they recommended actions to bring current conditions in line with the desired conditions. There are 4 goals for human habitat.

Goal One: *Manage growth and development within the watershed*.

Objectives on how to achieve this goal include encouraging future development into existing development nodes or areas not zoned as forest and farm use; maintaining resources (agricultural/forest) use and open spaces between development nodes; and encouraging clustering of residential development on large residential zoned parcels. They also plan to study whether there is a need for change in the flood plain ordinance and encourage the analysis of cumulative effect of growth and development on the health of the watershed.

Goal Two: *Maintain the rural character within the watershed*.

Encourage communities to set design standards, themes, and community growth boundaries coordinated with Lane County planing regulations. Communities should be an opportunity area for aesthetically compatible economic development. Encourage but limit the negative impacts of cottage industries and home occupations where appropriate. Encourage landscaping of existing commercial areas (beautification). Maintain the quality of the viewshed.

Goal Three: *Maintain the ecological function within the watershed*.

Maintain the health of riparian areas. Maintain the health of the river. Increase the public's knowledge of watershed issues, riparian areas, etc. Seek ways to minimize negative impacts from existing and future roads. Promote and support land conservancy measures that preserve and maintain the ecological function of the watershed.

Goal Four: *Increase safety within the watershed*.

Work with agencies to address community-based solutions to traffic concerns. Improve access to the river on and around boat ramps. Increase visibility (visibility of driveways for

vehicles, bike, signage for safety, etc.)

FINDINGS

Age: The population has decreased in numbers and has grown older.

- C The population has decreased by 8.4 percent
- C The number of people under 18 has decreased by 4.8 percent while the number of those over 62 has increased by 10.8%
- C The median age has increased from 33.9 to 39.7 years (a 17.1% increase). The median age is higher in the McKenzie corridor than in Lane County.

Race: Racial diversity has increased.

- C The number of colored residents has grown from 12 to 16 people.
- C The number of Native Americans has increased from 25 to 37 people.
- C The number of Asian/Pacific Islanders has increased from 37 to 61 people.
- C The number of people with Spanish origins has decreased from 90 to 82 people.
- C The white population has decreased by 9.1 percent.

Education: Enrollment in school has decreased while education levels have increased.

- C Kindergarten to 12th grade enrollment has decreased by 24.5 percent.
- C College enrollment has increased by 19.7 percent.
- C The percentage of the population that has completed high school has increased from 77.1 to 82.7 percent.
- C The percentage of the population that has a college degree or higher has increased from 14.3 to 18.8 percent.

Housing: Housing transiency has decreased. Rent has increased drastically.

- C The percentage of the population that live in the same house they did 5 years previously has increased from 46.6 to 52.6 percent.
- C The median house value has increased by 14.11 percent. Rental prices have increased by 61.0 percent (not corrected for inflation). Median housing values are higher in the McKenzie corridor than the rest of the county, but median contract rents are lower.

Journey to Work: The number of people working in Eugene and Springfield has increased.

- C The mean travel time has stayed approximately the same (28.7 minutes - 27.4 minutes)
- C The number of people working in Eugene has increased by 32.9 percent and the number of people working in Springfield has increased by 23.0 percent.

Labor Force: The labor force has decreased (maybe due to the aging trend?) and unemployment has decreased.

- C The labor force has decreased by 7.6 percent.
- C Unemployment has decreased from 13.1 to 7.3 percent.

Occupation and Selected Industries:

Income: Income has increased and poverty levels decreased slightly.

- C The median income has increased by 68.3 percent and the per capita income has increased by 77.5 percent. Neither figure has been corrected for inflation.

- C The percentage of families below the poverty level has decreased from 5.7 to 4.9 percent while county and State poverty levels increased. Poverty levels are much lower than countywide and statewide levels.

THE MCKENZIE RIVER WATERSHED COUNCIL

C The McKenzie River Watershed Council exists as a means for residents of the McKenzie River Corridor to get involved in resource management decisions. Currently the Watershed Council would like to have more citizens involved in the council than there presently are.

C Human habitat goals that the watershed council has adopted include: managing growth and development within the watershed, maintaining the rural character within the watershed, maintaining the ecological function within the watershed, and increasing safety.

Lane County Labor Force

	1980	1990
Employed	117,421	129,698
Manufacturing	18.6	17.5
Wholesale/Retail	24.1	23.7
Professional	23	-
Other Industries	6.7	-
Government	18.3	-
Self Employed	9.4	-
Agriculture	-	3.7
FIRE (finance, insurance and real estate)	-	4.9
Health Services	-	7.2
Public Administration	-	3.1

APPENDIX C
WATER RIGHTS FOR BEAR/MARTEN WAU

PERMIT NUMBER	DIV. LOCATION	USE
MCKENZIE RIVER		
22873	17S-2E-2 NE/NE	Irrigation
25294	16S-2E-35 SE/SW	Irrigation
25729	17S-3E-9 NE/NW	Irrigation
35634	16S-2E-35SE/SW	Irrigation
45576`	17S-3E-9 NE/NW	Irrigation
49632	17S-3E-11NW/NW	Irrigation
51760	16S-2E-34SE/NW	Irrigation
51537	16S-3E-32SE/SW	Irrigation
21866	17S-2E-2 NE/NE	Domestic
28719	17S-3E-11NW/NW	Domestic
38919	16S-2E-36SE/SE	Domestic
41236	16S-3E-31NW/SE	Domestic
43305	17S-3E-11NW/NW	Domestic
47274	16S-3E-32NW/SW	Domestic
51638	16S-3E-32SW/SE	Irrigation
51639	17S-3E-04SE/SW	Irrigation
SPRINGS		
5713	17S-3E-11NW/NW	Domestic
14982	17S-3E-03NW/NW	Domestic
16217	16S-2E-34NW/NE	Domestic
29722	17S-3E-10SE/NE	Domestic
43996	16S-3E-32NW/SE	Domestic
BEAR CREEK		
6710	16S-3E-31SW/SW	Domestic
8525	16S-3E-32SW/NW	Domestic
11767	16S-3E32NE/SW	Domestic
13341	16S-3E-32NE/SW	Domestic
14782	16S-3E-32NW/SW	Domestic
ROUGH CREEK		
8834	16S-3E-32NW/SW	Domestic
43692	16S-3E-32NWSW	Domestic
HE287	16S-3E-32NW/SW	Hydroelectric
UNNAMED STREAMS		
24980	17S-3E-03	Irrigation
43997	16S-3E-32SE/SW	Domestic

APPENDIX D
SOIL PRODUCTIVITY AND RESILIENCY ASSESSMENT

PURPOSE, ASSUMPTIONS, AND METHODOLOGY

Purpose/Key Question - This assessment will identify the areas with similar soils and natural, inherent productivity. The following key question will be addressed:

WS5 What is the inherent, natural range of soils and site productivity and has it been affected by man?

Assumptions - Soils with similar properties and charateristics have similar inherent productivity and resiliency and behave similarly.

- Data from Soil Conservation Soil (SCS now is Natural Resources Conservation Service) surveys combined with professional knowledge and experience of soil characteristics and behavior can be used to develop mapping units that identify soil capability and resiliency.

- Soil characteristics, including moisture and temperature regimes, have some correlation to vegetation communities.

Methodology - Resiliency Units for the Bear/Marten Watershed analysis area were created by combining soil mapping units listed by SCS in the *Soil Survey of Lane County* (1987), Oregon. Each resiliency Unit has soils with similar properties. Resiliency Units are based on such factors as soil temperature and moisture regimes, soil drainage and permeability, soil depth, coarse fragment content, texture, water holding capacity, and nutrient capital. Eleven resiliency units were created to cover soils in the Eugene District. These units cover xeric and udic moisture regimes, mesic and cryic temperature regimes, and wetland type soils.

APPENDIX E
HILLSLOPE EROSION ASSESSMENT

PURPOSE, ASSUMPTIONS, AND METHODOLOGY

Purpose & Key Question - The purpose of this assessment is to identify the existing and potential hillslope related surface erosion areas that contribute sediment to stream channels. The following key question will be addressed by this assessment: What is the hillslope erosion potential, i.e.,what areas are sensitive?

Assumptions

- Sheet erosion of hillslopes is influenced primarily by soil type, hillslope gradient, protective cover, precipitation intensity, and human activity.

- Certain soils (easily detachable) and slope conditions (steep) are conducive to surface erosion.

- On potentially erodible soils, the primary factors determining whether surface erosion occurs are exposure and compaction of mineral soil and topography. Surface erosion tends to increase as these 3 characteristics increase.

- Certain management practices can expose and/or compact surface mineral soil and significantly increase surface erosion. Practices that do not expose or disrupt the surface mineral soil are unlikely to increase surface erosion.

- Surface erosion may be delivered anywhere in the stream system by dry ravel or overland flow, but is fairly easily disrupted by a buffer of slash, duff, and other protective soil cover. Therefore, sediment is generally not delivered to the stream system if adequate buffers exist on the hillslopes.

- Dry ravel is primarily a function of slope gradient, hillslope storage potential, surface cover, and soil erodibility.

- Most surface erosion occurs within 5 years of a contributing activity.

Methodology - A soil erosion potential map (Map C) was developed using GIS with topography (slope steepness) and soils (USDA, Soil Conservation Service (NRCS) K-factors) themes. Three categories of relative potential for erosion of exposed mineral soil were mapped using the following criteria:

High	Slopes >65%, K >.25
	Slopes >30%, K >.40
Moderate	Slopes >65%, K <.25
	Slopes 30-65%, K .25-.40
	Slopes <30%, K >.40
Low	Slopes <30%, K .25-.40
	Slopes <65%, K <.25

From past experience, it was decided that the use of aerial photographs would not be helpful in determining sites with existing surface erosion (i.e., gullies). Field visits were conducted for

the 3 erosion potential categories to determine presence (and degree) or absence of erosion.

APPENDIX F
GEOLOGY MAP UNITS

DESCRIPTION OF GEOLOGY MAP UNITS FOR BEAR/MARTEN WA AREA

SEDIMENTARY AND VOLCANIC ROCKS

Qal **Alluvial Deposits** (Holocene) - Sand, gravel, and silt forming flood plains and filling channels of present streams.

Qls **Ancient Landslide and Debris-Flow Deposits** (Holocene and Pleistocene) - Unstratified mixtures of fragments from adjacent bedrock. Largest slides and debris flows occur where thick sections of basalt and andesite flows overlie clayey tuffaceous rocks.

Qt **Terrace, Pediment, and Lag Gravels** (Pleistocene) - Unconsolidated deposits of gravel, cobbles, and boulders intermixed and locally interlayed with clay, silt, and sand. Mostly on terraces and pediments above present flood plains.

Trb **Ridge-Capping Basalt, and Basaltic Andesite** (Pliocene and Upper Miocene) - Flows and flow breccia of basaltic andesite and lesser olivine basalt.

Tsv **Silicic vent complexes** (Pliocene, Miocene, and upper Oligocene) - Large, rhyolitic to dacitic vent areas in the Cascade Range that commonly include multiple intrusions and much associated silicic eruptive breccia and erosional debris and some flows.

Tbaa **Basaltic and Andesitic Rocks** (upper and middle Miocene) - Primarily basaltic andesite and andesite lava flows and flow breccia containing plagioclase and pyroxene phenocrysts, and basalt.

Tu **Undifferentiated Tuffaceous Sedimentary Rocks, Tuffs, and Basalt** (Miocene and Oligocene) - Heterogeneous assemblage of continental, largely volcanogenic deposits of basalt and basaltic andesite, including flows and breccia, complexly interstratified with epiclastic and volcaniclastic deposits of basalt to rhyodacitic composition. Includes extensive rhyodacitic to andesitic ash-flows and air-fall tuffs, abundant lapilli tuff and tuff breccia, andesitic to dacitic mudflow (lahar) deposits, poorly bedded to well-bedded, fine to coarse-grained tuffaceous sedimentary rocks, and volcanic conglomerate. (Originally included in the Little Butte Volcanic Series)

Tub **Basaltic Lava Flows** - Basaltic and basaltic andesite lava flows and breccia, grading laterally into rare bedded palagonitic tuff and breccia.

INTRUSIVE ROCKS

Thi **Hypabyssal Intrusive Rocks** (Miocene) - Hypabyssal, medium-grained, hornblende

diorite and quartz diorite in small stocks and large dikes.

APPENDIX G
MASS WASTING ASSESSMENT

(SLOPE FAILURE POTENTIAL)

ASSUMPTIONS Identification of existing mass movement features can be used to predict the likelihood of future instability. Areas prone to these processes can be mapped based on physical characteristics interpreted from digital terrain modeling, research, and field inventories.

METHODOLOGY – A Slope Failure Potential Map was analyzed and mapped utilizing a model for the topographic influence of shallow landslide initiation developed by coupling digital terrain data with near surface through flow and slope stability models. (This model was developed by Dr. William E. Dietrich, Department of Geology and Geophysics, University of California, Berkeley). Modeling components and concepts include:

Bulk density of soil and rock
Elevation of interface
Soil transport vector
Change in soil thickness with time
Rate of conversion of bedrock to soil
Divergence of soil transport
Soil depth
Area per unit contour length
Bulk density ratio of wet soil to water
Ratio of the tangent of the ground surface to the angle of internal friction
Hydrologic ratio (transmissivity/effective precipitation)
Ground slope
Root cohesion

Site-specific information collected from 900 individual oversteepened headwalls (hollows) in the Coast Range Resource Area (Eugene District) was used in developing and calibrating the model. The areas mapped in the "High" category for slope failure are those areas that relative to the rest of the watershed and given the modeling components and concepts indicate the inherent potential for slope failure. This is a planning level tool, and in no way precludes the need for site-specific slope stability analysis at the project level.

APPENDIX H

BLM ROADS WITH EROSION AND SEDIMENT DELIVERY CONCERNS – Bear/Marten WA

ROAD-RELATED EROSION

Subbasin	Road Number	Concern
Little Bear	16-2E-36.1 (Powerline)	High delivery due to lack of relief drainage
	County Rd. (gravel)	Not inventoried - suspect high delivery
Marten Creek	17-2E-1.2	Potentially high delivery due to steep, eroding cutbanks
Jimbo Mtn	16-3E-33	Sections with steep, eroding cutbanks
Gale Creek	17-2E-2	Old Gale Creek road - Not inventoried, but located adjacent to Gale Creek and suspected high sediment delivery

MASS WASTING CONCERNS

Deer Creek	16-2E-36.2	Sections of Ridge Road with steep, failing cutbanks
	Dirt Spur in Sec. 8	In SE corner of section; has failed in the past
Marten Creek	17-2E-1.2	75% of road with steep, eroding and slumping cutbanks, ditchlines, and culverts fill relatively quickly, and failures related to sidecasting, very high road maintenance needs
Jimbo Mtn	16-3E-33	Two flood-related failures
	16-3E-34 (Ridge Road)	One failure; related to obstructed road drainage
Little Bear	Spur Roads in Sec. 6	Unmaintained spur roads, midslope portions with failing, slumping cutbanks

BIBLIOGRAPHY

Applegarth, John S. 1994. Special status amphibians and reptiles of the Eugene District. A guide for their conservation. USDI, Bureau of Land Management (Eugene, Oregon), 52 pages, March.

Applegarth, John S. 1995. Invertebrates of special status or special concern in the Eugene District. U.S.D.I., Bureau of Land Management (Eugene Oregon), 126 pages, December.

Armantrout, N.B. 1992. McKenzie River Aquatic Habitat Management Plan. USDI BLM Eugene District, Draft.

Armantrout, N.B. 1995. "Aquatic Habitat Inventories Using Remote Sensing." USDI BLM Eugene.

Barnhart, R.A. 1991. Steelhead, the Wildlife Series: Trout. Harrisburg, PA.

Beckham, Stephen Dow. 1976. Indian Distribution in Oregon. In *Atlas of Oregon*, edited by William G. Loy, pp. 6-7. University of Oregon Books, Eugene.

Beckham, Stephen Dow, Rick Minor and Kathryn Anne Toepel. 1981. *Prehistory and History of BLM Lands in West-Central Oregon: A Cultural Resource Overview* . University of Oregon Anthropological Papers 25.

Bull, Evelyn L., and Bernie E. Carter. 1996. Tailed Frogs: Distribution, ecology, and association with timber harvest in northeastern Oregon. USDA Forest Service, Pacific Northwest Research Station (Portland OR), Research Paper PNW-RP-497, iv + 11 pages, July.

Bunnell, Fred L., Laurie L. Kremsater, and Ralph W. Wells. 1997. Likely consequences of forest management on terrestrial, forest-dwelling vertebraes in Oregon. University of British Columbia, Centre for Applied Conservation Biology, report M-7, 130 pages, February.

Csuti, Blair, A. Jon Kimerling, Thomas A. O'Neil, Margaret M. Shaughnessy, Eleanor P. Gaines, and Manuela M. P. Huso. 1997. Atlas of Oregon wildlife. Oregon State University Press (Corvallis OR), xiv + 492 pages.

Hall, Troy and Shelby, Bo. *1996. McKenzie River Boater Study* (prepared for McKenzie Ranger District, Willamette National Forest and Eugene District Bureau of Land Management)

Hershler, Robert, Terrence J. Frest, Edward J. Johannes, Peter A. Bowler, and Fred G. Thompson. 1994. Two new genera of hydrobiid snails (Prosobranchia: Rissooidea) from the northwestern United States. The Veliger (California Malacozoological Society, Berkeley), volume 37, number 3, pages 221-243, July 1.

Marshall, David B. 1992. Sensitive vertebrates of Oregon. Oregon Department of Fish and Wildlife, Nongame Program (Portland, Oregon), 192 pages, June.

Meehan, W.R. and T. C. Bjornm. 1991. Salmonid Distribution and Life Histories. American Fisheries Society Special Publication 19:47-82.

Moring, J.R. 1991. Life and Death. The Wildlife Series: Trout. Harrisburg, PA.

Nussbaum, Ronald A., Edmund D. Brodie Jr., and Robert M. Storm. 1983. Amphibians and reptiles of the Pacific Northwest. University Press of Idaho (Moscow ID), 332 pages and 8 plates of color photos.

ONHP (Oregon Natural Heritage Program). 1995. Rare, threatened and endangered plants and animals of Oregon. Oregon Natural Heritage Program (Portland), iv + 84 pages, December.

Pilsbry, Henry A. 1948. Land Mollusca of North America (north of Mexico). Academy of Natural Sciences (Philadelphia, PA), Monograph number 3, volume 2, pages i-xlviii and 521-1113, March 19.

ROD (Record of Decision) 1994. Record of Decision for amendments to Forest Service and Bureau of Land Management planning documents within the range of the Northern Spotted Owl. U.S. Department of Agriculture Forest Service and U.S. Department of the Interior Bureau ofLand Management (Washington, DC), ii + 74 pages and Attachment A (Standards and Guidelines for managementof habitat for Late-Successional and Old-Growth forest related species within the range of the Northern Spotted Owl), viii + 148 pages.

Rosgen, C.L. 1996. Applied River Morphology. Wildland Hydrology. Pagosa Springs.

RRTT (Riparian Reserve Technical Team). 1997. Riparian Reserve evaluation techniques and synthesis: species information addendum to Appendix B. Supplement to Section II of "Ecosystem analysis at the watershed scale: Federal guide for watershed analysis." Regional Ecosystem Office (Portland, Oregon), viii + 342 pages, February.

SAT (Scientific Analysis Team). 1993. Viability assessments and management considerations for species associated with late-successional and old-growth forest of the Pacific Northwest. Scientific Analysis Team, report to the US Interagency Scientific Committee, viii + 530 pages.

Slevin, Joseph R. 1928. The amphibians of western North America.... California Academy of Sciences (San Francisco CA), Occasional Papers, number 16, 152 pages and 23 plates, September 15.

Southard, Michael D. 1992. *Archaeological Testing At The Viny Maple Site (35LA825), Lane County, Oregon.* Report of the Bureau of Land Management, Eugene District, to the Oregon Historic Preservation Office.

Toepel, Kathryn Anne and Stephen Dow Beckham. 1981. Ethnographic Overview. In *Prehistory and History of BLM Lands in West-Central Oregon: A Cultural Resource*

Overview, by Stephen Dow Beckham, Rick Minor and Kathryn Anne Toepel. University of Oregon Anthropological Papers 25.

USDA and USDI. 1994. Environmental Assessment for the Implementation of Intetrim Strategies (PACFISH) for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California. USDA Forest Service and USDI Bureau of Land Management, Washington D.C.

USDI BLM. 1991. Macroinvertebrate Survey Report. Logan, Utah.

USDI (US Department of the Interior). 1992. Recovery plan for the Northern Spotted Owl--DRAFT. US Department of the Interior, xiv + 662 pages and 3 maps, April.

USFW (US Fish and Wildlife Service). 1994. Endangered and Threatened wildlife and plants; animal candidate review for listing as Endangered or Threatened species. Federal Register (Washington DC), volume 59, number 219, pages 58982-59028, November 15.

Washington Forest Practices Board. 1995. State Department of Natural Resources: Standard Metholdology for Conducting Watershed Analysis - Version 2.0.

Webb, Glenn R. 1959. Two new Northwestern slugs, *Udosarx lyrata* and *Gliabates oregonia*. Gastropodia (published by the author - 14 Henry Road, Fleetwood, PA 19522-9726), volume 1, number 3, pages 22-23 and figures 37 and 39 in plate 14 on page 28.

Weyerhaeuser Timber Company. 1994. Lower McKenzie River Watershed Analysis. Weyerhaeuser Company, Springfield, Oregon

Willis. 1960. From Weyerhaeuser Timber Company - Lower McKenzie River Watershed Analysis. No citation available.

--0--

Central Cascades Adaptive Management Area Strategic Guide , December 1996. (Willamette National Forest and Eugene District Bureau of Land Management)

McKenzie Watershed Council Action Plan for Recreation and Human Habitat , March 1997. (prepared by Lane Council of Governments and Lane County Land Management Division)

Oregon Department of Fish and Wildlife . 1983. Hutcheson et al., McKenzie River creel survey, Information Report Number 90-1.

Recreation Management Plan for the McKenzie River Recreation Management Area (Draft), October 1993. (Eugene District Bureau of Land Management)

Vida/McKenzie Watershed Analysis , April 1996. (McKenzie Resource Area, Eugene District Bureau of Land Management)