Watershed Analysis

Rock Creek

Roseburg District BLM

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Key Issues and Concerns

The following issues and concerns were developed during the analysis or as feedback from the various individuals and groups that were interviewed.

- Stream temperatures
- Stream sedimentation
- Past logging and future restoration needs for fish
- Future recreation use
- Functionality of the Riparian Reserve System

Findings

The following highlights the main findings by major topic.

Vegetation:

- There have been drastic changes in the type of forests in this watershed from 1936 compared to present conditions (**Figures 3-4 and 3-5**).

Terrestrial Habitat and Species:

- Approximately 62% of the reserves allocated under the Forest Plan within Rock Creek watershed are functioning as late seral habitat (LSH) (forest stands greater than 80 years of age). Thirty-six percent of these reserves won't start functioning as LSH at least for another 40 years because they currently have young forest stands less than 40 years of age (**Figures 4-6, 4-7, and Table 4-5**).

Hydrology:

- Rock Creek has high road densities (**Table 5-5**) which may pose a potential risk for peak flow increases.

Erosional Processes:

- Landslides are more heavily located in the eastern portion of the watershed and are highly correlated with Loamy Skeletal soils (**Figures 6-2 and Table 6-1**).

Water Quality:

- Stream temperatures are probably higher than historic levels and most likely have and are affecting fish populations (**Table 7-1**). This may be associated with the cumulative effects of harvesting streamside vegetation. Empirical evidence seems to indicate that stream temperatures have been declining over the past decade with the increased growth of riparian vegetation.

Aquatic Habitat and Species:

- There is a large contrast in the riparian vegetative habitat condition from 1936 to present day (**Figure 8-1 and 8-2**). In 1936 97% of the riparian areas had late seral type habitat whereas today it is 23% (**Tables 8-1 and 8-2**). This has implications both on stream temperatures as well as future contributions of large old fallen trees into the riparian areas and streams.
- The stream areas that are most important for fish species of concern (coho and cutthroat) are in the worst condition, and are the most vulnerable under the current land use allocations.
- Although sedimentation of streams is perceived to be a problem (above issue listed from residents), the ODFW surveys (**Table 8-4**) indicate that it is only an isolated problem in Kelly, McComas, Miller, Taylor, Conley, and Woodstock Creek drainages.

Restoration Opportunities and Recommendations

The following are the major restoration opportunities and recommendations by major topic.

Terrestrial Habitat:

- Because of the low level of riparian areas functioning as LSH (**24%, Table 8-2**) and because of the moderate levels of reserves on federal lands functioning as LSH (**62%, Table 4-5**), changes in the riparian reserves have been proposed to better utilize the LSH on federal lands (**Figure 9-1 and Tables 9-1 and 9-2**).

Water Quality (Stream Temperatures):

- Silvicultural treatments may be appropriate to speed the recovery of shade (pre-commercial thinning). Instream work should only be attempted in areas that do not have high stream temperatures. Faster growing hardwoods could be planted along Woodstock Creek to more quickly establish shade.

Aquatic Habitat and Species:

- Several culverts currently pose a risk to high quality fish habitat or block fish passage to traditional coho and cutthroat trout habitat (NE Fork, Woodstock, Kelly, and McComas Creek culverts). These culverts need to be replaced to protect the resources and/or extend fish spawning habitat.
- Road restoration and maintenance should be prioritized towards the northern and eastern portions of the watershed. Removing road related threats would benefit fish because:
  - -These subwatersheds contain the best fish habitat
  - -They also have the highest road densities
  - -They have some of the highest occurrences of management related landslides
  - -These areas are in Late Successional Reserve land use and will need a lower level of road maintenance.
- Reconnect the riparian reserves by decommissioning unneeded roads within the riparian reserves especially in the drainages in the lower (southerly) portions of Rock Creek.
- Harrington Creek and East Fork Rock Creek are dominated by alder and could be treated to restore conifers as the dominant species.
- Where stream temperatures are not a problem, instream additions of LWD may be a feasible option in the short term.
- Salvage of LWD in riparian habitats of all ages **would not** be recommended in order to maintain the current effectiveness of the remaining habitat for LSH species.

Timber Harvest Recommendations:

- Commercial thinning needs to be the main mode of timber harvesting in drainages that have been heavily harvested in the past and are currently important for fish. Examples include Kelly, McComas, Miller, and East Fork drainages.
- Regeneration harvests would have the least impacts to the fisheries resources in lesser important drainages and drainages that have had a high historical disturbance frequency.

Figure 1-1

Rock Creek Watershed Vicinity Map

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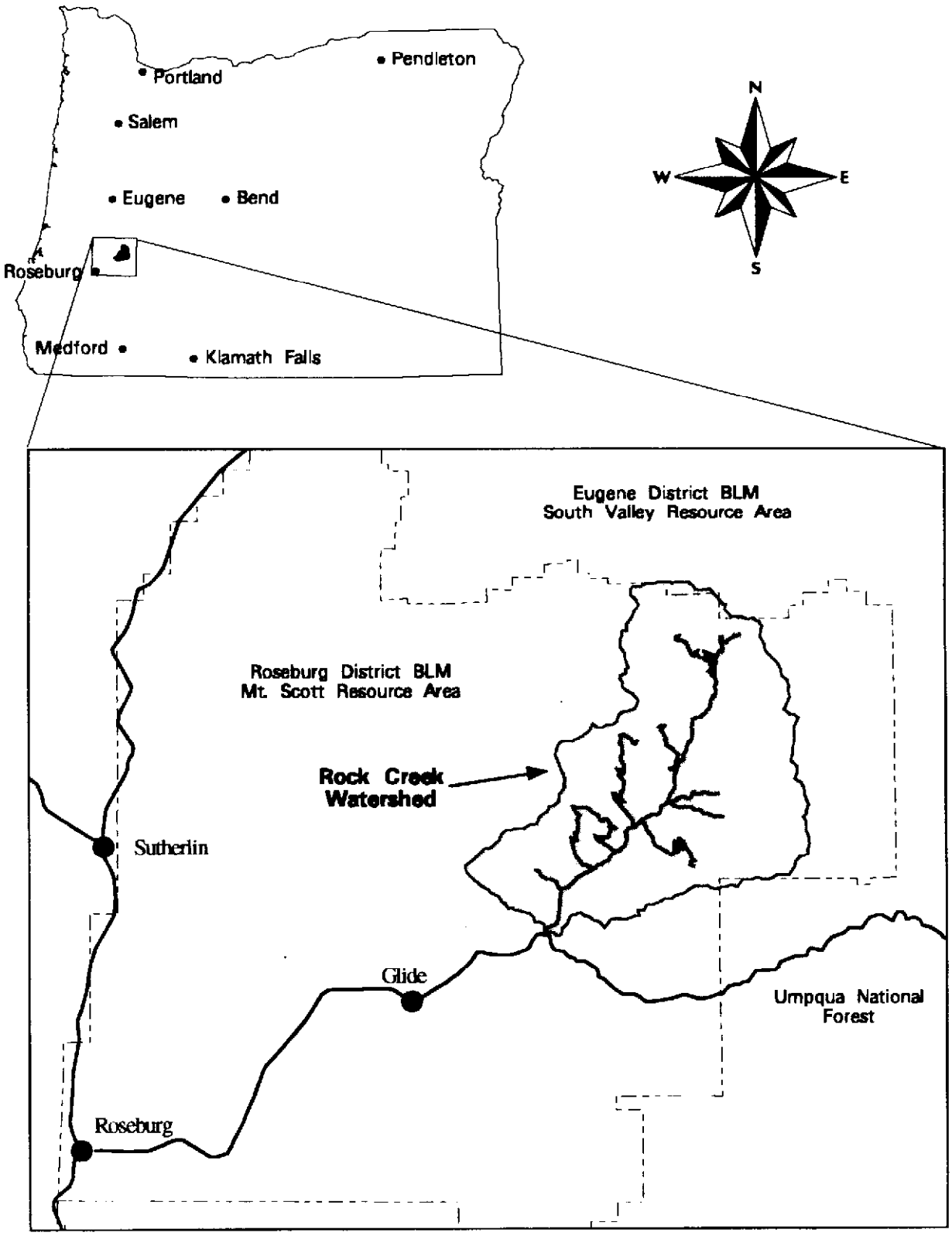
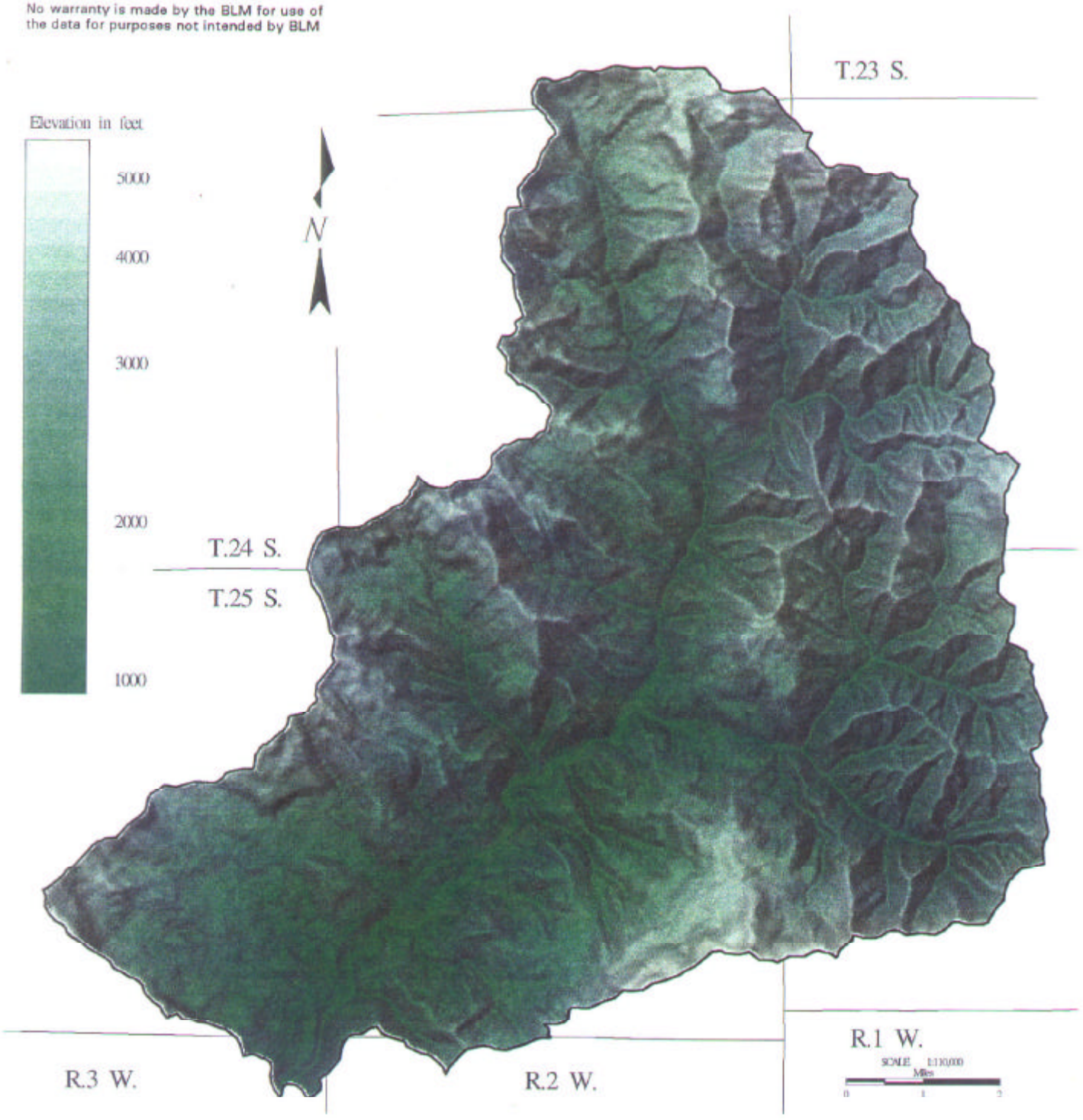


Figure 1-2

Relief Map of Rock Creek



OVERVIEW OF ROCK CREEK WATERSHED

A. General Description

Size and Location: Rock Creek is a watershed containing approximately 62,684 acres. This 98 square mile watershed is located on the Western slopes of the Cascade mountains and drains into the North Umpqua river system. Rock Creek joins the North Umpqua River approximately 5 miles upstream from the town of Glide. The North Umpqua and the South Umpqua join to form the 1300 square mile river system that flows 200 miles from the Cascade crest through the Oregon Coast Range to the Pacific Ocean. This coastal river system supports fish and aquatic life adapted to both a low gradient riverine habitat, as well as steep boulder-step channels common to Coast Range sedimentary mountains and the Cascade volcanics.

Specific Description: Rock Creek stretches approximately 14 miles south to north, from an elevation of 800 feet at its mouth, to 4,720 feet along Calapooya Divide. The watershed is made up of 5 major subwatersheds: Lower Rock Creek, Mill Pond, Upper Rock Creek, N.E. Fork Rock Creek, and East Fork Rock Creek. These subwatersheds are also divided into 34 drainages (**Figure 1-3**).

Climate: Average annual rainfall is approximately 63 inches near the bottom of the watershed. Approximately 45,140 acres or 72% of the watershed have elevations between 2000 and 5000 feet. This zone typically will have periods of snow followed by rain (transient snow zone).

Vegetation: Douglas-fir is the dominant tree species over the landscape. Grand fir, western hemlock and western red cedar are common associates.

People and Recreation: This watershed has two recreation sites (Mill Pond and Rock Creek) that receive moderate to high use during the summer. The 30 to 40 home residences are located in the lower 1/4 of the watershed with the Rock Creek Fish Hatchery located near the mouth of Rock Creek. Logging and timber products have been the major use of the area during the last 50 years.

B. Ownership and Federal Land Use Allocations

Figure 1-4 shows the general ownership patterns within the Rock Creek watershed. The following is a breakdown of the major land owners.

Land Owner	Acres	Percent of Watershed
Government (BLM)	28,284	45%
Roseburg Resources	13,614	22%
Weyerhaeuser Co.	11,048	18%

Of the 62,284 acres within Rock Creek, approximately 28,284 acres (45%) is federally managed under the following Forest Plan and Roseburg District RMP land use allocations (**Figure 1-5**) (note: these acreages are estimates based on computer generated maps):

	Acres, Fed Lands	% Fed Lands	% of Watershed
Late Successional Reserve	11,708 ac	41%	19%
Other Reserves	6,362 ac	22%	10%
Connectivity	3,583 ac	13%	6%
General Forest Management Area (GFMA)	6,631 ac	23%	11%

1. Late Successional Reserves

The management objectives for the Late Successional Reserves (LSR) are to protect and enhance old-growth forest conditions. Of the 11,708 acres of LSR in Rock Creek, approximately 7,409 acres (63% of Rock Creek LSR) are currently in late-successional type forests (80+ years). This includes approximately

252 acres within the LSR that have been or are being harvested under the Section 318 and the Salvage Bill legislation. The LSR within Rock Creek is only a small portion of a much larger LSR block that also includes USFS lands from the Umpqua National Forest to the Williamette National Forest. An LSR assessment is currently being coordinated and planned with the USFS and is expected to be completed by the end of 1996.

2. Other Reserves
As shown on **figure 1-5**, this includes riparian reserves, unmapped pre-1994 Northern Spotted Owl (NSO) designated core areas, reserves for threatened and endangered (T&E) species, and areas withdrawn because they are considered not suitable for timber production (TPCC).

The riparian reserves were established for federal lands as one component of the Aquatic Conservation Strategy to protect the health of the aquatic system and its dependent species and provide incidental benefits to upland species. The reserves were designated to help maintain and restore riparian structures and functions, benefit fish and riparian-dependent non-fish species, enhance habitat conservation for organisms dependent on the transition zone between uplands and riparian areas, improve travel and dispersal corridors for terrestrial animals and plants, and provide for greater connectivity of late-successional forest habitat (ROD, B-13).

The riparian reserves were estimated from the stream network characterized by the Geographic Information System (GIS) computer database as well as on the ground verification and mapping of intermittent (1st and 2nd order) streams. A slope distance of approximately 180 feet will be used as representing the average site-potential tree height for the Rock Creek watershed (ROD, pg. 9). The site-potential tree height of 180 feet was determined from 10 plots taken on the lower one-third of the hill slopes in the Rock Creek watershed. Thus the following riparian reserve widths were used for the estimating the total amount of riparian reserves: 180 feet (55 meters) for intermittent, non-fish bearing streams and 360 feet (110 meters) for fish bearing streams. Because many of the actual field intermittent streams are unmapped and because only known fish bearing streams based on a fish presence/absence inventory conducted in 1995 on BLM lands was used for the 360 foot riparian reserve width, the total amount of riparian reserves represented in this analysis is most likely underestimated. Actual projects would use on-the-ground stream information for

In Rock Creek there are twelve core areas designated for NSOs. For T&E species one area was administratively withdrawn from timber management in order to maintain foraging habitat for the bald eagle along the lower reaches of Rock Creek. Other smaller scattered areas are designated as not suitable for timber production (TPCC withdrawn).

3. Connectivity
The objective of these lands on the overall landscape is to provide a bridge between larger blocks of old growth stands and Riparian Reserves. This provides habitat for breeding, feeding, dispersal, and movement of old growth-associated wildlife and fish species. Rock Creek contains approximately 3,583 acres of Connectivity. Within this land designation there are approximately 1,330 acres in young pre-commercial age class (0 to 30 years), 722 acres potentially available for a commercial thinning (30 to 80 years), and 1,531 acres available for regeneration harvest (80+ years) (**Figure 1-6**)

4. General Forest Management Area (GFMA)
The objective of these lands is to manage on a regeneration harvest cycle of 70 to 110 years, leaving a biological legacy of 6 to 8 trees per acre to assure forest health. There is approximately 6,631 acres of GFMA in Rock Creek watershed. Within this land designation there are approximately 2,264 acres in young pre-commercial age class (0 to 30 years), 2,108 acres potentially available for a commercial thinning (30 to 80 years), and 2,258 acres available for regeneration harvest (80+ years) (**Figure 1-6**).

Figure 1-3

Rock Creek Watershed Subwatersheds & Drainages

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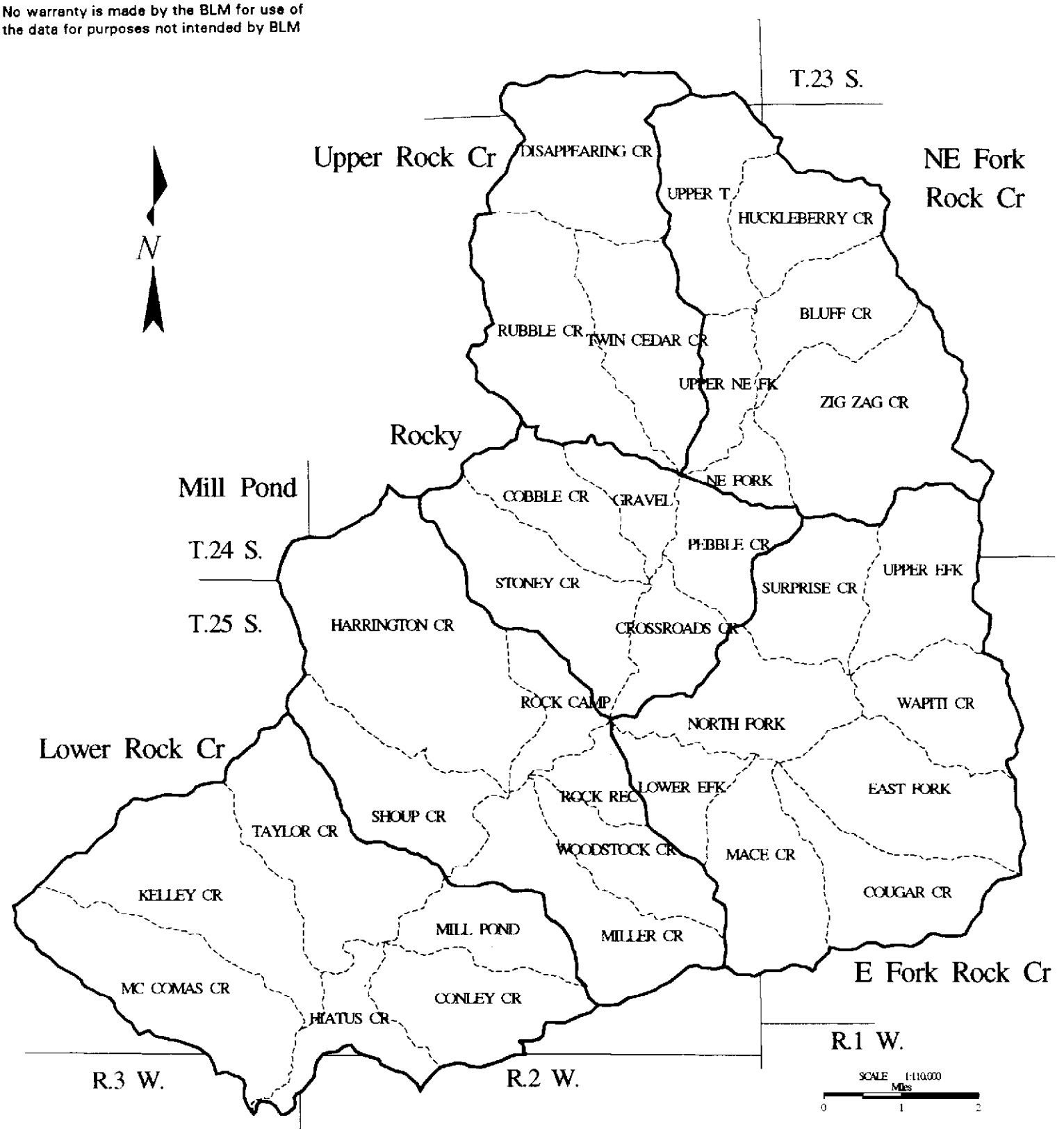


Figure 1-4

Rock Creek Watershed Ownership

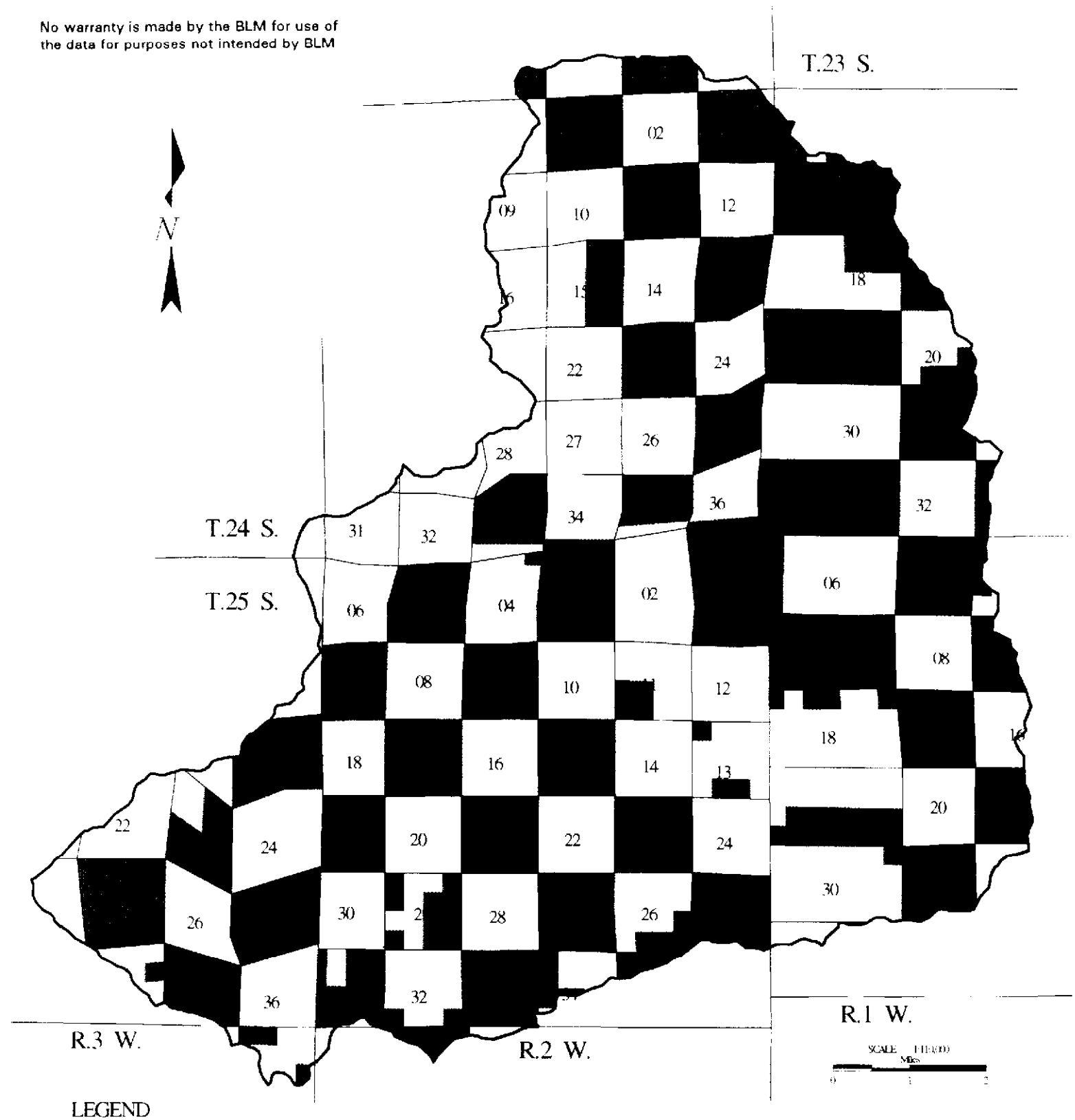


Table 1-1

ROCK CREEK WATERSHED
LAND OWNERSHIP

LANDOWNER/ADMINISTRATOR	ESTIMATED ACRES	PERCENT OF TOTAL ACRES
BUREAU OF LAND MGMT.	28,284	45.1
LONE ROCK TIMBER CO. R-617	235	0.4
ROSEBURG RESOURCES CO. R-617	13,614	21.7
KENNETH & HALLIE FORD R-680	1,961	3.1
SENECA JONES TIMBER CO. R-767, R-490, R-646	4,045	6.4
WEYERHAEUSER CO. R-540	11,048	17.6
OTHER PRIVATE ≥40 AC./ OWNER	3,185	5.1
OTHER PRIVATE <40 AC./ OWNER	156	0.3
U.S. FOREST SERVICE	156	0.3
TOTALS	62,684	100.0

Figure 1-5

Rock Creek Land Use Allocation

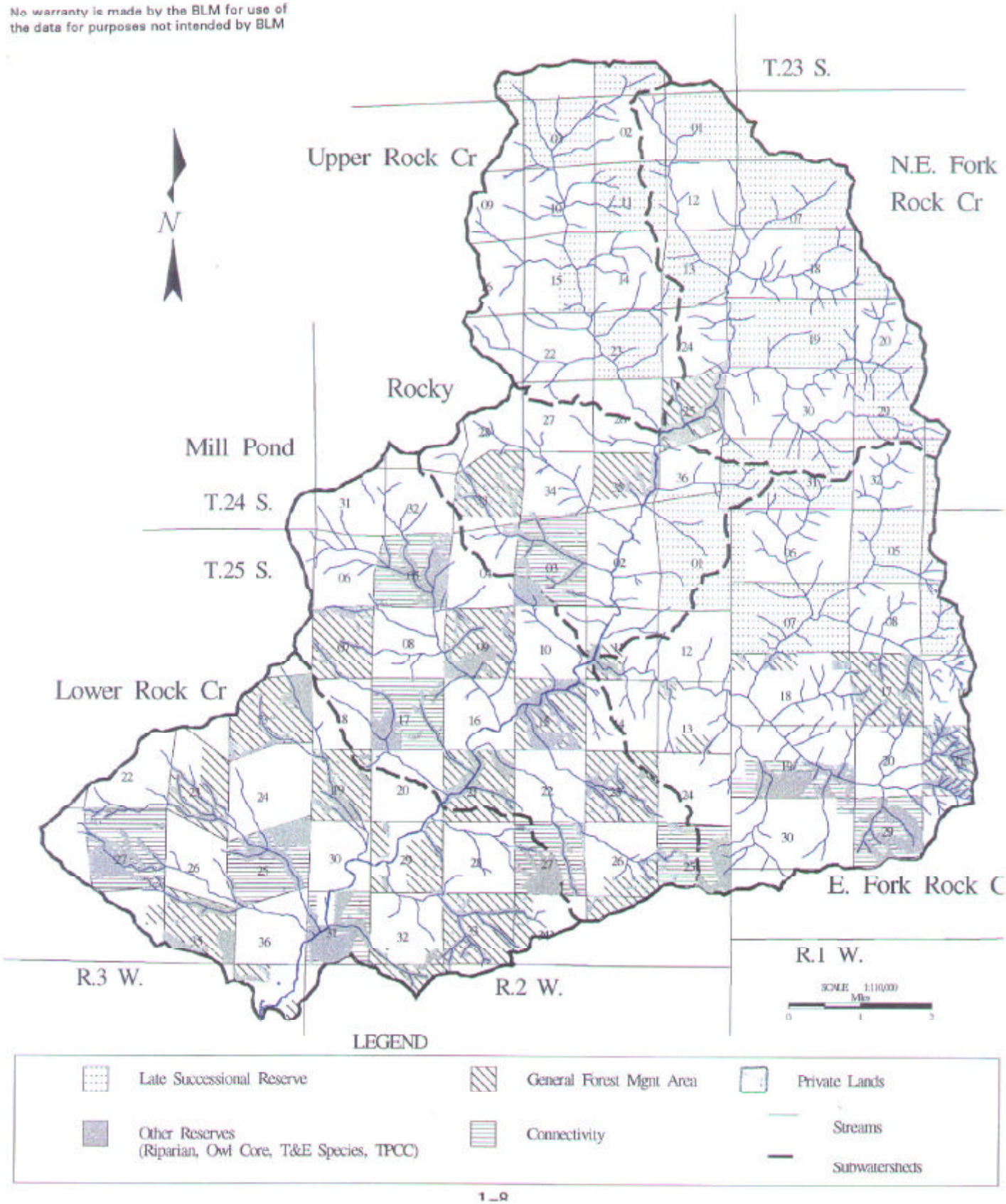


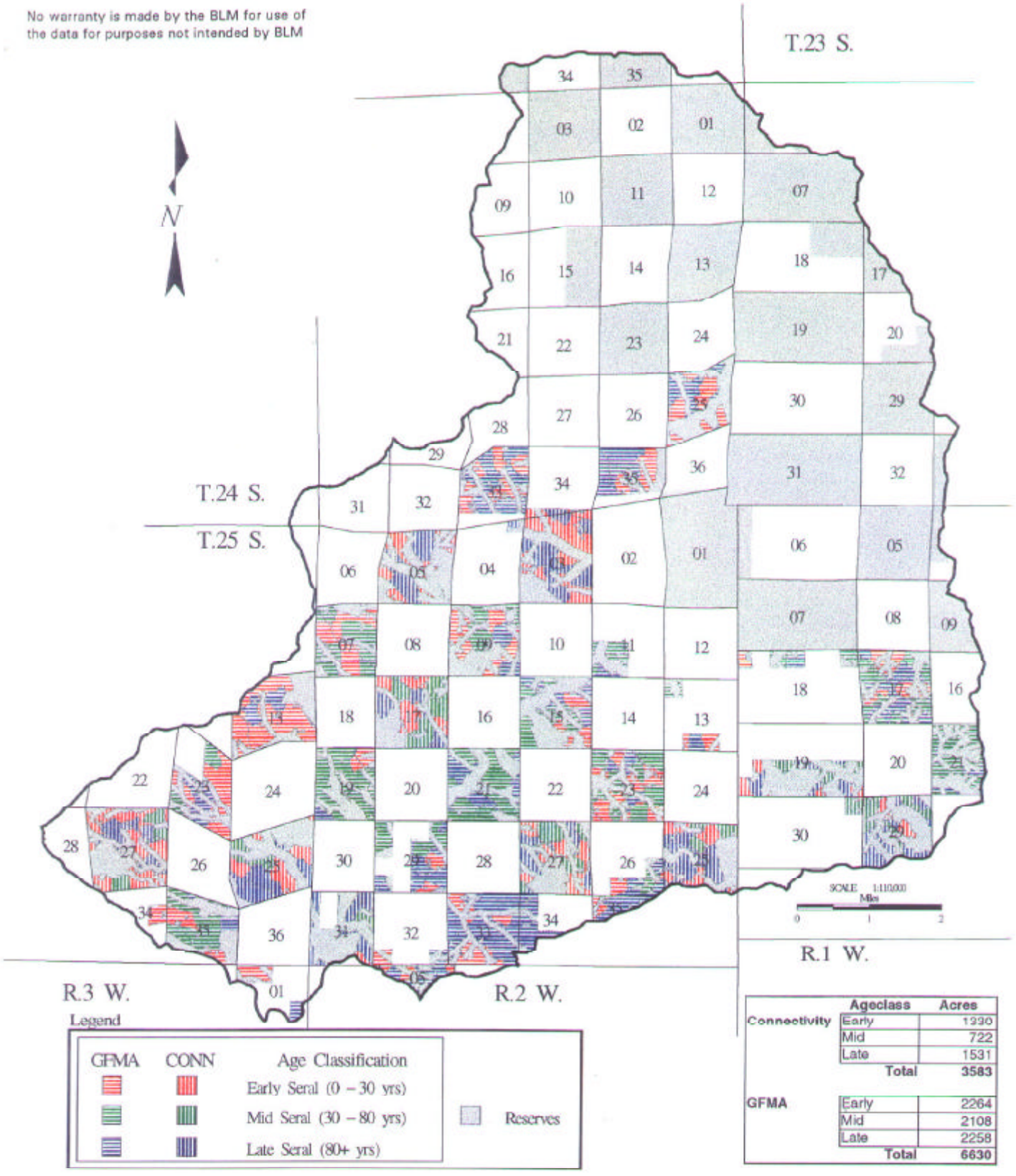
Table 1-2

ROCK CREEK LAND USE ALLOCATION

DRAINAGE	LSR		Other Reserves		Connectivity		GFMA		Private Lands		Total Ac
	acres	%	acres	%	acres	%	acres	%	acres	%	
COUGAR CR	0	0%	471	25%	421	23%	18	1%	944	51%	1854
EAST FORK	0	0%	388	16%	14	1%	423	18%	1544	65%	2369
LOWER EFK	0	0%	46	5%	0	0%	103	10%	838	85%	987
MACE CR	0	0%	255	13%	221	11%	59	3%	1475	73%	2010
NORTH FORK	667	36%	73	4%	0	0%	93	5%	1035	55%	1867
SURPRISE CR	801	50%	0	0%	0	0%	0	0%	803	50%	1604
UPPER EFK	996	52%	0	0%	0	0%	0	0%	923	48%	1919
WAPITI CR	450	28%	117	7%	0	0%	213	13%	854	52%	1634
E. Fork Rock Cr	**2914**	20%	**1350**	9%	**655**	5%	**908**	6%	**8416**	59%	**14244**
CONLEY CR	0	0%	243	13%	13	1%	719	39%	868	47%	1843
HIATUS CR	0	0%	323	31%	149	14%	156	15%	418	40%	1047
KELLEY CR	0	0%	526	17%	515	17%	366	12%	1703	55%	3110
MC COMAS CR	0	0%	555	19%	372	13%	403	14%	1555	54%	2885
MILL POND	0	0%	211	17%	123	10%	250	20%	640	52%	1224
TAYLOR CR	0	0%	399	15%	7	0%	782	29%	1512	56%	2701
Lower Rock Cr	**0**	0%	**2257**	18%	**1179**	9%	**2677**	21%	**6696**	52%	**12809**
HARRINGTON CR	0	0%	706	15%	394	8%	524	11%	3192	66%	4816
MILLER CR	0	0%	347	15%	383	17%	532	24%	997	44%	2259
ROCK CAMP	0	0%	186	22%	0	0%	86	10%	578	68%	850
ROCK REC	0	0%	112	19%	0	0%	203	35%	270	46%	585
SHOUP CR	0	0%	339	18%	346	18%	329	17%	909	47%	1923
WOODSTOCK CR	0	0%	313	24%	102	8%	432	34%	442	34%	1288
Mill Pond	**0**	0%	**2003**	17%	**1225**	10%	**2105**	18%	**6388**	54%	**11721**
BLUFF CR	844	55%	0	0%	0	0%	0	0%	694	45%	1538
HUCKLEBERRY CR	1074	73%	0	0%	0	0%	0	0%	403	27%	1477
NE FORK	127	24%	128	24%	0	0%	33	6%	252	47%	540
UPPER NE FK	135	16%	105	13%	0	0%	171	21%	411	50%	822
UPPER T	1187	62%	0	0%	0	0%	0	0%	722	38%	1909
ZIG ZAG CR	1903	56%	0	0%	0	0%	0	0%	1481	44%	3384
N.E. Fork Rock Cr	**5270**	55%	**233**	2%	**0**	0%	**204**	2%	**3963**	41%	**9670**
COBBLE CR	0	0%	18	1%	23	2%	141	10%	1222	87%	1404
CROSSROADS CR	281	27%	10	1%	0	0%	29	3%	717	69%	1037
GRAVEL	0	0%	78	10%	0	0%	212	26%	514	64%	804
PEBBLE CR	804	66%	36	3%	0	0%	14	1%	373	30%	1227
STONEY CR	0	0%	366	16%	501	22%	297	13%	1154	50%	2318
Rocky	**1085**	16%	**508**	7%	**523**	8%	**692**	10%	**3980**	59%	**6789**
DISAPPEARING CR	1323	51%	0	0%	0	0%	0	0%	1287	49%	2610
RUBBLE CR	214	8%	0	0%	0	0%	0	0%	2593	92%	2807
TWIN CEDAR CR	902	45%	11	1%	0	0%	44	2%	1065	53%	2023
Upper Rock Cr	**2439**	33%	**11**	0%	**0**	0%	**44**	1%	**4945**	66%	**7439**
											0
TOTAL	**11708**	19%	**6362**	10%	**3583**	6%	**6631**	11%	**34388**	55%	**62672**

Figure 1-6

Early, Mid, & Late Seral Age Classes Outside Reserve Areas



	Ageclass	Acres
Connectivity	Early	1330
	Mid	722
	Late	1531
	Total	3583
GFMA	Early	2264
	Mid	2108
	Late	2258
	Total	6630

HUMAN USES

A. Characterization

Four human uses have come to dominate the Rock Creek watershed - timber production, recreation, fish production, and residences. Agricultural pursuits, at one time the main focus of human activity in the drainage, currently constitute a minor activity. There are no treaty rights or tribal uses in the watershed, although individual tribal members may utilize the area.

Timber production and harvest, on both federal and private lands, constitute, perhaps, the most visible use of the watershed. The first recorded sale of federal timber was in 1941, when 5.8 MMBF of fir, pine, and cedar was sold in the Millpond vicinity. Harvest levels on federal land reached a peak of 43.2 MMBF in 1988. In 1991 the harvest level had dropped to a low of 1.1 MMBF, rising to 13 MMBF in 1993.

The Rock Creek watershed, especially at the lower end, receives significant recreation use. The watershed has two developed recreation sites - Millpond Recreation Site, and Rock Creek Recreation Site, both of which are satellite areas in the North Umpqua Special Recreation Management Area (SRMA) (**see Figure 2-1**). In addition to the day-use and overnight recreation opportunity offered at these two sites, there also is some fishing (for trout only) and swimming in Rock Creek. There is significant dispersed recreation use of the watershed, mostly associated with back road driving and big game hunting. From a recreation use standpoint, this is one of the two most important watersheds in the Mt. Scott Resource Area, the other being Susan Creek.

The Rock Creek fish hatchery, near the mouth of the creek, was built in the 1920s. It was originally used for the propagation of trout, coho, and spring chinook. By the 1950s the hatchery program had expanded to include fall chinook and winter and summer steelhead. Closed for several years in the 1970s, the hatchery was refurbished and reopened in 1979.

Large-scale use of the Rock Creek watershed solely for residential purposes is a fairly recent phenomenon and is relegated to the lower reaches of the creek, primarily below Kelly Creek. Although people have lived in the drainage for thousands of years, until quite recently residency was usually tied to subsistence. Only within the last 25 years or so have a substantial number of people come to reside in the drainage while gaining their sustenance elsewhere.

B. Issues and Key Questions

Issues and questions concerning timber harvest have not been fleshed out with industry. However, industry concerns will probably include a diminishing level of harvest from federal land, environmental constraints that will effect harvest levels on private land, and increasing use of the area by recreationists.

Many people from the local area use Rock Creek watershed for their recreation pursuits - particularly the Rock Creek and Millpond recreation areas. A major issue with these people, is how these sites will be managed so that they can continue to have a high quality recreation experience when visiting these sites. The Roseburg District Resource Management Plan (1995) has identified both sites as ones which will be maintained and managed for recreation. It also recognizes that because of the intensive recreation use at the sites located within the North Umpqua Special Recreation Management Area, these areas require more intensive recreation planning and management.

An additional issue may involve those who benefit from the recreational use in the drainage, such as the

proprietors of the Idleyld store. The manager of Idleyld store says they may have seen a downturn in business with the shut down of Millpond Recreation site this year but he expects business to pick up over the coming years because the site has been improved.

Interviews with current and former hatchery employees point to the issue of deteriorated water quality in the drainage. They suggest that low summer flows, high water temperatures, and increased sedimentation have led to disease problems and the suffocation of fish. They further suggest that the closing of the hatchery in 1975 was a direct result of the temperature and turbidity problems associated with heavy logging in the preceding decade.

Those residents of the watershed who were interviewed consistently spoke of water quality and fisheries issues. There is a perception that unrestrained timber harvesting and associated road building have had a deleterious affect on water quality, resulting in a degraded fishery. Higher winter peak flows and a diminished summer flow were mentioned. Other factors mentioned as contributing to poor water quality include dispersed camping along the creek, particularly at Conley Creek bridge, and the use of off highway vehicles on dirt roads and the increased sediment load that results. Another issue is the poaching of anadromous fish at holding pools. Traffic along the main road is an issue for some, particularly those whose houses are close to the road.

C. Reference Conditions

Human use of the Rock Creek watershed can be viewed from the perspective of three general periods: 1) the period of transitory Native American subsistence use, lasting up until about 1850; 2) the period of initial, somewhat intensive Euro-american use, from about 1850 until about 1940; and 3) the current period of intensive use, revolving around timber harvesting, recreation, and residences, dating from about 1940.

The Rock Creek watershed has provided sustenance for humankind for perhaps as long as 11,000 years. Although concrete proof of such antiquity has yet to be found within the watershed, evidence of the ancient Clovis culture, dating to between 11,000 and 12,000 years ago, has been found in the Little River drainage, within five miles of the mouth of Rock Creek.

For most of the period of human use of the watershed the presence was probably transitory, geared to the extraction of seasonally available resources. The prehistoric sites thus far recorded appear to be temporary hunting and gathering camps, toolstone quarries, and temporary shelters located on and near the major ridge crests that define the watershed boundaries and provided its earliest travel routes. Not yet documented in the prehistoric record are the creek-bottom fishing localities and the long-term residential sites known from nearby areas.

Euro-american use of the watershed began around the middle of the nineteenth century and ushered in a period of more intensive, but still somewhat transitory, use. In 1855 William H. Wilson and Henry Beckley, beset by grasshopper problems in the Scotts Valley area, brought their cattle herds into the upper reaches of Rock Creek, perhaps to the Elk Meadows area, to find forage. This was perhaps the first agricultural use of the watershed.

Within thirty years of the Wilson and Beckley visit, homesteading had begun near the mouth of the creek and would eventually result in the establishment of the community of Hoaglin. Hoaglin was located several miles up Rock Creek, centered between Kelly Creek and Taylor Creek. By 1896 there were reported to be 15 families in the community, which stretched between McComas and Harrington creeks and included a school and post office. The 1901 cadastral survey plat shows structures associated with the names Harrington, J. H. Shoup, C. W. West, and P. J. Connine. Other sources indicate that the McComas and

Kelly families were in the area. These early settlements were based largely on subsistence farming, supplemented to some extent by hunting and trapping. The community of Hoaglin eventually withered away and had probably disappeared by the first decade of the twentieth century. Subsistence farming has continued, however, on a smaller scale, notably by the Rice and Taylor families.

This period also saw the initial attempts at timber and recreation pursuits. In 1892, the Bowler brothers, Fred, William, and A. R., moved a portable sawmill to Rock Creek, with the intention of developing a lumber business. At about the same time J. L. Williams attempted to turn his homestead just west of Rock Creek into a resort catering to the recreation needs of Roseburg. Neither enterprise seems to have succeeded, but they did point the way to the uses that would come to dominate the drainage.

It was during this period that the Rock Creek hatchery was developed. Beginning in 1900, several locations between Glide and Steamboat were used as hatcheries. In 1920 a trout hatchery was built on Rock Creek. In 1925 the salmon hatchery that had been operating downstream on the main river moved to Rock Creek. Except for several years in the 1970s, the hatchery has operated since then.

The modern uses of the watershed, especially timber production, recreation and residential, were largely initiated by the need for lumber during World War II. BLM's first sale in Rock Creek was in 1941 when A. C. Hink bought timber on 240 acres in the vicinity of the current Millpond Campground. He paid $4 per thousand for sugar pine, $2 per thousand for Douglas fir, and $1.50 per thousand for cedar. A short time later, Douglas County Lumber Company leased the Millpond area from BLM and built a mill. The mill continued in operation until the mid-1950s. By this time timber production, with its resulting road system, had opened up the drainage for intensive use. Recreationists began to use the area more extensively. With the development of the Rock Creek and Millpond campgrounds between 1964 and 1969 recreational use became well established. Residential use increased substantially around 1970 when the Overton property near the mouth of the creek was subdivided.

D. Current Conditions

1. Timber Production

An understanding of the current role of timber production in the Rock Creek drainage is hampered to some extent by a paucity of records. There is no single, authoritative source that defines the amount of timber produced on BLM lands during the period of intensive harvest (1941-1995). Information concerning the amount of timber produced on private lands is similarly scattered. However, an attempt has been made to quantify harvested volume on BLM land and its impact on the local job market. These data are represented in Table 2-1.

Harvest acreage figures for the years 1973 through 1993 were pulled from the Micro*STORMS database, using the variable DENUDE.DATE. An average volume figure of 66.3 MBF per acre was calculated by examining the acreage and cruised volume numbers in the prospectuses for the 29 timber sales sold in the Rock Creek drainage between 1980 and 1991. Multiplying the acreage figure by the average volume figure produced the approximate annual harvest volumes listed in the third column of Table 2-1. The annual volume figure (in MMBF) was then multiplied by nine (9) to arrive at an approximation of the number of jobs associated with timber production in Rock Creek. Nine jobs per year is the figure cited in the FEMAT report and is supported by Oregon Employment Division personnel. Finally, in an attempt to get some sense of the impact of the drainage on the local economy, the number of jobs generated by timber production in Rock Creek was divided by both the number of timber jobs and the number of total jobs in Douglas County for the years 1976 through 1993. These job figures were derived from Oregon Employment Division statistics.

Table 2-1 **Rock Creek Timber Harvest, BLM Lands**

Year	Acres	Volume MMBF	Rock Creek Timber Jobs	County Timber Jobs	Percent Contrib. by Rock Creek	Total County Jobs	Percent Contrib. by Rock Creek
1973	525	34.8075	313				
1974	334	22.1442	199				
1975	253	16.7739	151				
1976	221	14.6523	132	8,810	1.50%	32,110	0.41%
1977	334	22.1442	199	8,930	2.23%	34,010	0.59%
1978	373	24.7299	223	8,940	2.49%	35,320	0.63%
1979	118	7.8234	70	8,510	0.83%	35,060	0.20%
1980	205	13.5915	122	7,600	1.61%	36,600	0.33%
1981	288	19.0944	172	6,560	2.62%	35,390	0.49%
1982	98	6.4974	58	6,010	0.97%	33,970	0.17%
1983	243	16.1109	145	7,830	1.85%	36,240	0.40%
1984	266	17.6358	159	7,920	2.00%	38,940	0.41%
1985	603	39.9789	360	7,640	4.71%	37,530	0.96%
1986	286	18.9618	171	8,520	2.00%	39,420	0.43%
1987	416	27.5808	248	8,820	2.81%	40,730	0.61%
1988	651	43.1613	388	8,790	4.42%	41,510	0.94%
1989	137	9.0831	82	7,840	1.04%	42,160	0.19%
1990	165	10.9395	98	8,230	1.20%	40,260	0.24%
1991	17	1.1271	10	6,920	0.15%	39,150	0.03%
1992	89	5.9007	53	6,020	0.88%	37,260	0.14%
1993	196	12.9948	117	5,970	1.96%	37,720	0.31%
TOTAL	5,818	385.7334	3,472	139,860	2.48%	673,380	0.52%

An examination of harvesting on private lands from past aerial photos shows that about 27,000 acres of private land in Rock Creek (about 43% of the watershed) were harvested between 1960 and 1980 (**Figure 4-1 and Table 4-1**). This would average about 1,350 acres of land harvested per year on private. Using the above average volume figure from BLM cruised timber sales in the same watershed, this would translate to a rough estimate of 89 MMBF of timber per year coming out of Rock Creek from private lands during this period.

For federal lands the figures indicate that for the period 1976 through 1993 Rock Creek provided one out of every 40 timber jobs in Douglas County and one out of every 200 total jobs in the county. It is estimated that harvest on private lands between 1960 and 1980 provided 801 timber related jobs per year. These estimated figures seem high and should be compared with figures from other drainages to assess their validity.

At this writing 5 timber sales that fall under the Salvage Bill or Section 318 legislation have been or are being harvested (**Figure 2-2 and Table 2-2**). These sales harvest a total of about 441 acres of old growth type forests, two of which, Pleasant Plunder and Zig Zag, harvest 252 acres within the current LSR land use allocation. Three other sales, Cobble Creek, Lower Conley, and Bit of Honey, being developed under the current management plan are estimated to harvest approximately 280 acres of old growth type forests within Rock Creek.

Table 2-2 **Current Awarded and Proposed Timber Sales**

SALE NAME	UNIT #	ACRES	SUBWATERSHED
Section 318 & Salvage Sales			
Pleasant Plunder	1	30	Upper Rock Creek
	2	26	NE Fork Rock Creek
	3	8	NE Fork Rock Creek
Total		64	
Zig Zag	1	30	NE Fork Rock Creek
	2	34	NE Fork Rock Creek
	3	8	NE Fork Rock Creek
	4	72	NE Fork Rock Creek
	5	44	NE Fork Rock Creek
Total		188	
Millers View	1	20	Mill Pond
	2	11	Mill Pond
	3	21	Mill Pond
Total		52	
Pond View	1	41	Lower Rock Creek
	2	43	Mill Pond
Total		84	
Another Fairview	1	10	Mill Pond
	2	23	Mill Pond
	3	20	Mill Pond
Total		53	
RMP Planned Sales			
Cobble Creek	1	120	Rocky
Lower Conley	19 A	18	Lower Rock Creek
	29 A	94	Lower Rock Creek
	29 B	23	Lower Rock Creek
Bit of Honey	34 A	25	Lower Rock Creek
Total		280	
Bit of Honey (Comm. Thin Portion)	34 B	37	Lower Rock Creek

2. Recreation and Miscellaneous

The Millpond recreation site is located in Section 21, T25S R2W, and Rock Creek recreation site is located in Section 15, T25S R2W (**Figure 2-1**). The Millpond site is 320 acres in size, and the Rock Creek site is 160 acres with the actual area of development being much less (approximately 20 acres each). Both Millpond and Rock Creek Recreation Sites have day-use areas for picnicking and other activities. While Rock Creek Recreation Site receives only minor day-use, the Millpond Day-use Site has over 5000 visitors a summer. With its ball field and pavilion, Millpond is the District's most popular day-use area for events such as company picnics, weddings and large family reunions. It is not uncommon to have groups of 300 people or more reserving this site for these purposes on summer weekends.

Rock Creek Campground - Rock Creek Campground has 17 sites and is located along Rock Creek. The campground had 1900 visitors in 1994, and in 1995 this number exceeded 2500. Some major improvements were made to the campground in 1994 including a new water system and pump house, electrical hookup to the host site, and a new rest room. Additional renovations are planned (driveway and spur paving) for 1996. As this campground continues to be improved, additional visitor use can be expected. If the campground were full to capacity throughout the camping season, May 24 to Oct 31, capacity would be approximately 9500 campers.

Millpond Campground - Millpond Campground has 12 campsites and is also located along Rock Creek, approximately 1 mile downstream from Rock Creek Campground. The campground had 1900 visitors in 1994. In 1995 the campground was closed for the season for major renovation. This renovation project included replacement of the existing rest room in the day-use area, replacement of the campground rest rooms, paving of the campground loop road and parking spurs, new water lines, electrical upgrade to the day-use area, and revegetation of the campground and day-use area. With these improvements, use is expected to increase in 1996 and beyond. The campground is open from May to September. Maximum capacity for the campground would be approximately 5500 campers per season. This would be in addition to the 5000 annual visitors that use the Day-use area.

There is a growing need for a reservation group camping facility somewhere in the North Umpqua SRMA. There are two areas near the Millpond Recreation Site which appear to have potential for such a development. While there are no immediate plans for development of such a facility, preliminary planning should begin in the next two years.

Dispersed Camping - There are a number of undeveloped sites in the watershed (both on BLM lands and on private lands), particularly along Rock Creek which receive substantial camping use during the summer and early fall months. BLM policy is that campers may camp on BLM land in these dispersed, non-developed sites for up to 14 consecutive days.

Trails and Other Points of Interest - The only developed and maintained trails in the watershed occur at Rock Creek and Millpond Recreation Sites. At Rock Creek Campground there is a short, one-quarter mile long trail at the north end of the campground which parallels Rock Creek. At Millpond Recreation Site there are approximately one-half mile of trails, half of which are paved, with the rest being rock surfaced.

In the SE1/4 SE1/4, Section 32, T25S.R2W., there is an impressive rock arch located on BLM land. There is road access to within one-half mile of the arch. While it is a relatively easy hike from the end of the road into the arch, there is no developed trail.

Driving For Pleasure - Rock Creek Road provides major access not only for logging, but also for a back country tie route to Cottage Grove to the north, and to Canton Creek to the east. The Kelly Creek road up to Scott Mountain and the tie road to Gassy Creek are also extensively used by back country travellers.

The main access route into this watershed is up Rock Creek road. This road begins as County Road No. 78 for the first mile before becoming a BLM controlled and maintained access road. Rock Creek road takes off from State Highway 138 approximately one mile east of Idleyld.

The Off Highway Vehicle designation in this watershed is "limited" to existing roads and trails.

ROS (Recreation Opportunity Spectrum) Classification - The ROS classification of the Rock Creek watershed is "Roaded Natural". This is characterized by a generally natural environment, but one which is roaded and also has other significant evidence of the sights and sounds of man.

VRM (Visual Resource Management) - All of the Rock Creek watershed is classified VRM IV with the exception of the area within a quarter mile of Millpond and Rock Creek Recreation Sites. These two areas are classified as VRM II. The VRM II classification is fairly restrictive in terms of landscape alteration with its objective being to retain the existing character of the landscape. The VRM IV classification, on the other hand, is less restrictive, and the objective of this classification is to allow management activities which may result in major modification of the existing landscape.

Hunting and Fishing - The Rock Creek drainage receives heavy hunting pressure in the fall. Deer and Elk are the primary species hunted, but there is also some hunting pressure for other big game animals such as cougar and bear. The Rock Creek campground has been left open through the deer hunting season for the past two years, in response to a specific request by hunters to leave this particular site open later in the season for their use during the hunting season.

Rock Creek receives limited fishing pressure from fishermen angling for trout. The stream is closed to salmon, steelhead and cutthroat fishing.

Rock Creek Fish Hatchery - This state run fish hatchery is located in Section 1, T26S R3W. The hatchery has been in use since the early 1900's and is one of 30 hatcheries operated by Oregon Department of Fish and Wildlife. Each year Rock Creek Hatchery produces the following: 312,500 North Umpqua Spring Chinook; 100,000 South Umpqua Fall Chinook; 140,000 North Umpqua Coho; 168,000 North umpqua (wild) Summer Steelhead; 88,000 South Umpqua (wild) Winter Steelhead; 57,000 Rainbow legals; and 35,000 Rainbow for high lakes.

Miscellaneous Sites - The BLM road maintenance shop is located along Rock Creek road between the Rock Creek and Millpond recreation sites in Section 21, T.25S R.2W. At the extreme west end of the Rock Creek watershed is Mt. Scott. At nearly 4000 feet Mt. Scott is the highest point in the vicinity, and is a prominent landmark in the area valued for sight-seeing and driving for pleasure. At the top of the mountain on private land is a major communication site.

Residents - There are currently about 40 property owners along the lower portions of Rock Creek, with perhaps 30 of them in residence. Most of the residents have come in the last 25 years and have properties that range in size from less than an acre up to 10 acres. An exception is the Taylor family which has been farming and logging in the drainage for 70 years and currently has 240 acres. Although there may be the potential for further subdividing a few parcels in the lower portion of the creek, most of the drainage is classified as timberland, requiring 160 acres per dwelling. This designation, while not preventing further residential development, will certainly curtail it.

E. Synthesis and Interpretation

Change within the Rock Creek watershed was slow for thousands of years. Population increases and climatic shifts led people from a wide-ranging, big-game hunting tradition to a lifestyle that emphasized

salmon fishing and localized plant gathering.

During the nineteenth century the pace of change quickened as Euro-american cultural practices displaced aboriginal practices. Initially focused on agricultural pursuits, these practices would eventually include industrial, recreational, and residential activities.

Spurred by the need for lumber, timber production has become the single largest agent of change in the Rock Creek drainage. Although providing a substantial number of jobs and contributing heavily to the local economy, timber production has also been associated with increased erosion, degraded water quality, reduced fish populations, and diminished wildlife habitat.

The road system associated with timber production has also contributed to increased recreation use and the eventual developments at the Millpond and Rock Creek campgrounds. These developments have not only brought an influx of recreationists, but have also concentrated them in two relatively small areas. The vegetative composition has been altered at the campgrounds. The net result is that the areas encompassed by these recreation sites no longer support the wildlife populations they did before the development of these sites, nor do they function as typical riparian areas. The swimming and wading that occurs in Rock Creek at these two recreation sites as well as the associated bank erosion may have some minor negative effect on the aquatic system. This needs to be weighed against the significant positive benefit from recreation.

Changes in the larger society related to such things as improved transportation networks, enhanced job opportunities, and broader lifestyle choices have allowed for increased rural residency without the need to gain sustenance from the landscape. A rural lifestyle has become a matter of choice rather than necessity, bringing people with opposing values to the drainage. Whereas people were once drawn to Rock Creek solely for purposes of natural resource extraction, they are now increasingly drawn for reasons of seclusion and natural resource conservation, leading inevitably to conflicts over the proper use of those natural resources.

Figure 2-1

No warranty is made by the BLM for use of the data for purposes not intended by BLM

Rock Creek Human Uses

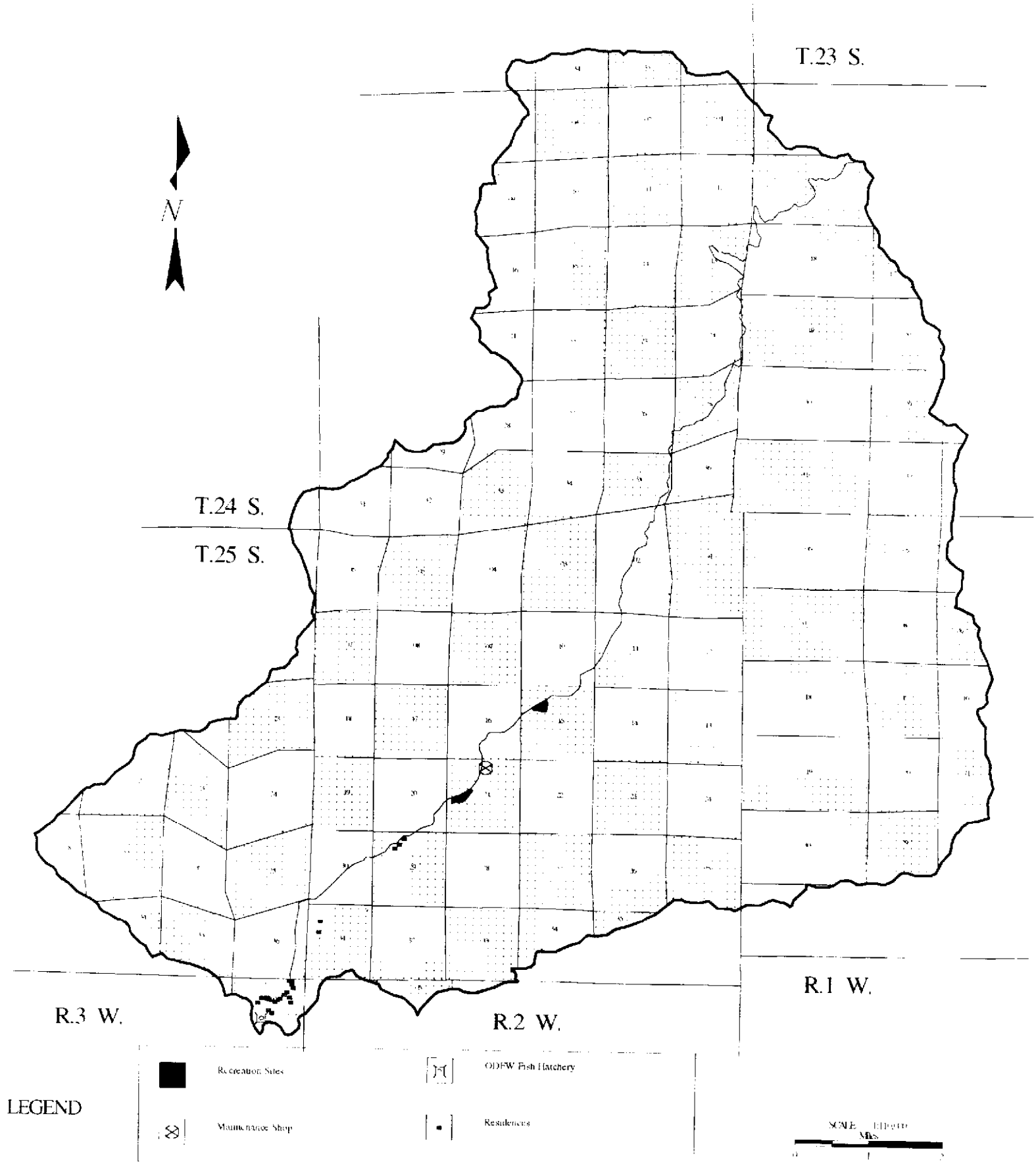
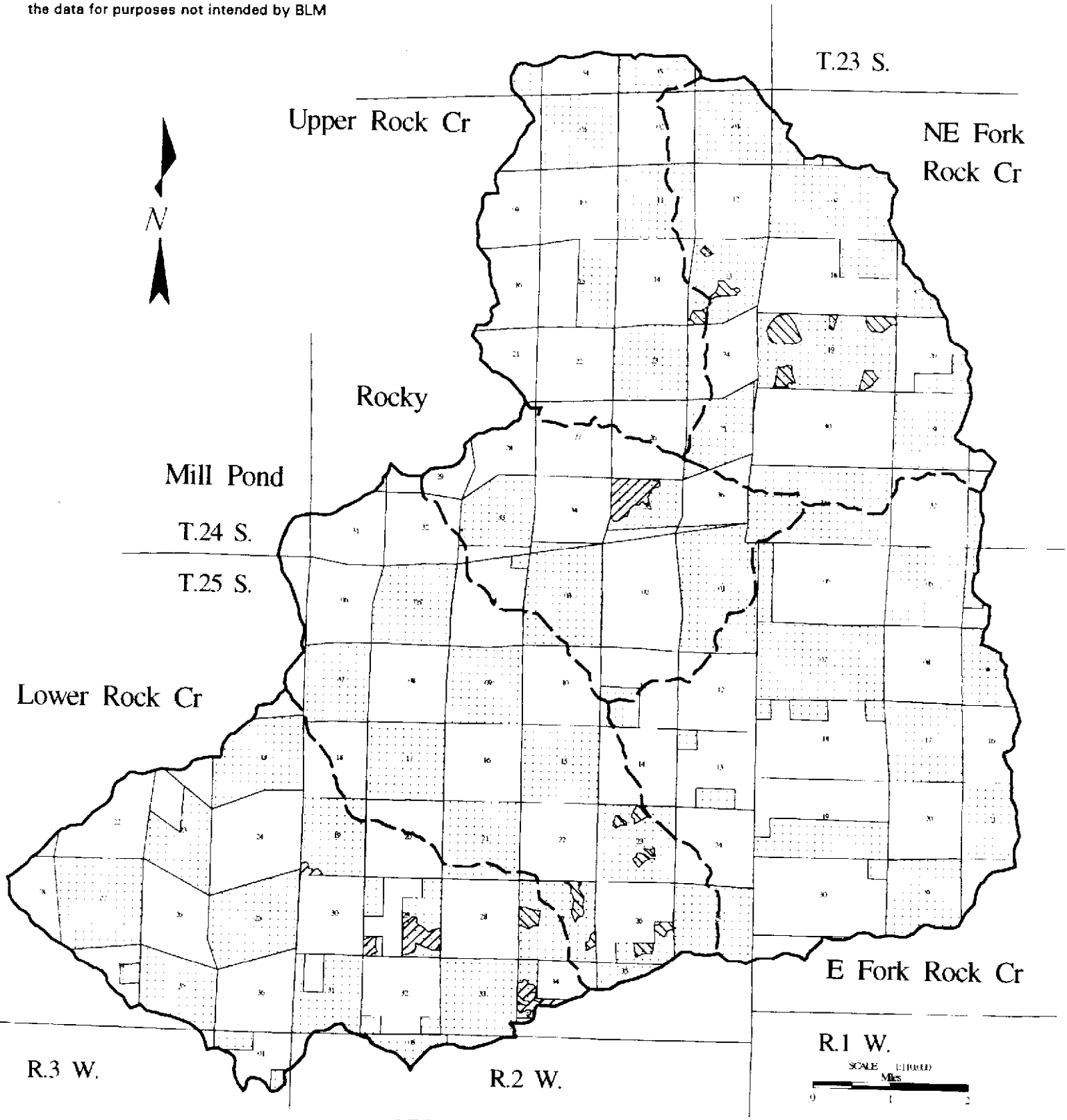


Figure 2-2

Current Awarded & Proposed Timber Sales

No warranty is made by the BLM for use of the data for purposes not intended by BLM



LEGEND

Sold/Awarded 1990/1991 Sales

Proposed Forest Plan Sales

Table 2-2 **CURRENT AWARDED AND PROPOSED TIMBER SALES**

SALE NAME	UNIT #	ACRES	SUBWATERSHED
Pleasant Plunder	1	30	Upper Rock Creek
	2	26	NE Fork Rock Creek
	3	8	NE Fork Rock Creek
Total		64	
Zig Zag	1	30	NE Fork Rock Creek
	2	34	NE Fork Rock Creek
	3	8	NE Fork Rock Creek
	4	72	NE Fork Rock Creek
	5	44	NE Fork Rock Creek
Total		188	
Millers View	1	20	Mill Pond
	2	11	Mill Pond
	3	21	Mill Pond
Total		52	
Pond View	1	41	Lower Rock Creek
	2	43	Mill Pond
Total		84	
Another Fairview	1	10	Mill Pond
	2	23	Mill Pond
	3	20	Mill Pond
Total		53	
PLANNED SALES			
Cobble Creek	1	120	Rocky
Lower Conley	19 A	18	Lower Rock Creek
	29 A	94	Lower Rock Creek
	29 B	23	Lower Rock Creek
Bit of Honey	34 A	25	Lower Rock Creek
Total		280	
Bit of Honey (Thin Portion)	34 B	37	Lower Rock Creek

VEGETATION

A. Historical Perspective and Reference Conditions

In order to develop an understanding of the natural processes that have contributed to the current conditions found in the forests in the Rock Creek watershed, we have reconstructed what the area would have looked like in the mid-1930's, prior to man's first major impacts. We have used several sources of information during this process, combining and comparing data to achieve an approximate picture of historical conditions.

Although there were no comprehensive forest surveys done in this region prior to the mid 1940's, there are some maps, dated 1936, available from the USFS that give general descriptions of forest types in Douglas County in terms of diameter class and species (**Figure 3-1**). Although the scale of these maps is large and detail lacking, the information they present can be interpreted directly with caution, or used to give an overview or a larger perspective of the surrounding geographical area. Information in these maps can be used to fill in gaps found in more recent and more accurate data.

During the 1940's, forest inventories had begun to be conducted in this region, and data for stand diameter class and average age was available at a much finer resolution than previously available. The maps generated from this data represent information on harvesting and minor species as well as descriptions of the existing dominant tree species. By the time these maps had been generated, however, substantial human activity had already begun in the watershed, and information about the ages of those stands prior to harvesting was not available. This data is presented in **Figure 3-2**.

In the late 1950's, a detailed forest composition map had been created for this watershed. Information on public and private lands was documented such as diameter class, stocking rate, major and minor species percentages, age, prior history such as deforestation by fire or insects, planting and harvest method. Plot sizes of as little as 10 acres were typed individually. These maps were kept by Bureau offices in individual resource areas as interesting historical documents, but never transferred into GIS imaging systems. This data was used as a quality-check for the final reconstructed maps and is not presented in this document.

Another method that was used to 'recreate' past vegetation structure makes use of the current stand age and diameter descriptions found in the Bureau's forest operations inventory. Individual stands can be regressed with the help of computer programs to simulate conditions as they would have been at the time of the earliest USFS maps, about 1936. At this time, there had as yet been no human activity in the form of timber harvesting in the drainage, and stand conditions may be taken to represent a 'natural' condition.

Using the early USFS maps and forest inventory information from 1948 and 1956 maps as well as historical information about the location and frequency of lighting strikes and past fire history (**Figure 3-3**), missing pieces of information in the regressed model (for stands harvested since 1936) can be filled in and an image of stand conditions in 1936 was constructed (**Figure 3-4**).

Conditions described in this image were used to approximate historical or natural conditions found in the watershed. The 'natural range of conditions' can only be approximated, however, as no 'real' information exists to describe the condition of the watershed prior to this time and the processes that created this landscape. Some inferences can be made, however, from cruise information from past harvest units on diameters of older, residual trees, amounts and sizes of down wood and understory development. Descriptions of soil types and aspects also give clues to vegetation history. This information helps to create an historical view of the types of processes working in various portions of the watershed and the resulting timber and vegetation types.

For instance, information from the reconstructed maps and cruise data seems to indicate that there were at least four general regions in this watershed which tended to have different fire histories and thus developed stands which are markedly different in structure.

As can be seen in **Figure 3-4**, the first region, located in township S24 W01, is a dry, rocky ridge system at elevations of about 3000 feet. It was characterized by a mixture of mid- and late-seral habitat with very low canopy closure. This area experienced one major fire around 1914 and no other major fires have occurred since then, although lightning strikes have been frequent along the high points. The 1914 fire was apparently not predominantly a stand replacement event. Many residual trees with birthdates in the 1800's still exist in this region. The trees are old, but do not have very large diameters (they are still typed as the same diameter class now as they were in 1936) and are very slow growing due to the soil type, slope and elevation. Unentered stands of older trees currently have less than 10% average canopy closure and poorly developed understory structure. This is consistent with a fire history which is characterized by partial replacement and understory burning, occurring at a low fire return interval. The surviving trees have very dense wood and the few snags that have developed since the fire are small and hard but typically persist in the stand until windthrown. New plantations in this region experience stress from soil moisture loss in summer. The region in general is low in productivity and the plant community is restricted mainly by temperature and water availability.

A second region that can be seen on the earlier maps is located along the South and SE boundaries of the watershed. This is also a ridge system, dividing the Umpqua River frontal drainages from the Rock Creek watershed. Mace Mountain and Old Fairview Peak dominate the crest. Fires here have been relatively frequent and extensive (one deforested area caused about the time of the 1936 map is visible as well as another fire event just before 1948). Stands in this region, in any time period, are of several age classes, but within-stand ages are uniform and indicate that stand-replacement events have been common in the past. A few areas that are currently typed as 200+ years old have apparently survived the fires and persist as older seral, multi-canopy stands in the same locations where late seral stands were described in the past, predominantly on north-facing slopes. Lightning strikes are very frequent along this ridge and fires generated on the dry, south-facing slopes of the Umpqua drainage to the south have burned up over the ridge and down into this watershed. It appears that the fire return interval for this area may have been about every 20 years in the past. Since the advent of fire suppression in the 1950's however, some mid-seral stands in this region have begun to develop multi-canopy structure and understory vegetation such as rhododendron and other fire-type shrub species. Soil types here are deeper and richer than in the northern rocky area, however down wood amounts are moderate and site productivity is average. It appears that the proportions of various seral stages in this region at any given time may have been roughly even, with the older seral stands persisting in lower elevation sites along the riparian system and on sheltered, north-facing slopes.

A third region, somewhat similar in nature to this one, is located along the south-west border of the watershed, on the east and south slopes of Scott Mountain. Stands in this region are of several age classes, and even-aged stands are common. More mid-seral stands here contain remnant old growth trees than those found in the south-eastern region, however, suggesting that fires here were either smaller in extent or were not stand replacement type fires. Lightning strike frequency is moderate here and soil types are generally deep and moist. It may be that fires in this area originated on the drier, south-facing river frontal slopes and burned over the ridge. Although there have been some stand-replacement events here, there is also evidence of partial burns and underburns. Some older stands currently have less than 10% canopy closure but old growth stands over 200 years of age in the area appear to have remained untouched for some time. Large amounts of down wood are found on the forest floor in these stands and snags are common. Canopy structure is well developed in several layers and shrub and ground cover species are not predominantly fire types. In general, the region displays a variety of stand types reflecting a wide variety in fire intensity and frequency acting on an area with good site productivity.

The fourth and largest region composes the remainder of this watershed. This region was once a part of a very large tract of uninterrupted old growth extending from Rock Creek westward through the eastern half of the Calapooya drainage. The 1936 USFS map illustrates this area as composed of trees over 40" in diameter. Although this may be an exaggeration, cruise information shows that many trees in harvested stands in this area were indeed that large. There is no recorded history of large fire events in this region and lightning strike activity is very low. Natural stand regeneration seems to have been the result of small areas of blow-down, small fire events, forest pathogens and other natural processes which created small patch openings within the matrix of old growth timber. Unentered stands in this area typically show large accumulations of woody debris in all size classes and well developed, multi-canopy structure. Although this region is located in the Western Hemlock zone, most of the forests have not reached the climax condition where this species predominates. Although many stands are typed as having hemlock as a secondary species, most stands are composed primarily of Douglas fir. Given enough time in an undisturbed situation, the shade-tolerant species such as hemlock and red cedar will eventually replace the Douglas fir as the dominant species. Evidently, there have not been enough small disturbances or enough time simply has not passed for this transition to climax forest type to occur. There are some areas along the main stem of Rock Creek that have historically been composed of younger seral stands, including areas of mixed conifer-hardwood composition, possibly due to meandering and changes in course taken by Rock Creek over time.

Analysis of different parts of this reconstructed forest can help to show how historic processes have contributed to the overall ecosystem. Riparian age class condition, for instance, can be approximated for 'natural' conditions by superimposing a given distance (in our analysis we used one site potential tree height, 180 feet) from the stream system and then examining the proportions of various age classes found in stands within this riparian area for various drainages or subwatersheds. This information helps to explain the historic contribution of large woody debris to the stream channels. This leads to an understanding of the channel conditions that may have helped to create the fishery and aquatic ecosystems in which the native populations of organisms developed.

B. Current Vegetation Age Class Distribution

The general change in age class distribution that has occurred since 1936 can be described as a shift from a watershed predominantly (97%) in old growth condition with smaller, localized areas of younger stands within it to a watershed with 25% of the landscape remaining in small patches of trees over 80 years in age, isolated in a matrix of young to mid seral-aged stands (**Figure 3-5 and Table 3-2**).

1. Late Seral Habitat and Old Growth - 80+ years and 120 years

Late seral habitat can be divided into two age classes which represent different levels of development of old growth characteristics. In general, stands between 80 and 120 years of age in this watershed contain vigorous, mature trees with diameters over 20", some understory development and moderate amounts of snags and down wood. These types of stands are described in the Forest Plan ROD as being in the maturation stage. Currently 2% of the watershed is in this age class.

Stands with ages over 120 years typically contain large trees with open, irregular crowns and thick, furrowed bark. The broken, dead and decayed portions of these trees provide habitat niches for many of the old growth dependent species of plants and animals. Large snags are common in stands of this age and down wood is generally abundant. Stands in this age class provide refugia for many threatened and sensitive species and provide the major contribution of coarse wood recruitment to stream channels. This stage is referred to as the transition stage. This stage may persist for up to 600 years depending on site

conditions. Currently 23% of the watershed is in this age class. One major deviation from this general age class description occurs in the north eastern portion of the watershed where site conditions are poor and fire history together with poor growth rates results in old stands (over 200 years) with relatively small average diameters (20-30" DBH) and poor stand development. The old trees in this region do not have the structure typically found in stands of this age. Canopy closure is often less than 10% in these stands and they function more like maturation stage stands.

The distribution of late successional habitat is such that patches in the matrix are separated from those in the LSR by more than a mile and from each other by lesser distances. The majority of late successional habitat (LSH) occurs on federal ownership. Approximately 500 acres of this age class remains on private lands. Habitat is continuous between corners of adjacent sections only in five of forty-five cases.

During the past several decades, there has been a shift in the distribution of this age class towards an increased proportion of occurrence on moderate to steep slopes due to the past history of harvesting on the gentler slopes. As a consequence, much of the historically persistent old growth on low, moist sites has been converted to younger seral stage stands and the remaining old growth stands on the drier slopes are at risk due to catastrophic fire.

In order to move in the direction of the 'natural range of conditions' in this watershed, the remaining stands with late seral characteristics must be protected. Late seral stands that occur in areas with historically high fire return intervals should be buffered from adjacent highly flammable young stands or otherwise treated to protect them from fire damage. What volume that is taken out of these stands must not reduce their nature or their productivity. The natural processes resulting from the variety of species of plants and animals occurring in these old stands will be essential for maintaining this ecosystem through the next several decades and populating newly developing stands in the vicinity.

2. Mid Seral Habitat - 40-80 years old

There is currently a lack of second growth stands between the ages of 40-80 years. The watershed of the 1930's apparently contained the same amount of acreage in this age class as it does today and the distribution of these acres is roughly the same as it was then. The scale of the early maps often made it difficult to describe small patches of regeneration within the larger stands of old growth, however, and today's forest inventory records may show that an area which had been harvested was all one age when only the average age of the dominant trees was actually recorded. Both of these types of errors inherent in the data could conceal large numbers of acres of younger seral inclusions, which were the predominant method for regeneration in historic times. Thus there may well have been a much larger proportion of this age class in the past.

Stands of this age are mostly located on private ownership. Stands on federal lands that have reached this age are frequently targeted for commercial thinning harvests. This has the effect of accelerating tree growth by removing competition. The objective of accelerating the development of LSH is often referred to when conducting treatments of this kind, especially in riparian and other reserve areas to enhance connectivity.

3. Young Second Growth - 16-40 years

An important future concern is related to the large tracts of younger second growth stands planted since 1950 which account for almost 50% of this watershed. Most of these early harvest areas were planted only with Douglas-fir creating a more simplified genetic structure (a monoculture type stand). Other conifer species (ie. cedar, pine) and non-commercial type species (ie. hardwoods) persist from natural seed sources where they existed. As a result the types of organisms these forests support in coming years may be more simplified and less diverse than their previous old growth predecessors. The young stands in the past

usually occurred through smaller openings in the forest canopy. The species richness in the surrounding habitat usually replaced what was lost. The lack of structural diversity typical of even-aged stands further limits the species richness.

Some of these early plantations were direct seeded or planted from questionable seed sources (ie. unknown seed sources, off-site sources, or sources lacking in genetic diversity). Usually, in naturally occurring stands genetic material from hundreds of trees and plants in the vicinity contributed to the regeneration. Only in conditions such as large severe forest fires, resulting in limited seed sources, would naturally occurring stands develop with such limited genetic diversity. Current stands that have developed with limited genotypes and lack of species diversity may have less resistance to epidemic disease and insect attacks.

4. Early Seral Stage - 0-15 years old

Approximately 18% of the watershed currently is in early seral stages known as grass/forb and shrub stages. Typically, these are regeneration harvest units that have been restocked with nursery seedlings from various sources. They may contain various amounts of hardwood species, either as residual trees from the previous stand or as new growth. Residual conifer components vary with the type of treatment used during harvest. In general, few if any residual old growth conifers remain on private harvest units. On federal lands, harvest prescriptions in the past ten years have required an average of 1.2 green trees per acre to be retained. However, many of these green trees were subsequently lost from the units due to slash burning and windthrow. The resulting new stands have a minimal number of residual old growth type trees.

C. Special Status Plants

The Rock Creek watershed contains 48% BLM administered lands of which a significant portion of federal lands (~35%) has been previously surveyed for special status plants. Some surveys are old (greater than 10 years) and the importance of some species has changed over time with different management significance. The Roseburg District Resource Management Plan has identified several species (both vascular and nonvascular) that will require management and protection of known sites and protection buffer on other species as they are identified. District knowledge and expertise on the identity and/or presence of the nonvascular species is very limited. Site specific surveys by District personnel or qualified outside sources for these and other species (see chart below) is recommended before any ground disturbing activities. One known strategy 1 and 2 species, Allotropa virgata (Candystick), is located in T. 24 S., R. 1 W., Section 29. **Figure 3-6** shows the location of this and other known sites of special status plant species. Much of the habitat that would represent suitable areas for special status plants that has not had previous surveys are currently in exclusion areas. Surveys would need to occur during the blooming periods of any special status plant.

The following is a list of survey and manage and protection buffer species that may occur in this watershed. The number beside the plant name refers to the ROD page number and the survey strategies required:

		Page No.	Strategy
Fungi:	Oxyporus nobilossimus	C54	1,2,&3
	Rhizopogon truncatus	C49	3
	Cantharellus cibarius	C51	3&4
	Cantharellus subalbidus	C51	3&4
	Cantharellus tubaeformis	C51	3&4
	Gautieria otthii	C49	3
	Otidea leporina[1]	C54	3

	Otidea onotica[1]	C54	3
	Otidea smithii[1]	C54	1&3
	Aleuria rhenana[1]	C54	1&3
Liverworts:	Marsupella emarinata (var. aquatica)	C59	1&2
	Ptilidium californicum	C59	1&2
Lichens:	Pseudocyphellaria rainierensis	C56	1,2,&3
	Hypogymnia duplicata	C56	1,2,&3
	Nephroma occultum	C56	1&3
	Usnea longissima	C57	4
Vascular Plants:			
	Allotropa virgata	C60	1&2
	Cypripedium montanum	C61	1&2
	Cypripedium fasciculatum	C61	1&2
	Aster vialis	C60	1&2
	Bensoniella oregana	C60	1&2
Bryophytes:	Buxbaumia piperi[1]	C58	1&3
	Buxbaumia virdis[1]	C58	1&3
	Rhizomnium nudum[1]	C58	1&3
	Ulota meglospora[1]	C58	1&2
	Tetraphis geniculata[1]	C59	1&3
	Brotherella roelli	C58	1&3
	Ptilidium californicum[1]	C58	1&2

[1] Indicates species to be protected through protection buffers, Appendix H, Table H-2, page 187

No data on special status plants has been obtained on private lands but could be obtained at a future date from the Oregon Natural Heritage program database.

Other species of concern (noxious weeds) data has been obtained from the Department of Agriculture but it is very broad based. However personal communication with Ken French (1995) of the Oregon Department of Agriculture has provided some of the following information. A significant population of Spanish Broom (Cytisus multiflorus) and French Broom (Cytisus monospessulanus) is located in T. 26 S., R. 3 W., Sections 1, 2, 11, and 12 at the very southern end of this watershed along the North Umpqua River. These populations appear to be located on both private and public land. In addition there are infestations of Scotch Broom (Cytisus scoparius), Tansey ragwort (Scenecio jacobaea), Musk Thistle (Cirsium arvense), and St. John's wort (Hypericum perforatum) along most major road systems in this watershed (**Figure 3-7**). Most heavily travelled roads along with river and stream corridors have one or more of these weeds present. Their infestation is so heavy and widespread that cost effective and successful control and/or eradication has been deemed impossible. Some mechanical control (roadside mowing) and biocontrol (seed weevil) has been attempted on Scotch Broom but it's success will have to be determined at a later time.

Figure 3-1

1936 USFS Habitat Types

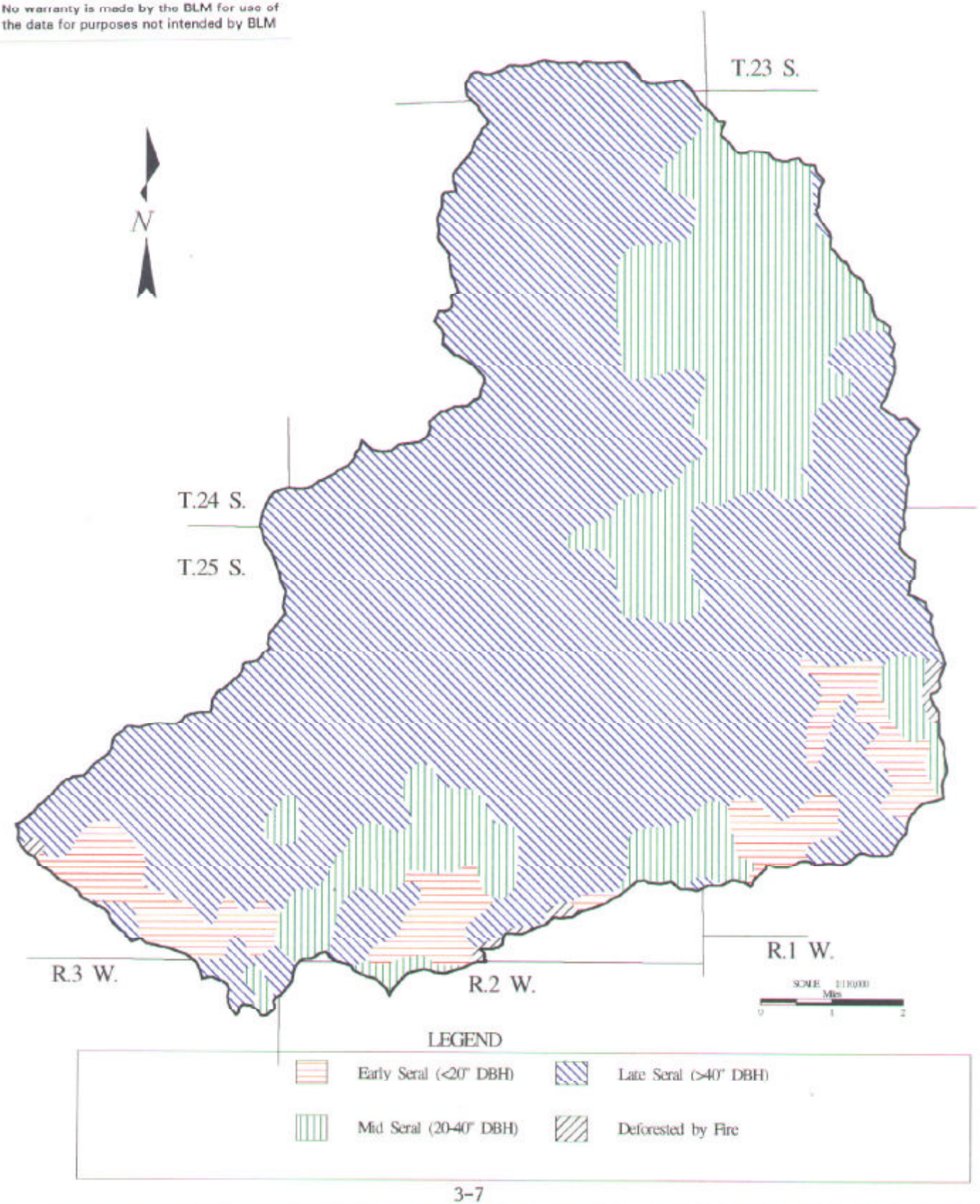


Figure 3-2

1948 USFS Habitat Types

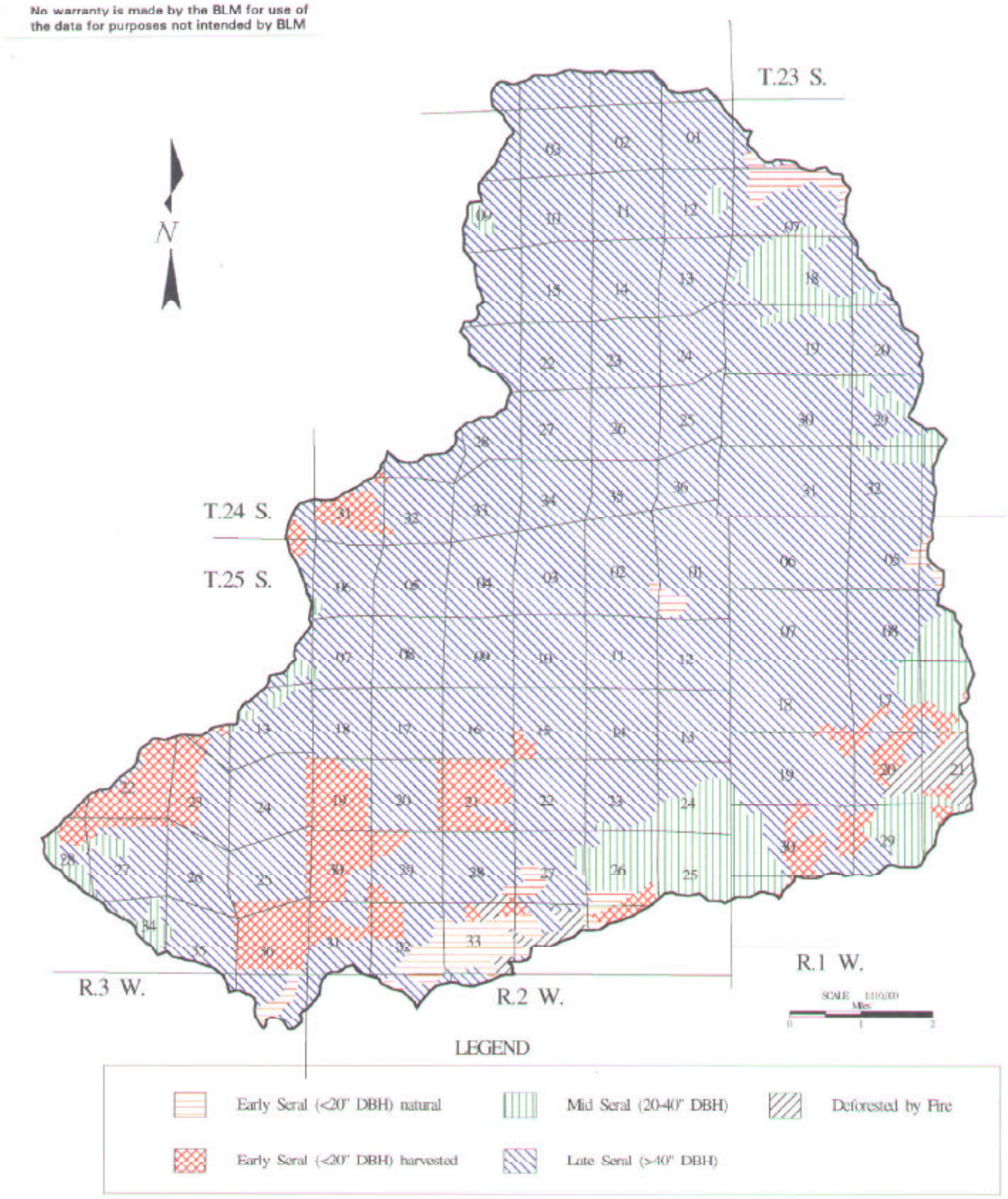


Figure 3-3

Rock Creek Fire Starts 1980 – 1995

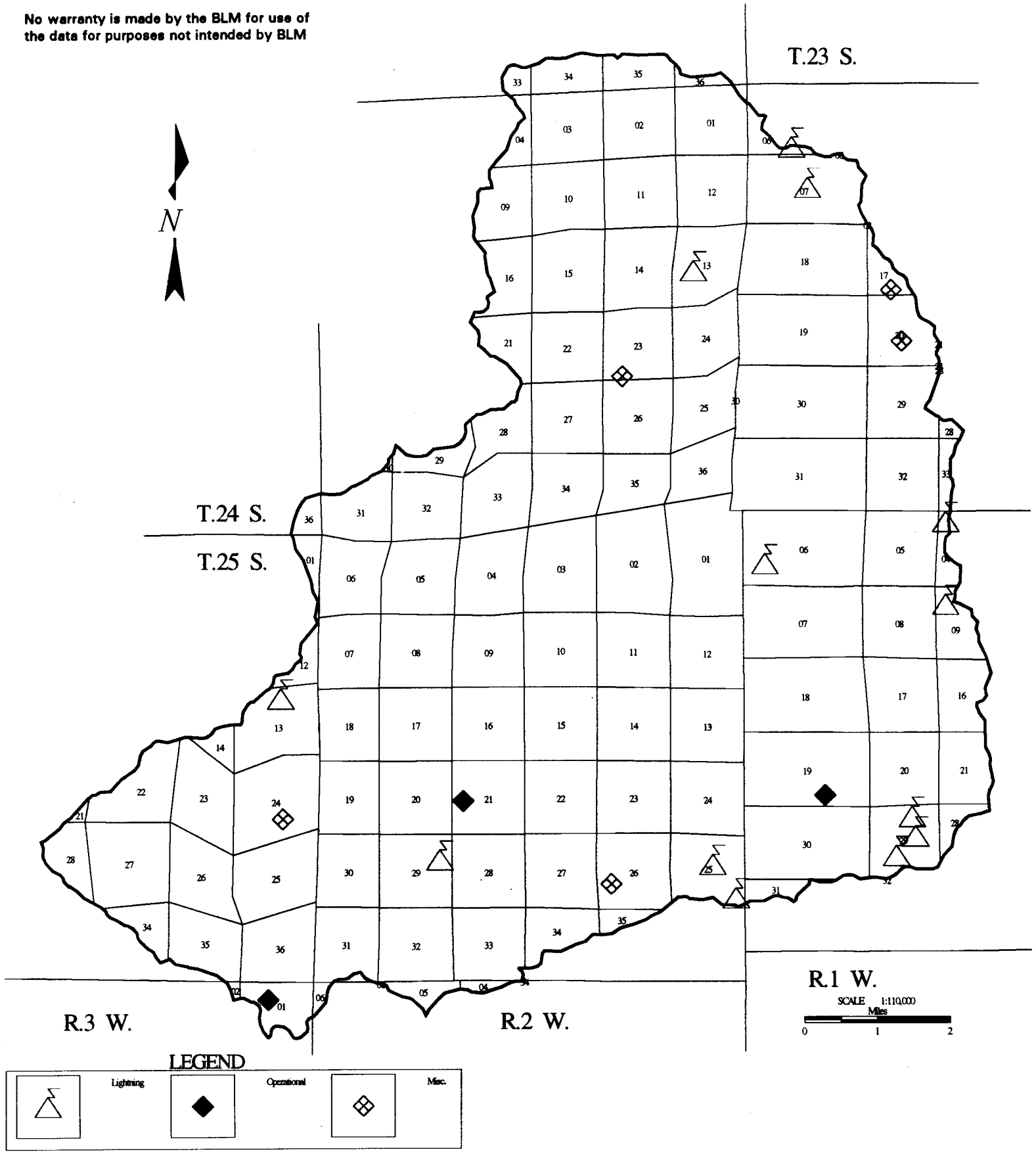


Figure 3-4

1936 Regressed Vegetation Age Classes

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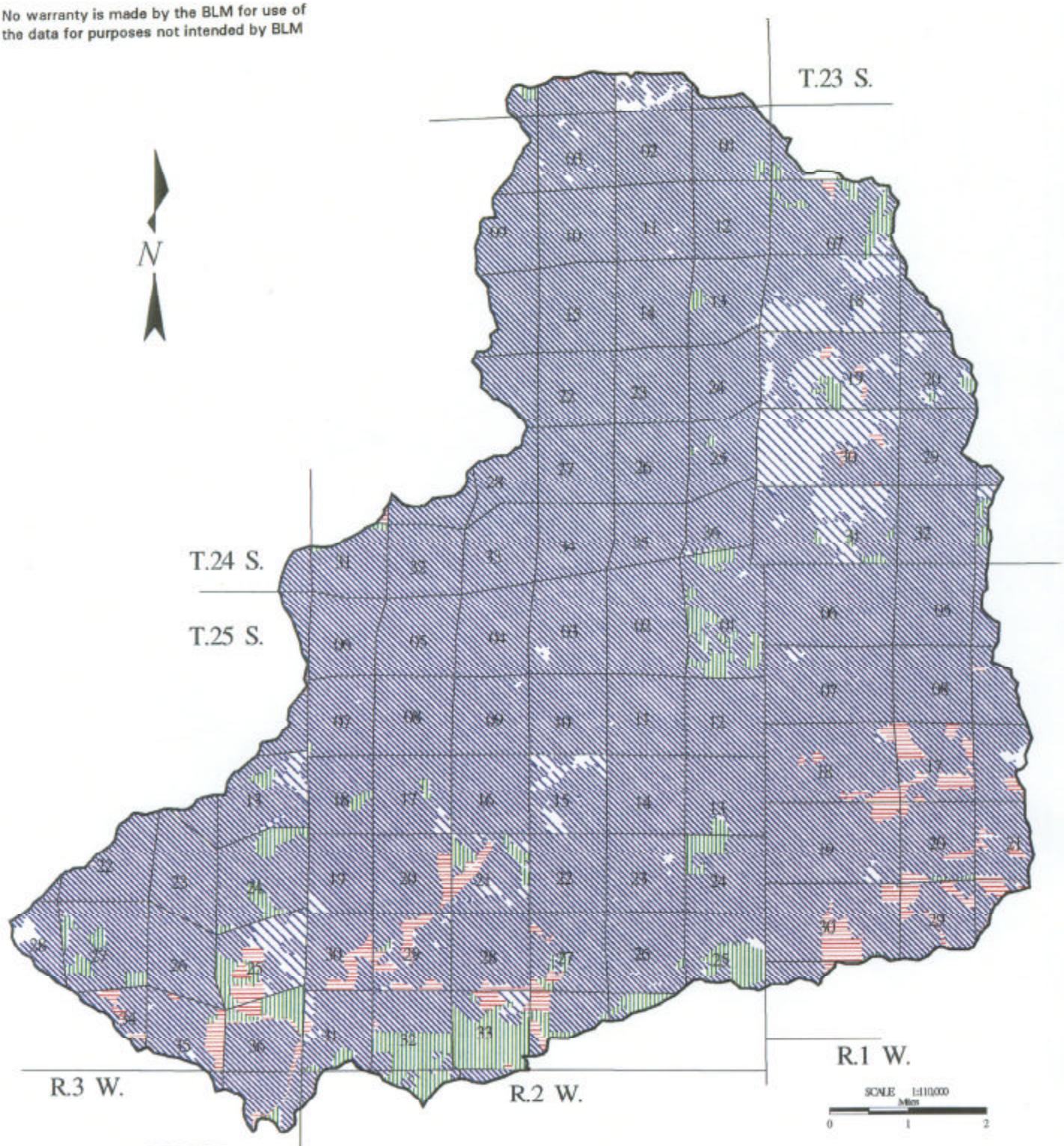

Table 3-1

EARLY, MID, & LATE SERAL AGE CLASSES

(REGRESSED TO 1936)

DRAINAGE	Age classes 0-40	%	41-80	%	80+	%	TOTAL ACRES
COUGAR CR	185	10%	28	2%	1640	88%	1853
EAST FORK	169	7%	0	0%	2200	93%	2369
LOWER EFK	0	0%	73	7%	915	93%	988
MACE CR	76	4%	29	1%	1904	95%	2010
NORTH FORK	14	1%	0	0%	1853	99%	1867
SURPRISE CR	0	0%	0	0%	1604	100%	1604
UPPER EFK	0	0%	0	0%	1919	100%	1919
WAPITI CR	46	3%	0	0%	1588	97%	1634
TOTAL EF ROCK CR	491	3%	130	1%	13623	96%	14244
CONLEY CR	55	3%	127	7%	1661	90%	1843
HIATUS CR	65	6%	141	13%	845	80%	1051
KELLEY CR	2	0%	163	5%	2952	95%	3117
MCCOMAS CR	185	6%	64	2%	2636	91%	2885
MILL POND	55	4%	0	0%	1169	96%	1224
TAYLOR CR	107	4%	93	3%	2501	93%	2701
TOTAL FOR LOWER ROCK CR	468	4%	588	5%	11764	92%	12820
HARRINGTON CR	15	0%	18	0%	4783	99%	4816
MILLER CR	1	0%	7	0%	2252	100%	2259
ROCK CAMP	0	0%	0	0%	850	100%	850
ROCK REC	0	0%	0	0%	585	100%	585
SHOUP CR	50	3%	28	1%	1846	96%	1923
WOODSTOCK CR	0	0%	6	0%	1283	100%	1289
TOTAL FOR MILL POND	65	1%	59	1%	11599	99%	11723
BLUFF CR	0	0	0	0%	1539	100%	1539
HUCKLEBERRY CR	0	0	0	0%	1477	100%	1477
NE FORK	0	0	0	0%	539	100%	539
UPPER NE FK	0	0	0	0%	822	100%	822
UPPER T	0	0	0	0%	1909	100%	1909
ZIG ZAG CR	37	0	0	0%	3347	99%	3384
TOTAL FOR NE FK ROCK CR	37	0	0	0%	9633	100%	9670
COBBLE CR	0	0	0	0%	1404	100%	1404
CROSSROADS CR	0	0	0	0%	1037	100%	1037
GRAVEL	0	0	0	0%	803	100%	803
PEBBLE CR	0	0	0	0%	1227	100%	1227
STONEY CR	0	0	0	0%	2318	100%	2318
TOTAL FOR ROCKY	0	0	0	0%	6789	100%	6789
DISAPPEARING CR	4	0	0	0%	2606	100%	2610
RUBBLE CR	0	0	0	0%	2807	100%	2807
TWIN CEDAR CR	0	0	0	0%	2023	100%	2023
TOTAL FOR UPPER ROCK CR	4	0	0	0%	7436	100%	7440
TOTAL BY AGE CLASS	1065	0	776	1%	60843	97%	62685

02/02/96REGVEG.WK4

Figure 3-5

Current Vegetation Age Classes

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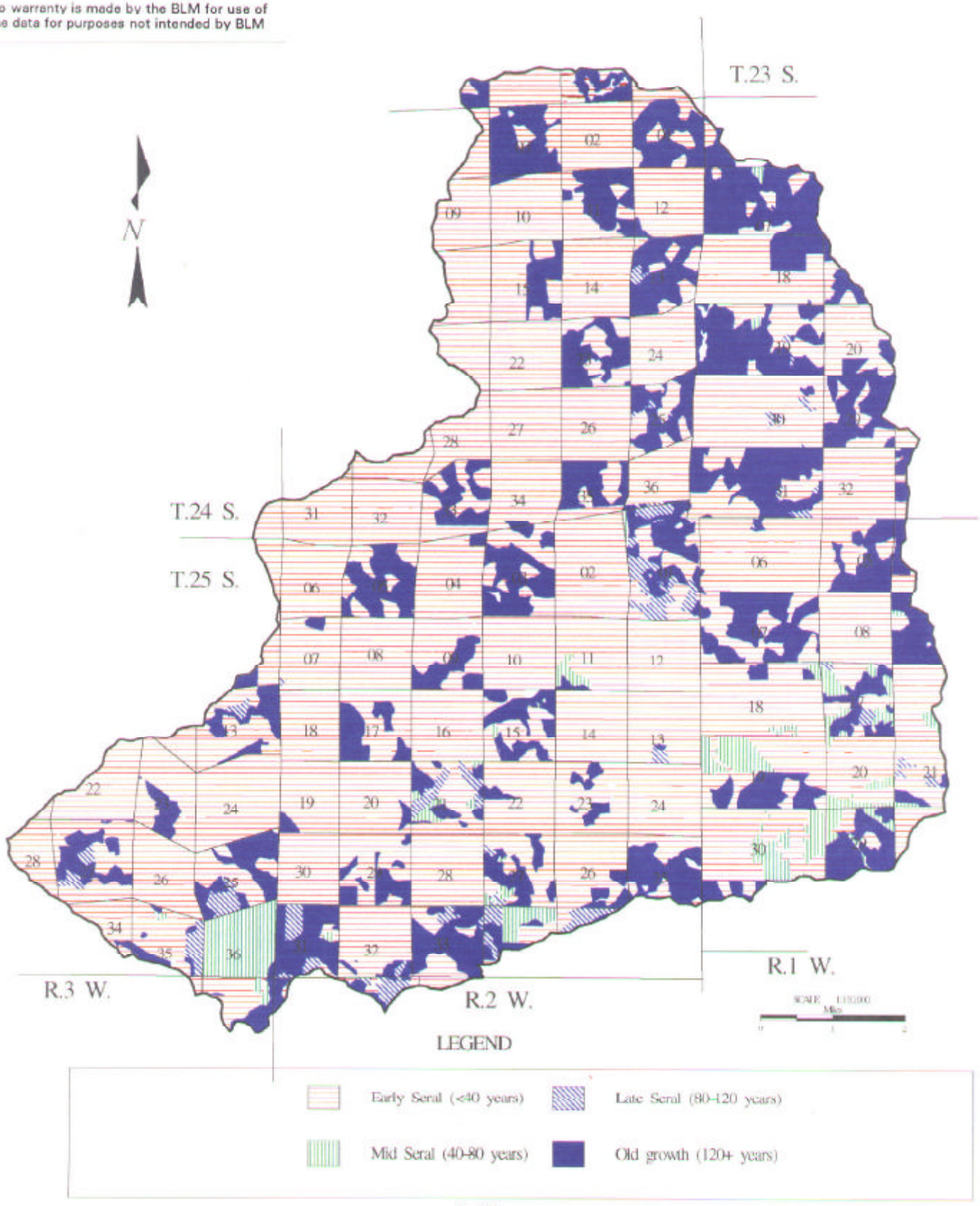

Table 3-2

1995 Early, Mid, & Late Seral Age Classes

	Early Seral		Mid Seral		Late Seral				Total
DRAINAGES	0-40 yrs	%	40-80 yrs	%	80-120 yrs	%	120+ yrs	%	Acres
COUGAR CR	690	37%	580	31%	6	0%	577	31%	1853
EAST FORK	1900	80%	213	9%	64	3%	192	8%	2369
LOWER E FK	952	96%	17	2%	0	0%	17	2%	987
MACE CR	1471	73%	130	6%	26	1%	382	19%	2009
NORTH FORK	1491	80%	10	1%	48	3%	318	17%	1867
SURPRISE CR	1147	71%	0	0%	40	3%	417	26%	1604
UPPER E FK	1376	72%	0	0%	5	0%	538	28%	1919
WAPITI CR	1125	69%	82	5%	21	1%	406	25%	1634
TOTAL FOR E F ROCK CR	**10153**	**71%**	**1032**	**7%**	**210**	**1%**	**2846**	**20%**	**14242**
CONLEY CR	963	52%	106	6%	144	8%	629	34%	1842
HIATUS CR	344	33%	34	3%	137	13%	536	51%	1050
KELLEY CR	2462	79%	85	3%	84	3%	485	16%	3115
MCCOMAS CR	1810	63%	530	18%	222	8%	321	11%	2883
MILL POND	938	77%	41	3%	22	2%	222	18%	1224
TAYLOR CR	2342	87%	0	0%	32	1%	327	12%	2700
TOTAL FOR LOWER ROCK CR	**8859**	**69%**	**795**	**6%**	**640**	**5%**	**2520**	**20%**	**12814**
HARRINGTON CR	4152	86%	0	0%	0	0%	663	14%	4815
MILLER CR	1594	71%	96	4%	141	6%	427	19%	2259
ROCK CAMP	687	81%	3	0%	0	0%	160	19%	849
ROCK REC	436	75%	17	3%	0	0%	132	23%	585
SHOUP CR	1543	80%	10	1%	58	3%	311	16%	1922
WOODSTOCK CR	1058	82%	12	1%	0	0%	219	17%	1289
TOTAL FOR MILL POND	**9471**	**81%**	**138**	**1%**	**199**	**2%**	**1911**	**16%**	**11719**
BLUFF CR	998	65%	2	0%	1	0%	537	35%	1539
HUCKLEBERRY CR	577	39%	19	1%	0	0%	865	59%	1461
NE FORK	362	67%	0	0%	0	0%	178	33%	539
UPPER NE FK	586	71%	0	0%	8	1%	227	28%	821
UPPER T	1066	56%	0	0%	25	1%	819	43%	1909
ZIG ZAG CR	1979	58%	11	0%	49	1%	1345	40%	3384
NE FK ROCK CR	**5568**	**58%**	**32**	**0%**	**82**	**1%**	**3971**	**41%**	**9654**
COBBLE CR	1306	93%	0	0%	0	0%	97	7%	1404
CROSSROADS CR	817	79%	3	0%	153	15%	63	6%	1037
GRAVEL	630	78%	0	0%	0	0%	174	22%	803
PEBBLE CR	704	57%	17	1%	85	7%	421	34%	1226
STONEY CR	1689	73%	0	0%	0	0%	629	27%	2318
TOTAL FOR ROCKY	**5145**	**76%**	**21**	**0%**	**238**	**3%**	**1384**	**20%**	**6788**
DISAPPEARING CR	1712	100%	0	0%	0	0%	897	52%	1713
RUBBLE CR	2628	94%	0	0%	0	0%	179	6%	2807
TWIN CEDAR CR	1520	75%	0	0%	5	0%	498	25%	2023
TOTAL FOR UPPER ROCK CR	**5860**	**79%**	**0**	**0%**	**5**	**0%**	**1574**	**21%**	**7439**
TOTAL FOR WATERSHED	**45055**	**72%**	**2019**	**3%**	**1374**	**2%**	**14207**	**23%**	**62655**

Figure 3-6

Special Species

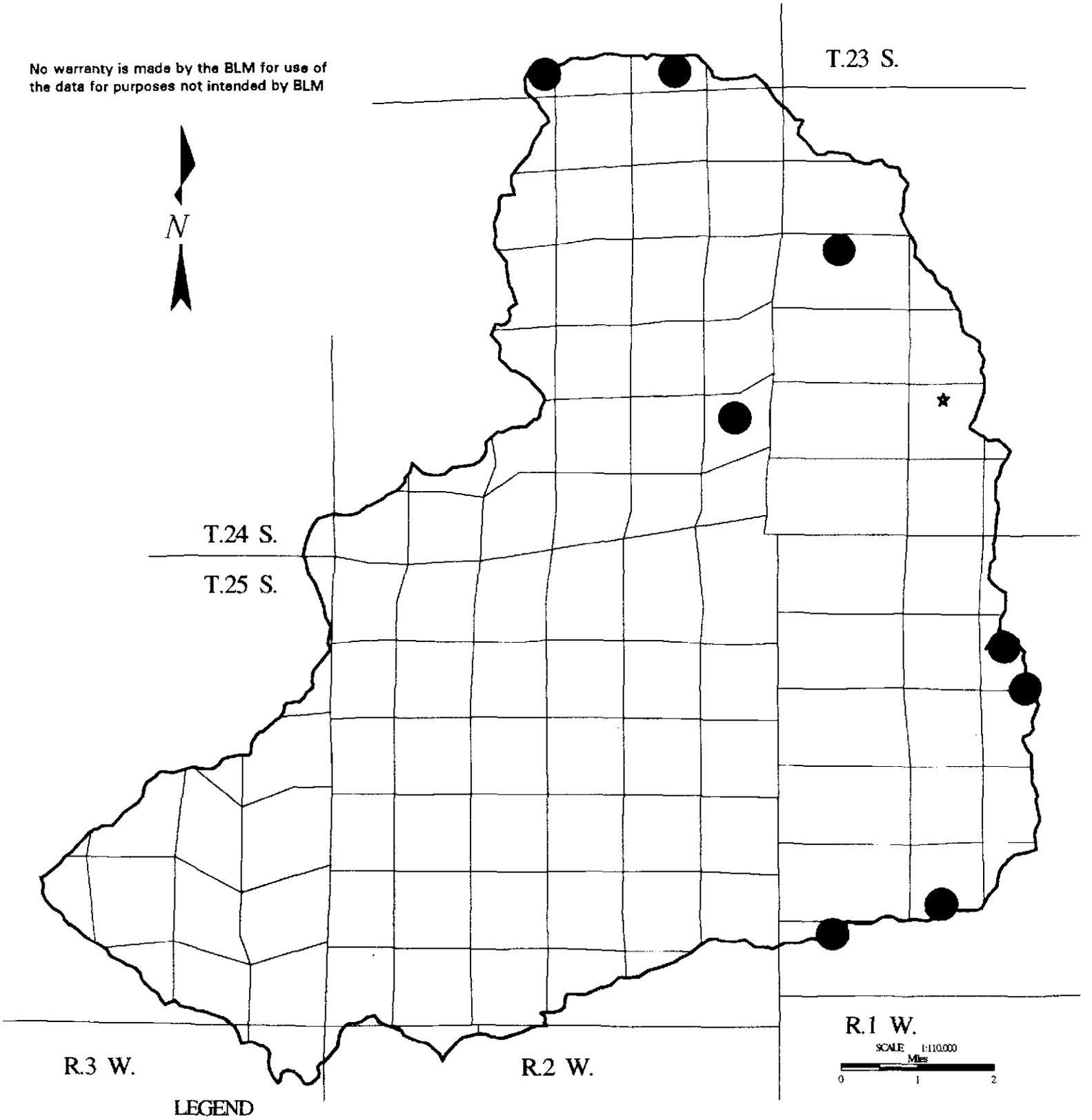

Figure 3-7

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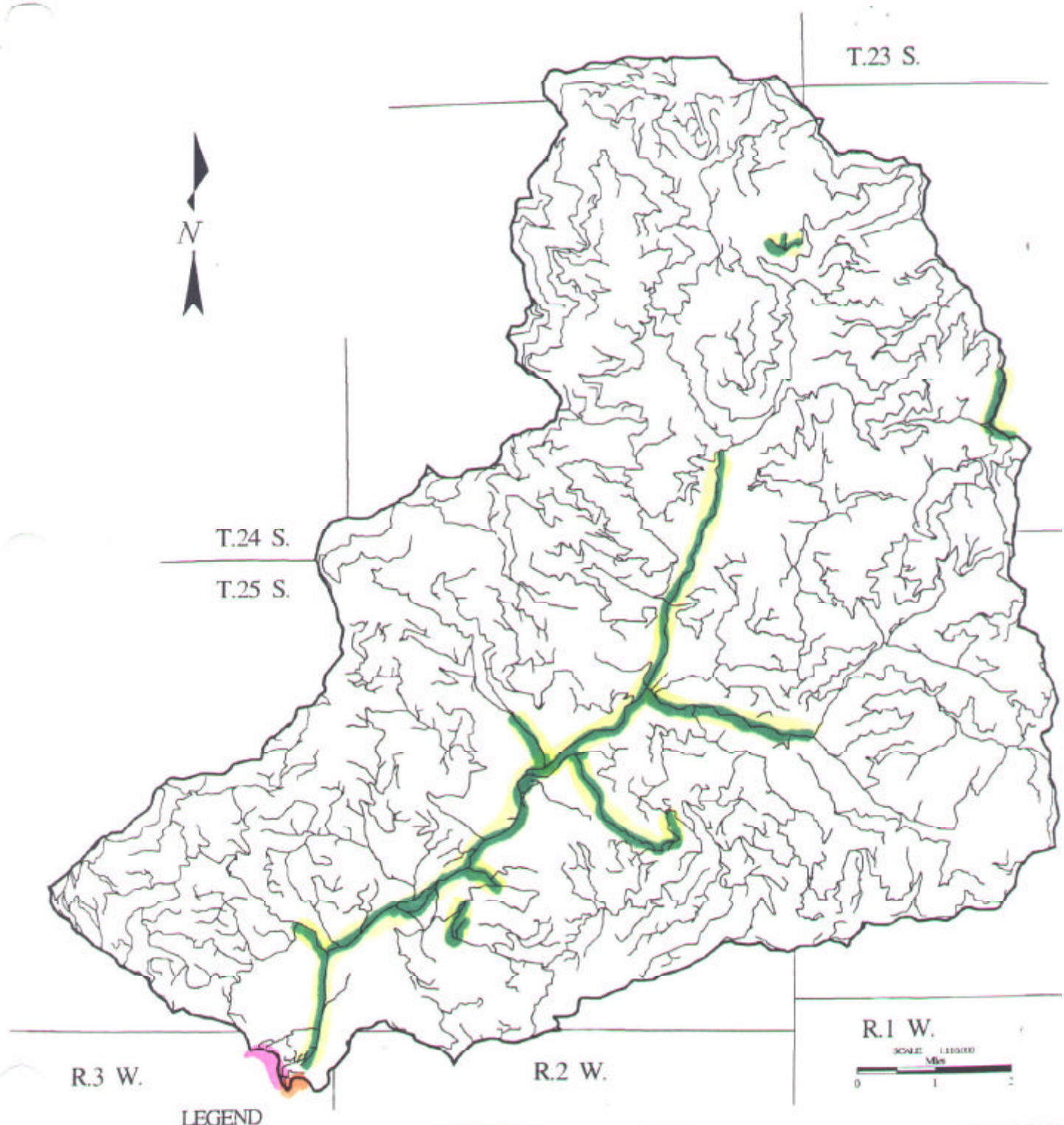
Rock Creek NOXIOUS WEEDS



TERRESTRIAL HABITAT AND SPECIES

A. Terrestrial Wildlife Species and Habitats

Wildlife habitat associations in conjunction with the abundance of this habitat in a drainage can be used for preliminary evaluation of the current status of any particular species. The current amount and distribution of seven seral stages, which correspond to habitat types described in Brown, et. al. (1985), are illustrated in **Figure 4-1** and acreage amounts and percentages given by drainage **in Tables 4-1 and 4-2.** Special habitat features which provide unique habitat types also occur in this watershed. Although a comprehensive survey for these features has not been undertaken at this time, a preliminary map illustrating those features currently known is presented in **Figure 4-2**. For more information about the distribution of habitat, refer also to the discussion of seral stage distribution in the Vegetation Section of this document.

Species for which the current President's Forest Plan provides an adequate strategy for conservation and viability will not require further evaluation in this watershed analysis document. Such species include those that are dependent on LSH but are not on the list of species in Table C-3 of the ROD. Examples include the northern spotted owl, piliated woodpecker, tailed frog and bald eagle. The success of this conservation strategy is dependent on the integrity and composition of the reserve system, the riparian reserves, the LSR and connectivity sections and other reserves designated for special status species and natural areas. Current habitat conditions in the reserve system and its functionality are described later in this section. This analysis, together with the aquatic section analysis provides a body of information on which to base decisions concerning adjustments of the riparian reserve boundaries. Distribution of occurrence for many of special status species is known to varying degrees, and the reader will refer to wildlife biologists records in local databases for this information. Observation locations for several special status species recorded in this drainage are illustrated in **Figure 4-3**. Although many sensitive species listed as threatened or endangered occur in this watershed (**Table 4-3**), it is not the role of this document to further analyze the impacts of the forest plan on them. Instead it seeks only to describe special land use designations where they are included for specific protection of these animals and to explain the functions of these areas.

Other species for which the forest plan was not considered adequate will require further evaluation. Species listed in Table C-3 of the ROD are dependent on LSH but were not considered to be adequately protected by the plan. Specific recommended mitigation measures are described in that document which should be considered at the project planning stage. Implementation of those measures may be appropriate based on detailed site specific information available at that time. Dispersal habitat for northern spotted owls was not considered in the ROD and also merits further evaluation at the watershed scale.

B. Administratively Withdrawn Areas

Two areas have been designated as administratively withdrawn areas in this watershed for protection of T&E wildlife species. One area was administratively withdrawn from timber management in order to maintain foraging habitat for the bald eagle along the lower reaches of Rock Creek. Surveys over the past several years have indicated a high use of this area by at least one pair of birds during periods of fish use. The spawned out carcasses of these fish are consumed in great numbers by wintering eagles. The protection of adjacent streamside habitat for perch and roosting structure allows this species to fully utilize this resource.

A second area was withdrawn from timber management for the protection of a hibernaculum site of a threatened species of bat (Townsends Big-eared bat). This area functions as it does due primarily to the microsite conditions created by the overstory canopy of trees combined with the large cavity structure created by the fell field at the base of a cliff. The bats have been present at this site for several years and

this type of special habitat is very limited in the watershed. Maintenance of this site is essential for conservation and management of this species.

C. Dispersal Habitat and Critical Habitat for Northern Spotted Owl

1. Dispersal Habitat

In general, the federal lands in the quarter townships in which the Rock Creek watershed lies currently contain more than 50% dispersal habitat, for analysis purposes defined as stands 40 years and older (**Table 4-4**). This habitat is composed of patches and small blocks surrounded by a matrix of younger forest. The private lands in the vicinity of Rock Creek generally contain very little dispersal habitat, and the majority of what does exist is at the younger end of the age range, from 25-40 years of age. The result is the typical checkerboard pattern of habitat distribution, with habitat on the federal lands being somewhat patchy (**Figure 4-4**).

The northern spotted owl is known to disperse successfully across several miles of non-habitat in order to reach suitable nesting and foraging sites. Such travel puts the animals at risk from predators, however, in direct proportion to the distance crossed. It has been assumed that if 50% of the federal lands in a given quarter township are in dispersal condition, that the species will be able to move across it successfully to reach the large blocks of suitable habitat reserved from harvesting. In the Rock Creek drainage, there is only one area, the East Fork of Rock Creek drainage, in which distances of more than one mile currently separate patches of dispersal habitat. Harvesting of habitat within the matrix will reduce the amount of habitat, making patches smaller and increasing distances between patches. Design and management of the riparian reserve system to maintain this habitat will help to ensure that, as the remainder of the matrix is harvested, a network of dispersal corridors and patches will remain.

Dispersal westward from the Rock Creek watershed presents a significant problem for this species. The area immediately to the west contains a large block of private ownership which is composed primarily of younger seral stages and will probably be managed on a 40 year rotation, thus preventing the development of dispersal habitat conditions across a wide area. Distances between habitat patches range from two miles in T25S R3W to more than twelve miles farther north near the border with the Eugene BLM. Unfortunately, this area lies in a critical area of concern for dispersal between the Coast Range province and the Cascades province. Designing management in the southwest portion of Rock Creek where quarter township percentages are less than 50% (as well as the eastern portion of the Calapooya drainage) which maintains at least the current level of dispersal habitat or accelerates the development of this habitat would allow continued use of the southern route around this non-habitat area.

The majority of the documented movement of birds in this drainage is in a north-south direction. The LSR in the northeastern portion of the watershed is contiguous with other large blocks of dispersal habitat in the Eugene BLM district and in the Canton Creek watershed. Birds have been known to move south from this area through the patchy dispersal habitat in Rock Creek and have relocated in the South Douglas resource area. The opposite is also true. Birds from the south find their way into the northern areas of Rock Creek. Connectivity between the Forest Service habitat to the west and Rock Creek is good, and birds from Rock Creek have relocated on USFS lands at several locations.

2. Designated Critical Habitat

Portions of two federally designated critical habitat units occur in this watershed. (**Figure 4-5**) Unit OR-25 includes the LSR located in the northern portion of the watershed. Analysis of the seral stage composition in this unit shows that it is currently providing good foraging and nesting habitat for the owl. The management of the LSR for maintenance and development of late seral characteristics will result in

improvement of the quality of habitat in this unit. Some of the sections are matrix designation. One proposed 1997 timber sale is located in the matrix portion of this unit which will remove approximately 120 acres of suitable nesting habitat on the west edge of this unit.

Unit OR-27 occurs in this watershed and continues into the adjacent watershed to the south. The function of this critical habitat unit was defined in the federal register as providing a connection between large blocks of suitable habitat and to provide habitat in which dispersing juveniles and adults could temporarily live while moving between them. Habitat conditions in this unit are currently poor due to the extensive fragmentation of suitable habitat combined with the location of this unit in areas of moderate to heavy past fire history. (Refer to discussion in Vegetation Section, historical conditions) Areas with this historical fire frequency are typified by stands with few older stand components such as snags and down wood. They also frequently have even-aged stands with little multiple canopy structure. Such habitat does not provide good foraging or nesting habitat for owls. Most of this unit is designated as matrix land to be managed for timber production. This is expected to further reduce the ability of this unit to provide habitat for the owl. In Rock Creek watershed, fourteen 100 acre reserves around spotted owl activity centers have been designated for management as late successional reserves within the matrix. Connectivity blocks located throughout the matrix together with these reserves and the riparian reserves are expected to compensate for the loss of function in this unit due to harvesting.

C. Habitat Conditions in Reserve System

In order to describe the functionality of the reserve system and the effectiveness of the forest plan for late successional species in this watershed, an analysis of the seral stage composition of the entire reserve system was done by drainage (**Table 4-5**). Maps of the distribution of these habitat types were constructed in order to describe the arrangement of this habitat across the landscape. (**Figure 4-6 and 4-7**) Overall, 62% of the lands designated as reserved currently contain habitat for late successional species. The usefulness of this habitat for any particular species, however, depends on its arrangement to provide for the needs of that species. For instance, small invertebrates would find most of the 62% to be useful habitat because of their small home range size, however they would be limited in their ability to disperse from one patch of habitat to another. Larger animals such as birds and mammals require more suitable habitat arranged in contiguous blocks in some cases but can disperse across unsuitable habitat. The quality of the habitat in the reserve system is expected to improve over time because of the emphasis on management for LSH in these areas. There is a lack of stands of the age class which will develop into this habitat type, however, and so there will not be an appreciable increase in the amount of suitable habitat in this system for eight decades (refer to Vegetation section, current conditions).

As can be seen in the map of LSH in the reserve system (**Figure 4-7**), the LSR portion is composed primarily of older habitat, while the matrix potion is highly fragmented. Individual drainages in the matrix, while currently containing blocks of this habitat, become much more fragmented if the lands outside of the reserve system are harvested. It seems, then, that the only ways to make the reserve system more functional in the near future are to either defer harvest of some portions of late seral habitat in the matrix lands adjacent to reserve habitat or to reconfigure the boundaries of the reserve system in order to include areas with currently functional habitat and exclude areas where the habitat is in early seral stages. Suggestions of how to reconfigure the riparian reserves are shown with **Figure 9-1** in the Restoration Opportunities section.

Currently, the matrix portion of the Rock Creek watershed does not function well for dispersal of late successional species, especially those which do not possess the ability to cross areas of younger seral stage habitat. Late seral habitat is distributed in patches across the matrix (GFMA and Connectivity) land use allocations and are separated from those in LSR by more than a mile and from each other by lesser distances. Habitat is continuous between corners of adjacent sections only in five of forty-five cases. As

the remaining stands of late seral habitat outside of the reserve system are harvested, this connectivity will become even more non-functional, with the remaining patches of old growth existing as isolated islands of habitat.

The contribution of the riparian reserve system in this watershed toward functional connectivity for late-successional species dispersal is dependent on the amount and distribution of the later seral stage stands within them and their relation on the landscape to other patches of this habitat, both in withdrawn areas and in deferred harvest areas in the matrix, such as portions of sections designated to be managed for connectivity. The riparian portion of this network is especially important as it maintains old growth habitat in the cool, moist lower slopes and valleys where this type of habitat persisted in the past through natural fire processes. During the past several decades, there has been a shift in the distribution of this habitat towards an increased proportion of occurrence on moderate to steep slopes due to the past history of harvesting on the gentler slopes. As a consequence, much of the historically persistent old growth on low, moist sites has been converted to younger seral stage stands and the remaining old growth stands on the drier slopes are more at risk due to catastrophic fire.

It is important, for the maintenance of the less mobile LSH dependent species in the matrix, to carefully consider the function that each stand of LSH outside of the reserve system is providing for connectivity when planning harvest schedules. Delaying harvest or providing more retention trees in some areas may preserve an important link between reserve patches until the surrounding matrix can mature and take on the functions of LSH.

In view of the existing and future lack of LSH in the reserve system in the matrix of Rock Creek, there may be some benefits to implementing changes in the riparian reserve boundaries, such as increasing buffer widths on intermittent streams where LSH exists and where it would increase connectivity to other LSH patches. See the Restoration Opportunities section for more details.

Figure 4-1

Current Wildlife Habitat Distribution

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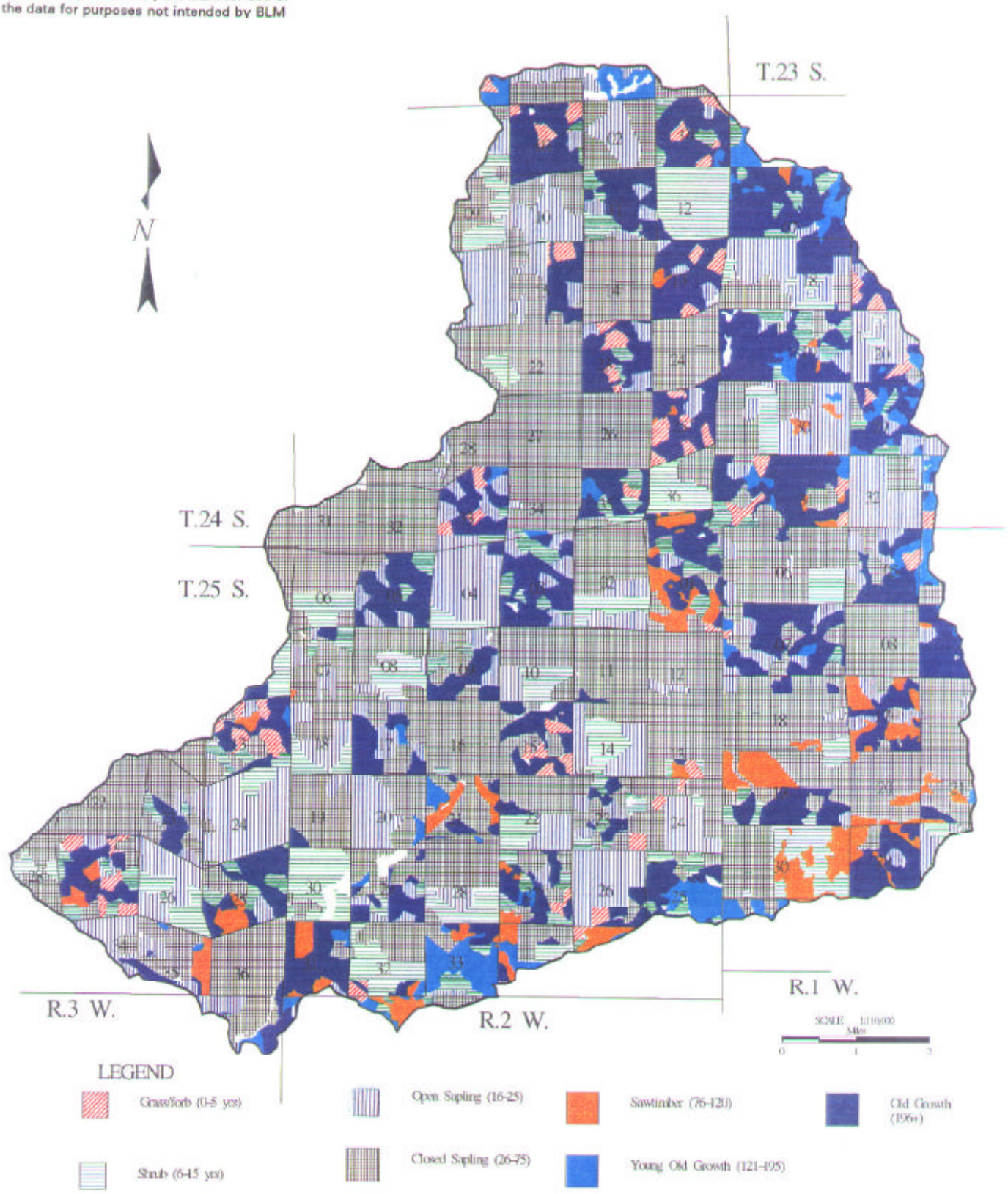

ROCK CREEK
COMBINED (FOI&POI) AGE CLASS ACRES BY DRAINAGE

DRAINAGE	0-5 FRB	% FRB	6-15 SHB	% SHB	16-25 OPS	% OPS	26-75 CLS	% CLS	76-120 SAW	% SAW	121-195 YOG	% YOG	196+ OGR	% OGR	TOTAL ACRES	% TOTAL
COUGAR CR	0	0%	461	25%	41	2%	769	41%	6	0%	0	0%	577	31%	1853	13%
EAST FORK	0	0%	90	4%	59	3%	1963	83%	64	3%	9	0%	183	8%	2368	17%
LOWER EFK	16	2%	126	13%	310	31%	518	52%	0	0%	0	0%	17	2%	987	7%
MACE CR	10	0%	231	12%	265	13%	1080	54%	26	1%	233	12%	149	7%	1994	14%
NORTH FORK	20	1%	39	2%	471	25%	970	52%	48	3%	43	2%	275	15%	1866	13%
SURPRISE CR	8	0%	92	6%	96	6%	950	59%	40	3%	13	1%	404	25%	1604	11%
UPPER EFK	18	1%	197	10%	607	32%	550	29%	5	0%	167	9%	371	19%	1916	13%
WAPITI CR	0	0%	19	1%	172	11%	1016	62%	21	1%	7	0%	398	24%	1634	11%
TOTAL EF ROCK CR:	**72**	**1%**	**1258**	**9%**	**2020**	**14%**	**7816**	**55%**	**210**	**1%**	**473**	**3%**	**2373**	**17%**	**14221**	**23%**
CONLEY CR	0	0%	500	27%	213	12%	356	19%	144	8%	410	22%	220	12%	1842	15%
HIATUS CR	36	4%	199	20%	38	4%	70	7%	137	13%	96	9%	440	43%	1015	8%
KELLEY CR	55	2%	368	12%	701	23%	1421	46%	84	3%	0	0%	485	16%	3114	25%
MCCOMAS CR	2	0%	554	19%	512	18%	1245	44%	222	8%	13	0%	308	11%	2857	23%
MILL POND	0	0%	237	20%	117	10%	599	50%	22	2%	35	3%	187	16%	1198	9%
TAYLOR CR	144	6%	693	26%	671	26%	755	29%	32	1%	37	1%	290	11%	2622	21%
TOTAL FOR LOWER ROCK CR:	**237**	**2%**	**2552**	**20%**	**2252**	**18%**	**4446**	**35%**	**641**	**5%**	**591**	**5%**	**1929**	**15%**	**12648**	**20%**
HARRINGTON CR	3	0%	767	16%	1662	35%	1687	35%	0	0%	0	0%	663	14%	4783	41%
MILLER CR	85	4%	274	12%	562	25%	757	34%	141	6%	55	2%	372	17%	2246	19%
ROCK CAMP	0	0%	157	19%	100	12%	401	49%	0	0%	0	0%	160	20%	818	7%
ROCK REC	74	13%	99	17%	144	25%	136	23%	0	0%	0	0%	132	23%	585	5%
SHOUP CR	0	0%	190	10%	507	26%	853	44%	58	3%	74	4%	237	12%	1919	17%
WOODSTOCK CR	79	6%	139	11%	311	24%	525	41%	0	0%	5	0%	214	17%	1272	11%
TOTAL FOR MILL POND:	**241**	**2%**	**1626**	**14%**	**3287**	**28%**	**4360**	**38%**	**199**	**2%**	**134**	**1%**	**1778**	**15%**	**11624**	**19%**
BLUFF CR	33	2%	497	33%	383	25%	52	3%	1	0%	12	1%	526	35%	1503	16%
HUCKLEBERRY CR	179	12%	265	18%	116	8%	19	1%	0	0%	240	17%	625	43%	1444	15%
NE FORK	0	0%	47	9%	285	53%	30	6%	0	0%	15	3%	163	30%	539	6%
UPPER NE FK	29	4%	66	8%	482	59%	0	0%	8	1%	0	0%	227	28%	812	8%
UPPER T	221	12%	381	20%	415	22%	44	2%	25	1%	28	1%	791	42%	1904	20%
ZIG ZAG CR	57	2%	878	26%	930	27%	123	4%	49	1%	286	8%	1059	31%	3382	35%
TOTAL FOR NE FK ROCK CR:	**519**	**5%**	**2153**	**22%**	**2810**	**27%**	**269**	**3%**	**82**	**1%**	**580**	**6%**	**3391**	**35%**	**9585**	**15%**
COBBLE CR	20	1%	1	0%	596	42%	689	49%	0	0%	41	3%	56	4%	1403	21%
CROSSROADS CR	0	0%	105	10%	183	18%	533	51%	153	15%	0	0%	63	6%	1037	15%
GRAVEL	21	3%	120	15%	25	3%	484	58%	0	0%	17	2%	156	19%	803	12%
PEBBLE CR	44	4%	448	37%	99	8%	124	10%	85	7%	11	1%	410	34%	1220	18%
STONEY CR	53	2%	385	17%	771	33%	478	21%	0	0%	16	1%	613	26%	2316	34%
TOTAL FOR ROCKY:	**137**	**2%**	**1059**	**16%**	**1674**	**25%**	**2288**	**34%**	**238**	**4%**	**85**	**1%**	**1299**	**19%**	**6780**	**11%**
DISAPPEARING CR	20	1%	520	21%	964	38%	106	4%	0	0%	203	8%	694	28%	2508	34%
RUBBLE CR	26	1%	475	17%	750	27%	1377	49%	0	0%	0	0%	179	6%	2807	38%
TWIN CEDAR CR	104	5%	286	14%	426	21%	701	35%	5	0%	0	0%	498	25%	2020	28%
TOTAL FOR UPPER ROCK CR:	**150**	**2%**	**1282**	**17%**	**2140**	**29%**	**2184**	**30%**	**5**	**0%**	**203**	**3%**	**1371**	**19%**	**7335**	**12%**
TOTAL ACRES BY AGE CLASS:	**1367**	**2%**	**9007**	**16%**	**13982**	**22%**	**21384**	**34%**	**1375**	**2%**	**2087**	**3%**	**12141**	**20%**	**62193**	**100%**

Table 4-1

ROCK CREEK
FOI AGE CLASS ACRES BY DRAINAGE

DRAINAGE	0-5 FRB	% FRB	6-15 SHB	% SHB	16-25 OPS	% OPS	26-75 CLS	% CLS	76-120 SAW	% SAW	121-195 YOG	% YOG	196+ OGR	% OGR	TOTAL ACRES	% TOTAL
COUGAR CR	0	0%	53	6%	19	2%	260	29%	0	0%	0	0%	577	63%	909	16%
EAST FORK	0	0%	2	0%	35	4%	533	65%	64	8%	9	1%	183	22%	825	14%
LOWER EFK	0	0%	22	15%	0	0%	108	73%	0	0%	0	0%	17	12%	148	3%
MACE CR	0	0%	151	29%	0	0%	50	10%	26	5%	143	28%	149	29%	518	9%
NORTH FORK	20	2%	39	5%	151	18%	256	31%	48	6%	43	5%	275	33%	832	14%
SURPRISE CR	8	1%	29	4%	81	10%	239	30%	40	5%	13	2%	390	49%	801	14%
UPPER EFK	18	2%	110	11%	152	15%	170	17%	5	1%	167	17%	371	37%	993	17%
WAPITI CR	0	0%	19	2%	143	18%	191	25%	21	3%	7	1%	398	51%	780	13%
TOTAL EF ROCK CR:	46	1%	426	7%	580	10%	1808	31%	204	4%	383	7%	2359	41%	5807	21%
CONLEY CR	0	0%	114	12%	109	11%	6	1%	144	15%	410	42%	192	20%	975	16%
HIATUS CR	36	6%	22	3%	14	2%	36	6%	105	17%	56	9%	358	57%	627	10%
KELLEY CR	55	4%	191	14%	222	16%	412	29%	41	3%	0	0%	484	34%	1404	23%
MCCOMAS CR	2	0%	248	19%	167	13%	370	28%	222	17%	13	1%	297	23%	1320	22%
MILL POND	0	0%	104	18%	21	4%	219	38%	22	4%	28	5%	187	32%	581	10%
TAYLOR CR	144	12%	94	8%	40	3%	603	51%	32	3%	26	2%	245	21%	1184	19%
TOTAL FOR LOWER ROCK CR:	237	4%	773	13%	573	9%	1648	27%	566	9%	533	9%	1763	29%	6092	22%
HARRINGTON CR	3	0%	211	13%	301	19%	442	27%	0	0%	0	0%	663	41%	1620	31%
MILLER CR	85	7%	128	10%	33	3%	467	37%	141	11%	54	4%	339	27%	1248	24%
ROCK CAMP	0	0%	0	0%	2	1%	78	33%	0	0%	0	0%	160	67%	240	5%
ROCK REC	74	23%	5	2%	0	0%	105	33%	0	0%	0	0%	132	42%	315	6%
SHOUP CR	0	0%	49	5%	212	21%	386	38%	58	6%	68	7%	237	23%	1011	19%
WOODSTOCK CR	79	10%	139	17%	91	11%	303	37%	0	0%	5	1%	214	26%	830	16%
TOTAL FOR MILL POND:	241	5%	532	10%	639	12%	1782	34%	199	4%	127	2%	1745	33%	5265	19%
BLUFF CR	33	4%	105	13%	82	10%	52	6%	1	0%	12	1%	523	65%	808	14%
HUCKLEBERRY CR	0	0%	143	14%	30	3%	19	2%	0	0%	240	23%	625	59%	1058	19%
NE FORK	0	0%	45	16%	36	12%	30	10%	0	0%	15	5%	163	57%	288	5%
UPPER NE FK	29	7%	66	16%	72	18%	0	0%	8	2%	0	0%	227	56%	402	7%
UPPER T	44	4%	196	17%	116	10%	3	0%	25	2%	28	2%	772	65%	1183	21%
ZIG ZAG CR	57	3%	265	14%	130	7%	103	5%	11	1%	276	15%	1059	56%	1901	34%
TOTAL FOR NE FK ROCK CR:	163	3%	820	15%	466	8%	207	4%	45	1%	570	10%	3369	60%	5839	20%
COBBLE CR	20	11%	1	0%	64	35%	0	0%	0	0%	41	23%	56	31%	182	6%
CROSSROADS CR	0	0%	3	1%	0	0%	100	31%	153	48%	0	0%	63	20%	320	11%
GRAVEL	21	7%	95	33%	0	0%	0	0%	0	0%	17	6%	156	54%	290	10%
PEBBLE CR	44	5%	174	20%	33	4%	91	11%	85	10%	11	1%	410	48%	848	30%
STONEY CR	53	5%	267	23%	200	17%	13	1%	0	0%	16	1%	613	53%	1162	41%
TOTAL FOR ROCKY:	137	5%	539	19%	297	11%	205	7%	238	8%	85	3%	1299	46%	2800	10%
DISAPPEARING CR	20	2%	211	17%	117	10%	0	0%	0	0%	203	17%	674	55%	1225	51%
RUBBLE CR	7	3%	0	0%	0	0%	27	13%	0	0%	0	0%	179	84%	214	9%
TWIN CEDAR CR	104	11%	201	21%	117	12%	29	3%	5	0%	0	0%	498	52%	955	40%
TOTAL FOR UPPER ROCK CR:	132	5%	412	17%	235	10%	58	2%	5	0%	203	8%	1351	58%	2393	9%
TOTAL ACRES BY AGE CLASS:	957	3%	3502	13%	2749	10%	5704	20%	1298	4%	1981	7%	11967	42%	27969	100%

Table 4-2

Figure 4-2

Special Habitat Features

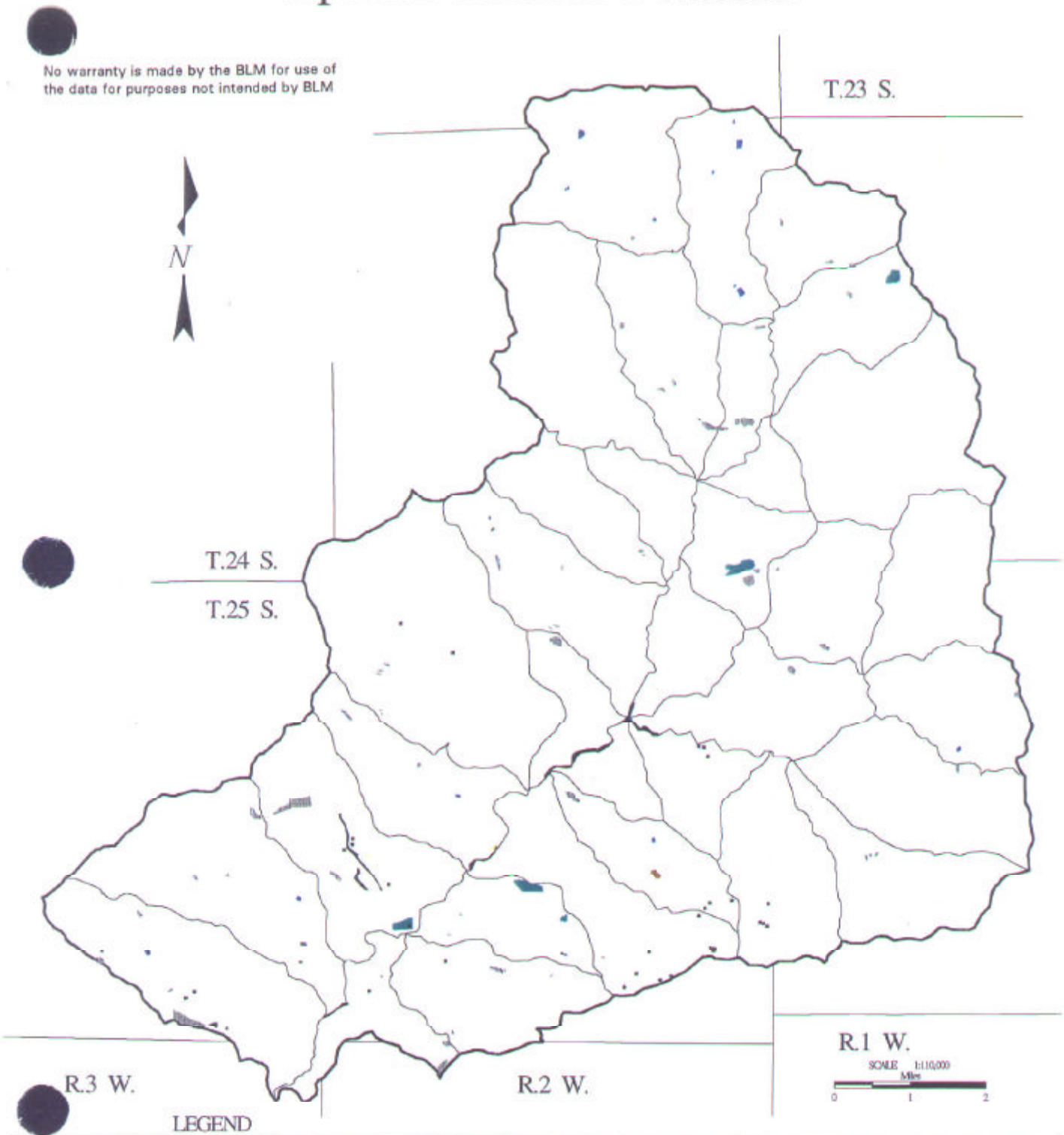

Figure 4-3

Special Status Wildlife Species Observations

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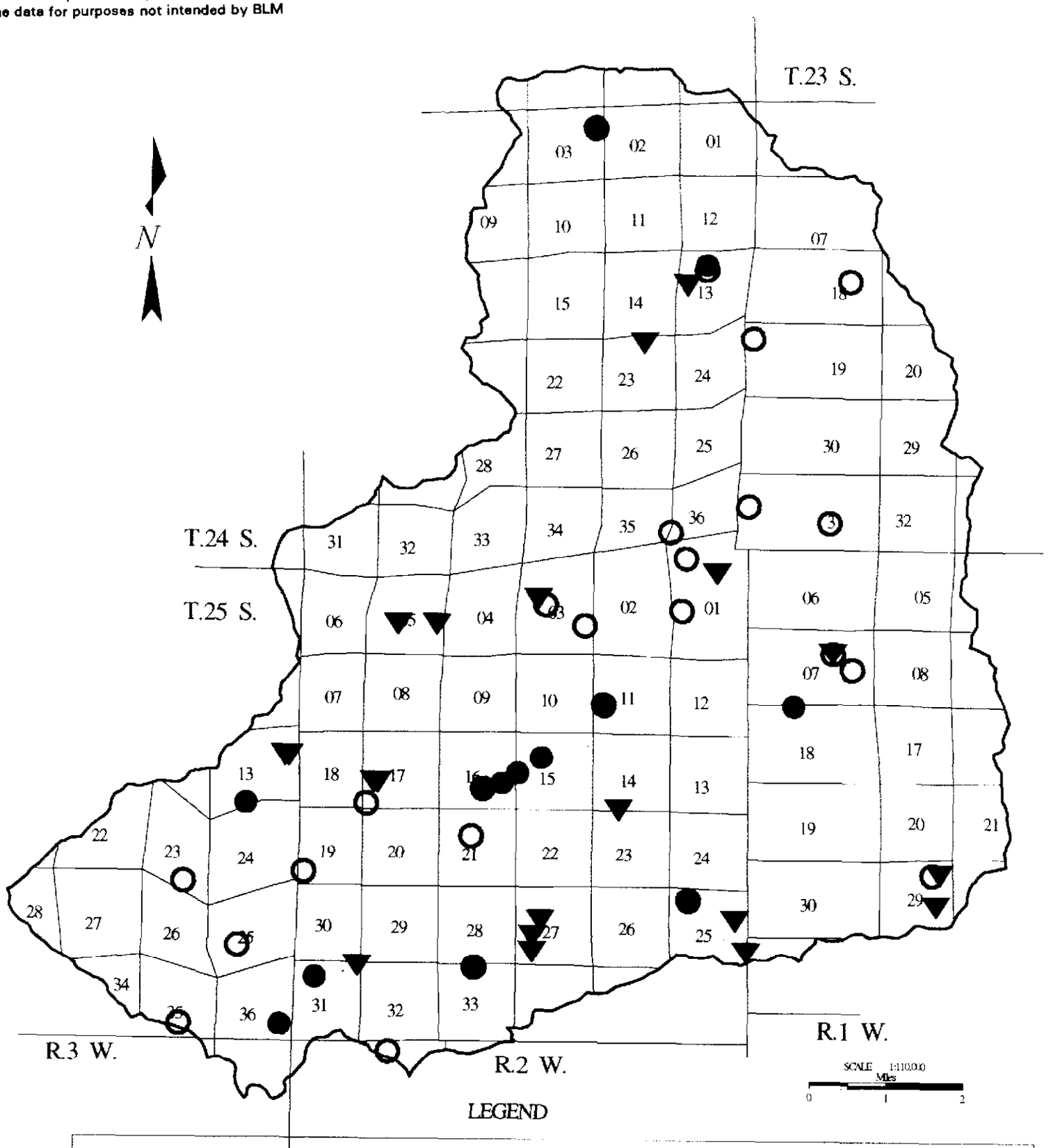

Table 4-3

Special Status Species - Rock Creek Watershed

Species	Status	Presence	Inventory
Peregrine Falcon	FE, ST	D	3
Bald Eagle	FT, ST	D	3
Northern Spotted Owl	FT, ST	D	4
Western Pond Turtle	FC, SC	D	3
Cascades Frog	FC, AS, SC	U	1
Foothill Yellow-legged Frog	FC	D	1
Red-legged Frog, Oregon Species	FC	D	3
Spotted Frog	FC, SU	U	1
Southern Torrent Salamander	FC	D	1
Northern Goshawk	FC, AS, SC	D	3
Pileated Woodpecker	AS, SC	D	3
Mountain Quail	FC	D	3
Western Bluebird	AS, SV	D	1
Northern Pygmy Owl	SU	D	3
Northern Saw-whet Owl	AS	D	3
Flammulated Owl	AS, SC	U	1
Purple Martin	AS, SV	U	1
Townsend's Big-eared Bat	FC, SC	D	2
Pacific Pallid Bat	AS, SC	S	2
Fringed Myotis Bat	FC, SV	S	2
Long-eared Myotis Bat	FC	D	2
Long-legged Myotis Bat	FC	D	2
Yuma Myotis Bat	FC	D	2
Pine Martin	AS, SC	U	1
Ringtail	SU	U	1
Clouded Salamander	AS, SC	D	3
Tailed Frog	AS, SV	D	1
Oregon Slender Salamander	AS, SP	U	1
California Mountain Kingsnake	AS, SP	S	1
Common Kingsnake	AS, SP	D	2
Sharptailed Snake	AS, SV	D	3
Vertree's Ceraclean Caddisfly	FC	U	1

Vertree's Ochotrichian Microcaddisfly	FC	U	1
Mt. Hood Primative Brachycentrid Caddisfly	FC	U	1
Fender's Blue Butterfly	FC	U	1
Oregon Snail	FC	U	1
Oregon pearly mussel	FC	U	1
Coho salmon	FP	D	2
Sea-run coastal cutthroat	FP	D	2
Winter steelhead	FP	D	2

Status:
FE - Federal Endangered
FT - Federal Threatened
FP - Federal Proposed
FC - Federal Candidate
BS - Bureau Sensitive
AS - Assessment Species (BLM)
SE - State Endangered
ST - State Threatened
SC - State Critical
SP - State Peripheral or naturally rare
SV - State Vulnerable
SU - State Undetermined

Presence:
D - Documented
S - Suspected
U - Uncertain
A - Absent

Inventory:
N - No surveys done
1 - Literature search only
2 - One field search done
3 - Limited field surveys done
4 - Protocol completed

Summary of spotted owl dispersal habitat in Rock Creek Watershed based on stands 40+ years old

Table 4-4

Quarter Township	Acres of habitat within watershed	Total acres of habitat in quarter township	Total BLM acres in QT	% QT in dispersal habitat	% QT dispersal habitat in watershed
S23W02 - SW	74	842	2562	32.86	8.79
S23W02 - SE	150	585	1480	39.53	25.64
S24W01 - SW	2020	2650	4345	60.99	76.23
S24W01 - NW	1177	3714	4485	82.81	31.69
S25W01 - NW	1180	2117	3487	60.71	55.74
S25W01 - SW	922	1076	1822	59.06	85.69
S24W02 - NE	1885	1885	2813	67.01	100.00
S24W02 - SE	946	946	1564	60.49	100.00
S24W02 - SW	270	270	507	53.25	100.00
S25W02 - NE	1552	1552	2813	55.17	100.00
S25W02 - NW	943	943	2492	37.84	100.00
S25W02 - SE	2023	2023	3018	67.03	100.00
S25W02 - SW	1465	1465	2781	52.68	100.00
S25W03 - NE	237	237	842	28.15	100.00
S25W03 - SE	1028	1028	2625	39.16	100.00
S26W02 - NW	115	1872	2440	76.72	6.14

Figure 4-4

Rock Creek Dispersal

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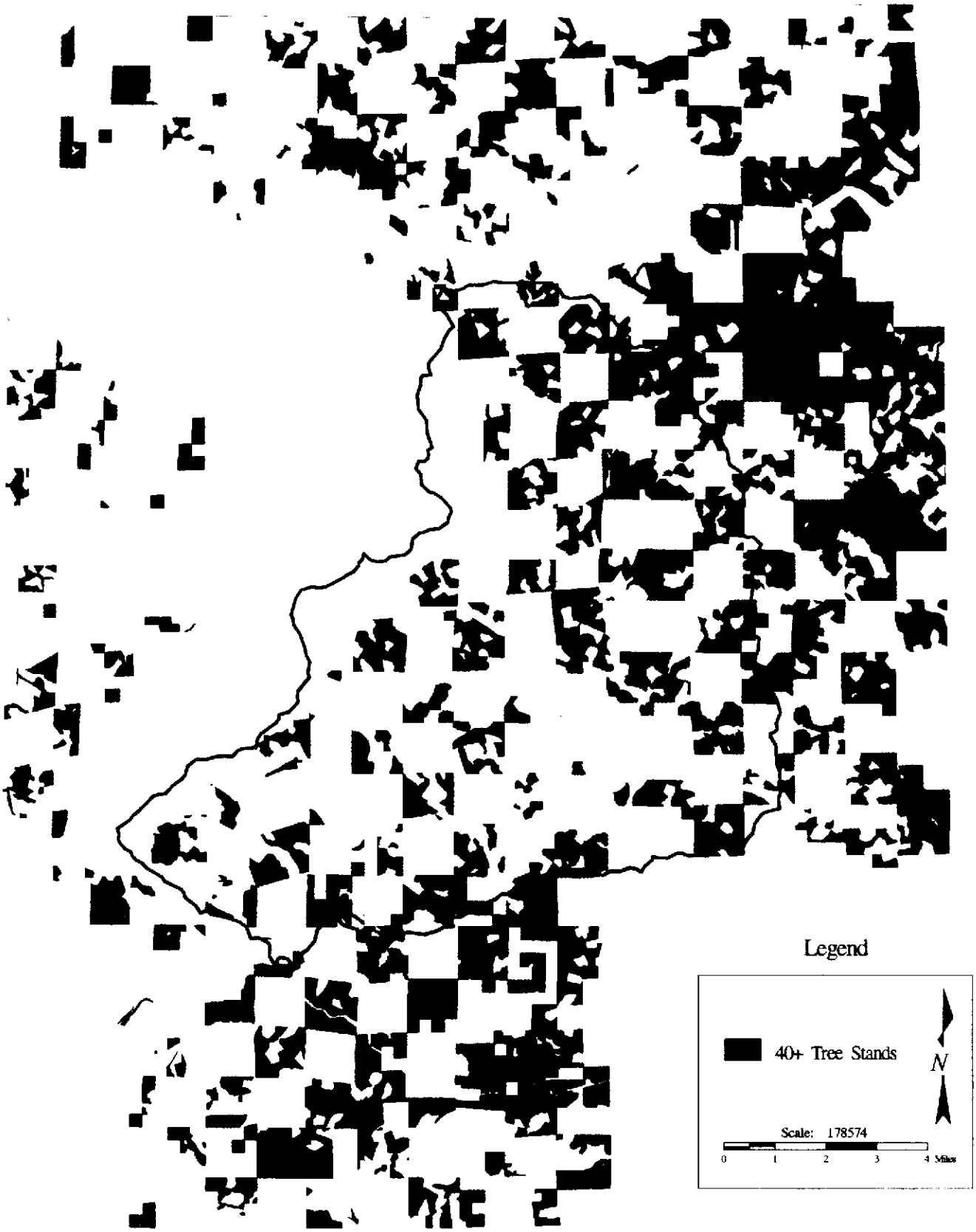

Figure 4-5

Critical Habitat for Northern Spotted Owl

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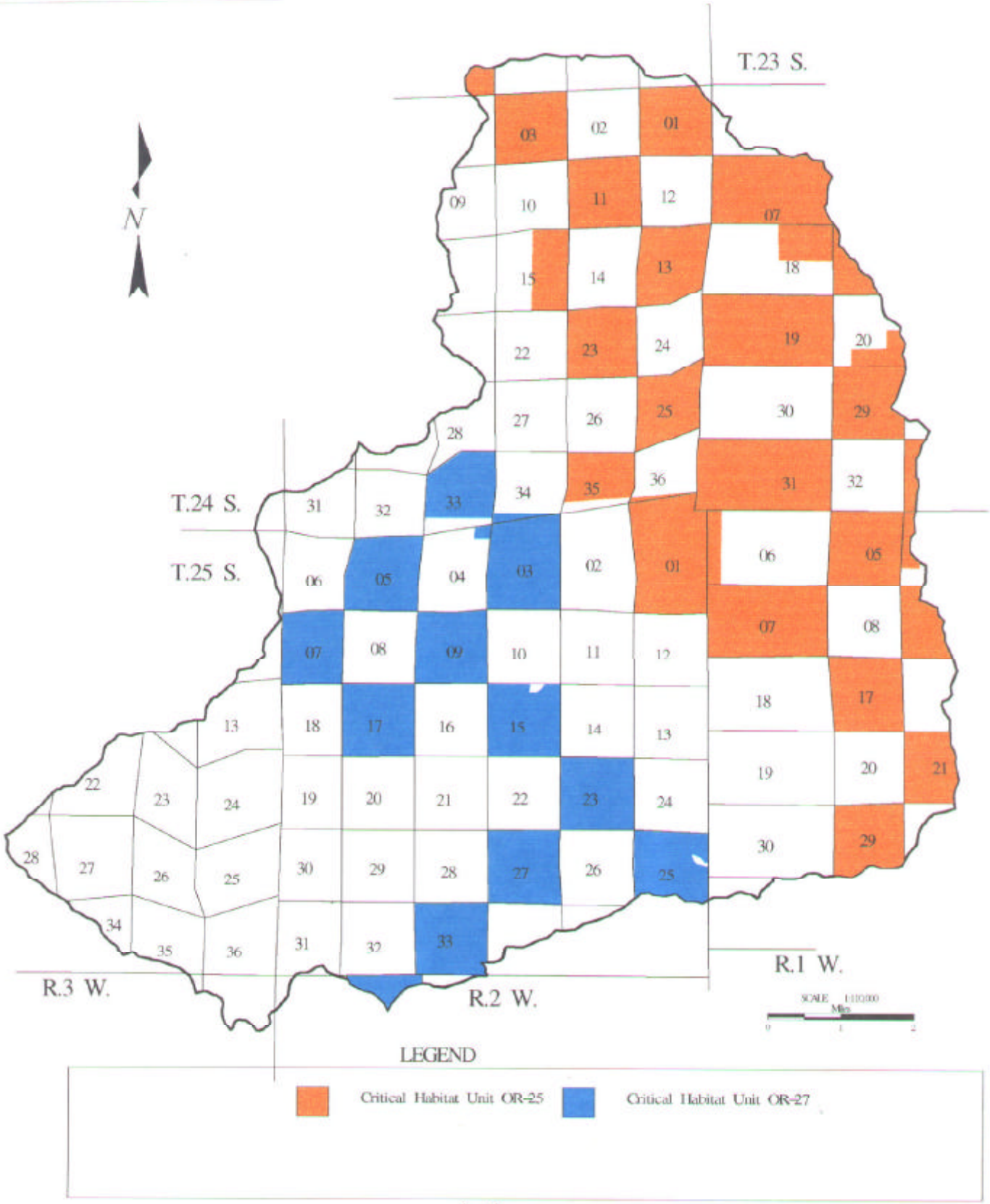

Figure 4-6

Early & Mid Seral Age Classes within Reserve Areas

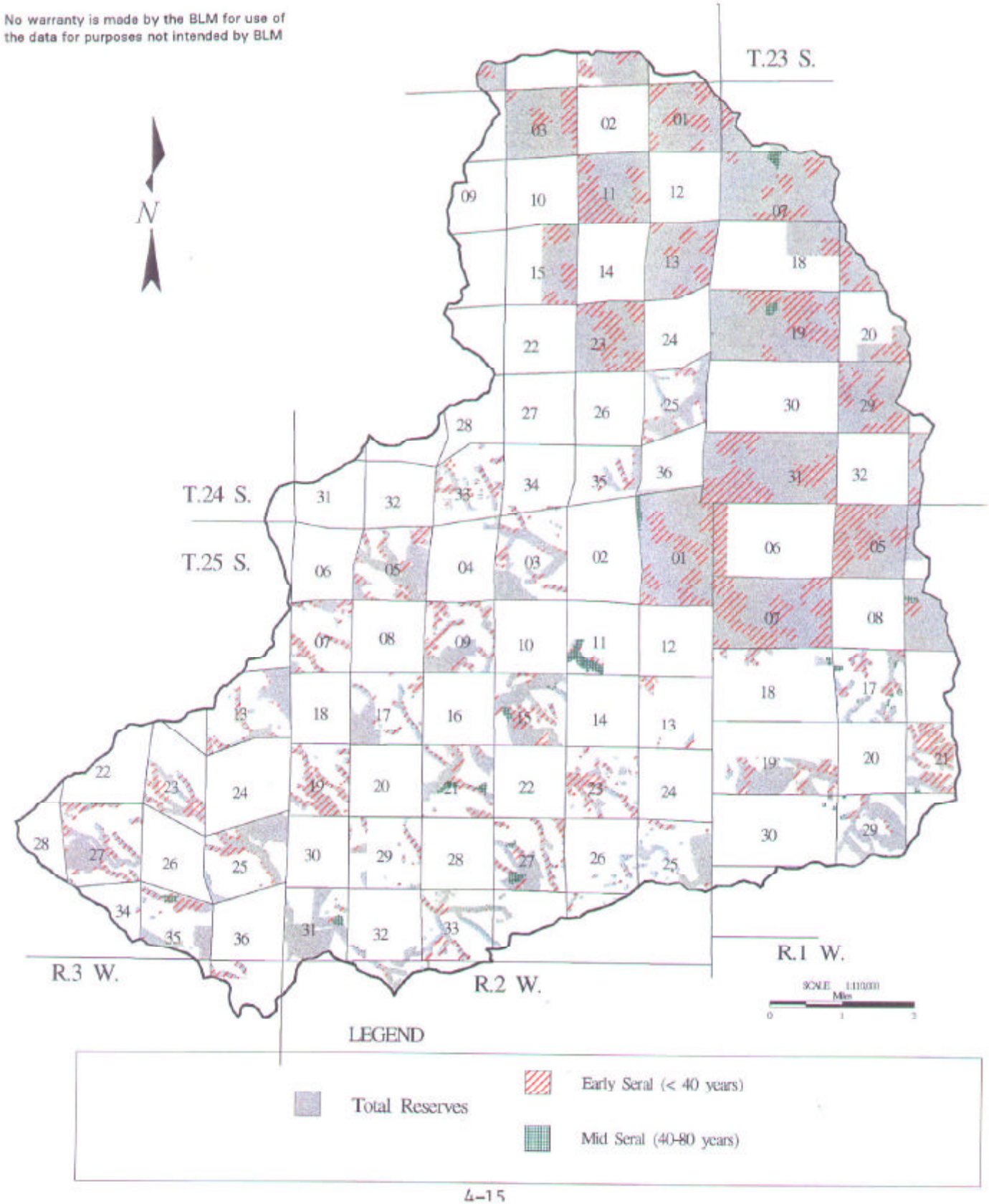

Figure 4-7

Late Successional (80+ Years) Age Classes

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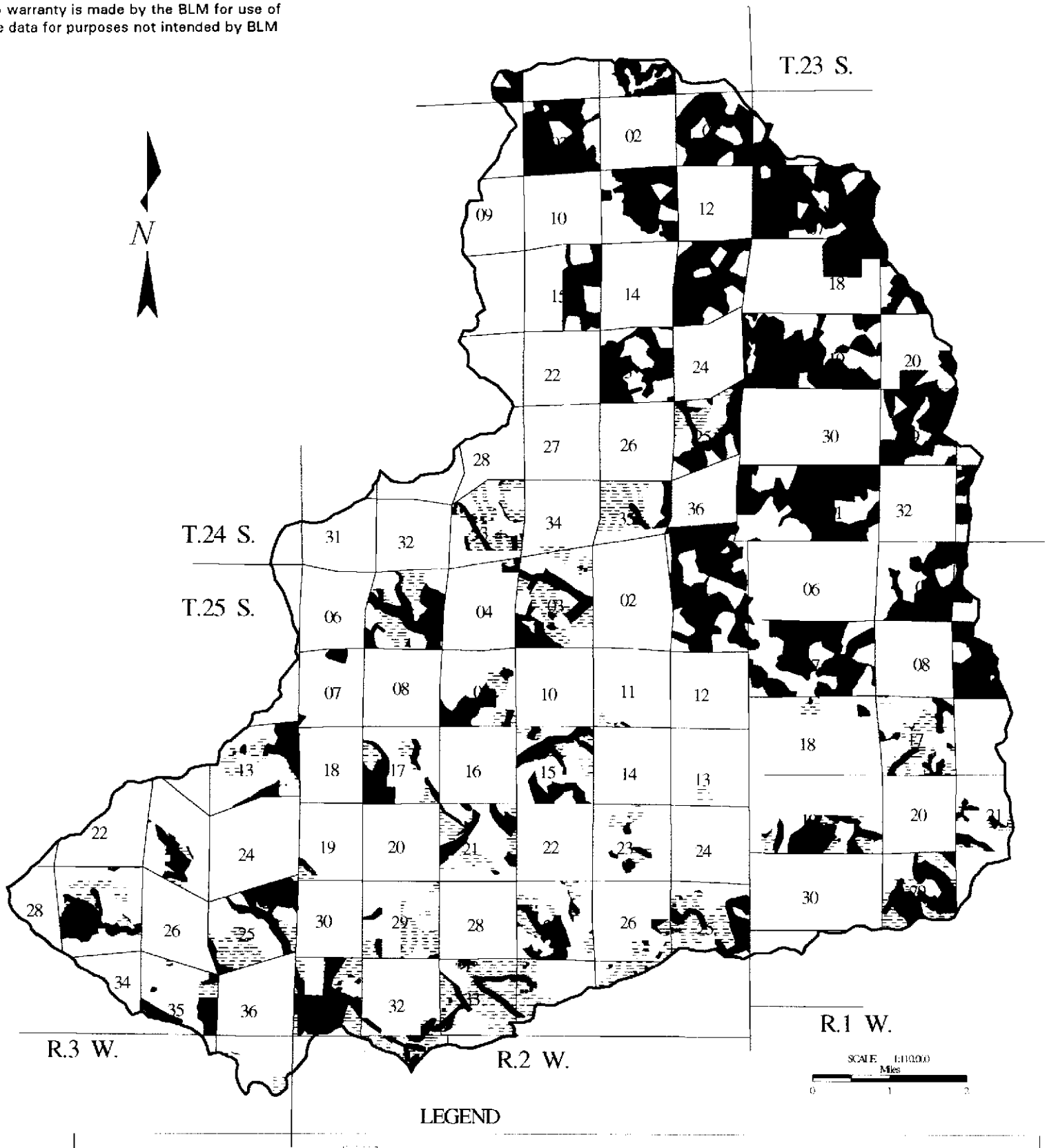

1995 VEGETATIVE AGE CLASSES within RESERVES

DRAINAGE	EARLY SERAL (0-40 yrs) 0-40 ac	%	MID SERAL (40-80 yrs) 40-80 ac	%	LATE SERAL (80-120 yrs) 80-120 ac	%	LATE SERAL (80-120 yrs) 120+ ac	%	TOTAL ACRES
COUGAR CR	79	17%	11	2%	0	0%	380	81%	470
EAST FORK	244	63%	19	5%	31	8%	94	24%	389
LOWER EFK	28	60%	15	33%	0	0%	3	6%	46
MACE CR	57	23%	0	0%	0	0%	189	77%	246
NORTH FORK	384	52%	23	3%	48	6%	285	39%	739
SURPRISE CR	358	45%	0	0%	40	5%	403	50%	801
UPPER EFK	450	45%	0	0%	5	1%	538	54%	993
WAPITI CR	194	35%	15	3%	2	0%	349	62%	560
TOTAL FOR E F ROCK CR	1794	42%	83	2%	127	3%	2241	53%	4244
CONLEY CR	83	33%	0	0%	30	12%	138	55%	251
HIATUS CR	16	5%	12	4%	68	21%	227	70%	323
KELLEY CR	249	47%	0	0%	0	0%	278	53%	527
MC COMAS CR	204	37%	10	2%	126	23%	214	39%	554
MILL POND	93	40%	23	10%	11	5%	106	45%	233
TAYLOR CR	257	57%	0	0%	3	1%	190	42%	451
TOTAL FOR LOWER ROCK CR	903	39%	45	2%	238	10%	1153	49%	2338
HARRINGTON CR	334	44%	0	0%	0	0%	433	56%	767
MILLER CR	156	46%	24	7%	52	15%	105	31%	337
ROCK CAMP	30	17%	5	3%	0	0%	138	80%	173
ROCK REC	46	37%	7	6%	0	0%	69	57%	122
SHOUP CR	126	36%	1	0%	50	14%	172	49%	348
WOODSTOCK CR	197	59%	9	3%	0	0%	126	38%	332
TOTAL FOR MILL POND	888	43%	45	2%	102	5%	1042	50%	2078
BLUFF CR	270	33%	2	0%	1	0%	535	66%	808
HUCKLEBERRY CR	174	16%	19	2%	0	0%	865	82%	1058
NE FORK	79	33%	0	0%	0	0%	163	67%	242
UPPER NE FK	71	29%	0	0%	1	0%	173	71%	245
UPPER T	361	30%	0	0%	25	2%	799	67%	1184
ZIG ZAG CR	543	29%	11	1%	11	1%	1335	70%	1901
TOTAL FOR NE FK ROCK CR	1498	28%	32	1%	38	1%	3870	71%	5438
COBBLE CR	16	90%	0	0%	0	0%	2	10%	18
CROSSROADS CR	65	22%	10	3%	153	53%	63	22%	291
GRAVEL	35	45%	0	0%	0	0%	43	55%	78
PEBBLE CR	311	37%	17	2%	85	10%	420	50%	834
STONEY CR	159	43%	3	1%	0	0%	204	56%	366
TOTAL FOR ROCKY	586	37%	30	2%	237	15%	733	46%	1586
DISAPPEARING CR	393	31%	0	0%	0	0%	877	69%	1270
RUBBLE CR	34	16%	0	0%	0	0%	179	84%	214
TWIN CEDAR CR	441	48%	0	0%	1	0%	473	52%	915
TOTAL FOR UPPER ROCK CR	868	36%	0	0%	1	0%	1529	64%	2398
TOTAL FOR WATERSHED	6537	36%	206	1%	742	4%	10669	59%	18083

Table 4-5

HYDROLOGY

A. General Setting and Climate

The Rock Creek watershed stream flow/basin characteristics file by the USGS, describes the watershed. The slope of the watershed is 163.5 ft/mile and has a length of 17.2 miles. Based on 1:24,000 scale topographic maps, the elevation ranges from about 4720 along the Calapooya Divide to approximately 800 feet near the mouth of Rock Creek.

The nearest National Oceanic and Atmospheric Administration (NOAA) climate station is Idleyld Park 4 NE. The station is at 1080 foot elevation. The topographic variation of the Rock Creek watershed will yield different precipitation and temperature values throughout the watershed. The climatological normals are based on the mean monthly maximum, minimum and monthly totals.

1. Precipitation

The annual normal(mean monthly average) precipitation for the Idleyld Park 4 NE station is 63 inches (National Oceanic and Atmospheric Administration, 1992). The percent of precipitation received from October to March is 79% of the yearly average.

2. Air Temperature

The annual normal temperature for the station is 51.8° Fahrenheit (F). The annual normal maximum temperature 63.9° F and the annual normal minimum temperature is 39.7° F. The normal maximum, minimum and annual temperatures for the summer months are as follows:

AIR TEMPERATURES

Month	Normal Maximum	Normal Minimum	Normal Annual
June	75.9°	46.4°	61.2°
July	82.6°	48.3°	65.5°
August	82.5°	48.5°	65.5°
September	76.6°	44.5°	60.6°

B. Existing Stream Network

There are approximately 359 miles of stream in this 98 square mile watershed (**Figure 5-1 and Table 5-1**). The drainage density is 3.67 miles/square mile (mi/mi^2) for the Rock Creek Watershed. The density data was compiled from the Roseburg BLM GIS database, which has varying degrees of accuracy for stream orders. **Table 5-2** displays the drainage density for each of the subwatershed and drainage.

A stream order analysis was conducted by the Roseburg BLM on the Brush Creek, Hayhurst, and Yoncalla Watersheds. Error was found in the amount of first and second order represented by the GIS database. It was found that the number and length of first order streams was less than the second order streams. It is not possible to have more second order streams than first order streams. By definition second order streams have first order tributaries while first order streams have no tributaries (Black, 1991). Upon inspecting the GIS data for Rock Creek tributaries, it was found that many second order streams did not have first order tributaries. Although the actual number of second and first order streams were not counted, it was observed that there was an insufficient number of first order streams in comparison to second order streams.

Table 5-2 **Drainage Density and Stream Miles**

DRAINAGE & SUBWATERSHED	DRAINAGE DENSITY (mi/sq.mi)	STREAM MILES
COUGAR CREEK	4.15	12.02
EAST FORK	6.08	22.53
LOWER EAST FORK	3.17	4.90
MACE CREEK	4.17	9.52
NORTH FORK	4.65	12.17
SURPRISE CREEK	4.27	11.65
UPPER EFK	4.27	12.82
WAPITI	5.80	14.80
EF ROCK CREEK	**4.51**	**100.41**
CONLEY CREEK	3.23	9.29
HIATUS CREEK	2.05	3.37
KELLY	3.24	15.78
MCCOMAS CREEK	3.26	14.68
MILL POND	3.00	5.74
TAYLOR	2.45	10.35
LOWER ROCK CREEK	**2.96**	**59.21**
HARRINGTON CREEK	3.36	26.07
MILLER CREEK	2.84	10.03
ROCK CAMP	4.05	5.39
ROCK REC	3.95	3.61
SHOUP CREEK	2.94	8.84
WOODSTOCK CREEK	3.34	6.74
MILL POND	**3.31**	**60.68**
BLUFF CREEK	4.10	9.85
HUCKLEBERRY CREEK	3.42	7.91
NE FORK	4.51	3.81
UPPER NE FORK	4.93	6.33
UPPER TWIN CEDAR CREEK	3.57	10.66
ZIG ZAG CREEK	4.28	22.65
NE FORK ROCK CREEK	**4.05**	**61.22**
COBBLE CREEK	3.42	7.52
CROSSROADS CREEK	4.20	6.81
GRAVEL	3.77	4.74
PEBBLE CREEK	3.73	7.15
STONEY CREEK	3.53	12.78
ROCKY	**3.67**	**38.99**
DISAPPEARING CREEK	3.18	12.99
RUBBLE CREEK	3.16	13.87
TWIN CEDAR CREEK	3.75	11.86
UPPER ROCK CREEK	**3.33**	**38.72**
ROCK CREEK WATERSHED	**3.67**	**359.23**

C. Stream Flow

1. Gaging Station Peak Flows

A Rock Creek gaging station (14317600) is located 0.3 miles downstream from McComas Creek and 5.8 miles northeast of Glide. The gaging station was operated by the United States Geologic Survey (USGS) from June 1957 to June 1973. Douglas County has operated a gaging station at the same location from 1981 to present.

The Rock Creek flood peaks during the 1957-1973 and 1981-1992 (excluding 1991) periods of record generally had a recurrence interval of less than 5 years. A flood event which occurred on December 22, 1964 had a 65 year recurrence interval. Five secondary peaks were recorded the same water year (October 64-September 65), but had recurrence intervals of less than 5 years. This information was extrapolated from the USGS Magnitude and Frequency of Floods in Western Oregon (Open-File Report 79-553).

A cumulative plot of each year's highest flood peaks for the gaging station flow data was not completed. The USGS period of record was 1957 to 1973 (water year 1972) and Douglas County did not resume monitoring of a gaging station until 1981 (water year 1981). The broken record period was considered significant, in that interpretation during this period represented a lack of highest flood peaks, and therefore could not accurately reflect what actually occurred within the watershed. The missing eight year period is significant in terms of land use disturbances and channel changes that may have occurred in Rock Creek Watershed during the missing period.

2. Maximum and Minimum Flows

The USGS Statistical Summaries of Streamflow Data in Oregon: Volume 1 (1990) showed the recorded maximum monthly discharge, based on the mean daily discharge was 2560 c.f.s. December, 1965. This discharge was equaled or exceeded less than 5% of the time. The annual maximum discharge is 567 c.f.s. which is equalled or exceeded less than 20% of the time.

The recorded minimum monthly discharge, based on the mean daily discharge was 17 c.f.s., September, 1965. This discharge was equaled or exceeded 95 % of the time. The record instantaneous low flow for Rock Creek was 14 c.f.s., September 5-11, 1966. However, August 28, 1992 the minimum flow recorded at the gaging station by Douglas County was 4.6 c.f.s. The annual minimum discharge is 220 c.f.s., which is equalled or exceeded approximately 45 percent of the time.

The mean annual discharge is 373 c.f.s, which is equalled or exceeded approximately 30 percent of the time. The instantaneous maximum discharge was 22,800 c.f.s., December 22, 1964.

D. Hydrologic Recovery

The hydrologic recovery for Rock Creek was based on the methodology presented in the *Umpqua National Forest Standard and Guideline Procedures for Cumulative Effects and Water Quality* (1990). The procedure evaluates the potential for peak flow increases due to forest cover removal and the resulting increase of melting snow during warm rains in the transient snow zone (2,000-5,000 foot elevation) (**Figure 5-2**). Hydrologic recovery was calculated only in the transient snow zone (TSZ) which was delineated with a Digital Elevation Model (DEM) and is based on the percent stand recovered for a given site class. The Rock Creek Watershed is an intermix of Site Class III and Site Class IV. Stand recovery is attained at about 27 to 32 years of age. A new stand is considered recovered when the canopy closure is 70% and the average DBH is eight inches. The recovered area is then weighted by the percent of land it occupies. **Table 5-3** shows the potential hydrologic recovery for each subwatershed and drainage.

Table 5-3 **Hydrologic Recovery for Rock Creek**

Drainages & Subwatersheds	% Hydrologic Recovery (SC III)	% Hydrologic Recovery (SC IV)
Cougar Cr	74	72
East Fork	94	93
Lower E. Fork	79	67
Mace Cr	78	72
North Fork	88	83
Surprise Cr	91	89
Upper E. Fork	78	68
Wapiti Cr	94	92
E FORK ROCK CR	86	82
Conley Cr	69	66
Hiatus Cr	57	55
Kelly Cr	78	71
McComas Cr	61	54
Mill Pond	56	51
Taylor Cr	58	49
LOWER ROCK CR	67	60
Harrington Cr	79	69
Miller Cr	61	51
Rock Camp	74	66
Rock Rec	50	37
Shoup Cr	76	65
Woodstock Cr	69	60
MILL POND	73	63
Bluff Cr	66	56
Huckleberry Cr	68	65
NE Fork	86	72
Upper NE Fork	86	70
Upper T	64	58
Zig Zag Cr	69	58
NE FORK ROCK CR	69	60
Cobble Cr	93	83
Crossroads Cr	89	85
Gravel	92	92
Pebble Cr	64	60
Stoney Cr	72	60
ROCKY	80	72
Disappearing Cr	72	61
Rubble Cr	78	72
Twin Cedar Cr	79	73
UPPER ROCK CR	76	68
TOTAL ROCK CREEK	75	68

An arbitrary sampling of various hydrologic recovery percents (HRP) in the past, based on Site Class IV was evaluated. **Table 5-4** identifies the total percent recovery for the various points in time.

Table 5-4 **Past Years Hydrologic Recovery (Assumes Site Class IV)**

Year	% Hydrologic Recovery
1960	92
1966	73
1970	74
1981	55
1995	68

From 1950 to 1959, approximately 3,649 acres within the TSZ were harvested from BLM and private lands. From 1960 to 1969 harvest increased to 8,953 acres. From 1970 to 1980 harvest further increased to 13,684 acres. The ages of the harvest acreage, from the BLM GIS database, were generated from field investigations and aerial photo interpretations. An improvement from the 1981 HRP of 55% compared to the 1995 HRP of 68% for Site Class IV is evident. The improvement is due to the recovery of the 1960's harvest units and to a lesser extent the 1970 to 1980 stand recoveries.

E. Channel Extension by Roads and Effect of Peak Flows

There are approximately 490 miles of road in the Rock Creek Watershed. The road density for the Rock Creek Watershed was 5.0 mi/mi^2. Stream and road densities by subwatershed and drainage are shown in **Table 5-5**. Road Densities and stream crossings were derived from the BLM GIS road inventory.

Wemple (1994) studied the hydrologic integration of forest road with stream networks. The study suggests that roadside ditches and gullies operate as surface flow paths, increasing drainage density during storm events. She hypothesized that the effect could decrease the time for concentrating storm flows, which could contribute to higher peak discharges. The study estimates that roads may extend stream networks by as much as 40% during storm events and as much as about 60% on winter base flow stream lengths. The results derived from two watersheds was based on road densities of 1.61 mi/mi^2. Rock Creek road densities are generally greater than 4 mi/mi^2. The higher road densities could possibly result in a more frequent road stream density crossing than was encountered in the Wemple Study.

Table 5-6 shows the number of road/stream crossings, and their densities by drainage and subwatershed. Although no field verification of road stream crossings were conducted, risk for potential peak flow increases by road channel extension was estimated by the number of road and stream crossings using the GIS database. As stated previously not all first order streams are identified by the GIS database. Therefore, the actual road and stream crossing densities may be higher than this information portrays. It was assumed that the highest crossing densities, and therefore greater hydrologic integration to the stream network, would have the greatest potential for peak flow increases from road related run-off. The potentially highest risk, East Fork Rock Creek subwatershed, has 178 stream crossings (1.61 crossing density). The drainages that have the highest crossing densities are East Fork, 32 crossings (2.2 crossing density) and North Fork, 36 crossings (2.18 crossing density).

F. Potential for Plugged Culverts

Figure 5-3 displays the roads and streams within Rock Creek watershed and **Table 5-6** shows the number of road/stream crossings, and their densities by drainage and subwatershed. The road lengths and number of stream crossings were derived from the BLM GIS road and stream inventory. As stated previously not all first order streams are identified by the GIS database. Therefore, the actual road and stream crossing densities may be higher than this information portrays.

The crossing density can be used to show a drainage or subwatershed's proportional potential for culverts being plugged during a 100 year flood event. No inventory exists at this time that would determine if existing culverts are appropriately sized to accommodate a 100-year flood event. The North Fork drainage and Rock Rec drainage have crossing densities of greater than 2. These two drainages may be more at risk for culverts plugging than Rock Camp with a crossing density of .45.

Figure 5-1

Rock Creek Streams

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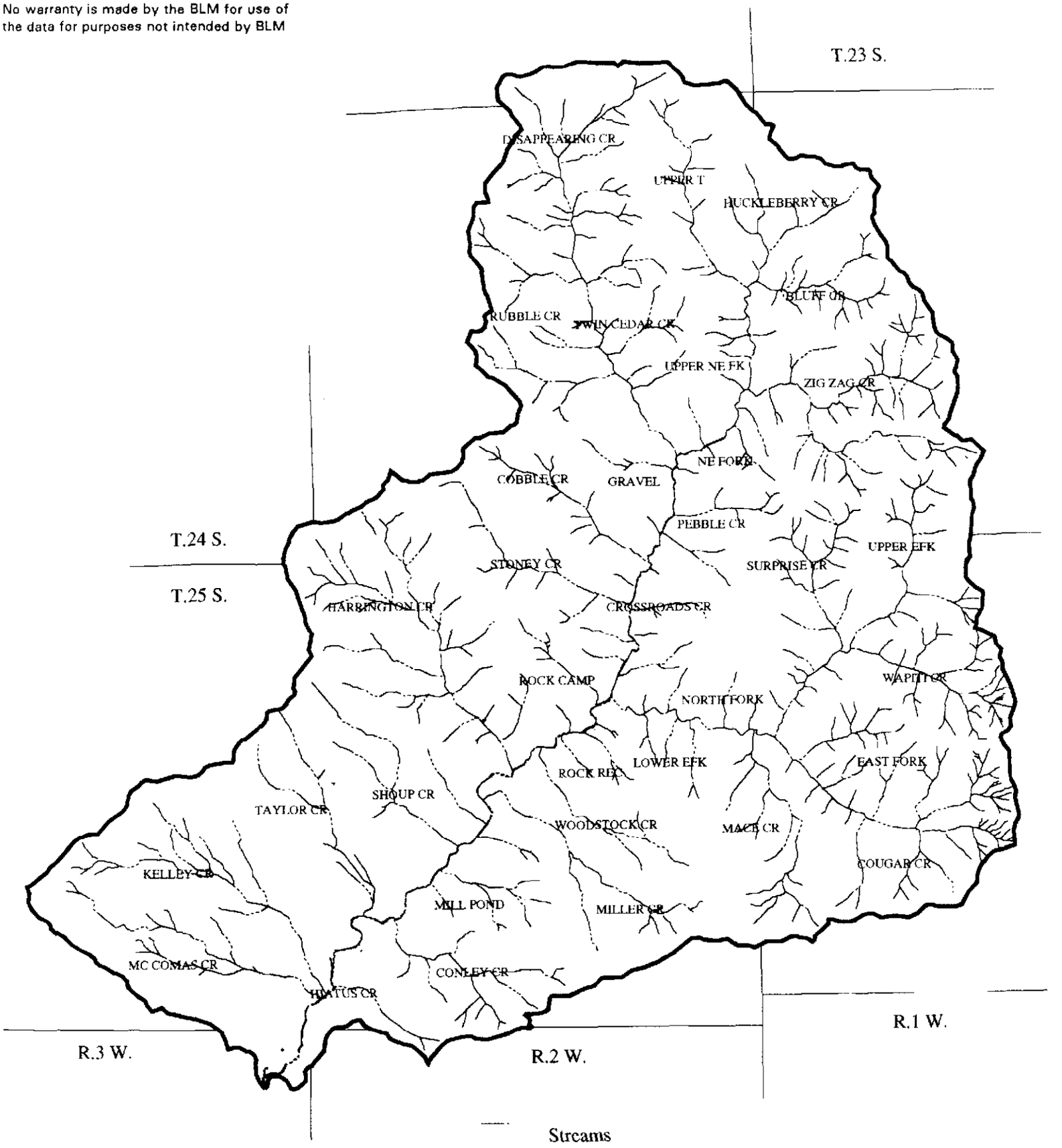

ROCK CREEK STREAM LENGTHS & DENSITIES

Table 5-1

DRAINAGES	ACRES	SQUARE MI	STREAM ORDERS 1	2	3	4	5	6	7	Unknown	TOTAL BY DRAINAGE	STREAM DENSITY MI/SQ.MI
COUGAR CR	1854	2.90	3.82	3.53	2		1.27			1.4	12.02	4.15
EAST FORK	2370	3.70	4.65	6.9	4.08	0.99	1.09			4.82	22.53	6.08
LOWER EFK	989	1.54	1.93	1.34	1.4	0.02		0.03		0.17	4.89	3.17
MACE CR	2010	3.14	1.13	3.18	1.65	2.43	0.03	0.08		1.01	9.51	3.03
NORTH FORK	1868	2.92	3.39	1.78	1.39	0.03	1.97	2.64		0.98	12.18	4.17
SURPRISE CR	1605	2.51	2.67	2.86	2.18	0.86				3.08	11.65	4.65
UPPER EFK	1920	3.00	3.4	2.96	1.92	1.98				2.56	12.82	4.27
WAPITI CR	1634	2.55	2.87	4.2	1.4	1.6	0.08			4.66	14.81	5.80
E FORK ROCK CR	**14250**	**22.27**	**23.86**	**26.75**	**16.02**	**7.91**	**4.44**	**2.75**	**0**	**18.88**	**100.41**	**4.51**
CONLEY CR	1844	2.88	1.71	2.47	2.24	1.53				1.35	9.3	3.23
HIATUS CR	1052	1.64	0.61	1.62	0.08			0.79		0.26	3.36	2.04
KELLEY CR	3118	4.87	3.68	4.84	4.02	0.12		0.78		2.35	15.79	3.24
MCCOMAS CR	2886	4.51	4.3	2.36	5.05	1.05		0.22	0.06	1.64	14.68	3.26
MILL POND	1224	1.91	1.41	2.8	1.08	0.04		0.28		0.14	5.75	3.01
TAYLOR CR	2702	4.22	2.13	3.65	1.78			2.01		0.79	10.36	2.45
LOWER ROCK CR	**12826**	**20.04**	**13.84**	**17.74**	**14.25**	**2.74**	**0**	**4.08**	**0.06**	**6.63**	**59.24**	**2.96**
HARRINGTON CR	4817	7.53	4.41	12.56	4.18	3.03				1.89	26.07	3.46
MILLER CR	2260	3.53	1.66	2.91	1.56	3.02		0.54		0.34	10.03	2.84
ROCK CAMP	851	1.33	0.66	1.09	1.17	0.01		1.69		0.77	5.39	4.05
ROCK REC	586	0.92	0.74	1.53	0.63			0.23		0.49	3.62	3.95
SHOUP CR	1924	3.01	1.36	3.28	2.56	0.01		1.33		0.3	8.84	2.94
WOODSTOCK CR	1290	2.02	2.12	2.64	1.98						6.74	3.34
MILL POND	**11728**	**18.32**	**10.96**	**24.01**	**12.06**	**6.07**	**0**	**3.79**	**0**	**3.79**	**60.89**	**3.31**
BLUFF CR	1539	2.41	2.3	3.37	0.99	1.03	0.31			1.85	9.85	4.10
HUCKLEBERRY C	1478	2.31	3.08	2.93	1.28	0.49				0.13	7.91	3.43
NE FORK	540	0.84	0.96	1.86	0.53		0.45				3.8	4.50
UPPER NE FK	822	1.28	1.28	2.29	0.02	0.02	2.3			0.43	6.34	4.94
UPPER T	1910	2.98	3.67	3.49	2.67	0.03	0.17			0.63	10.66	3.57
ZIG ZAG CR	3385	5.29	2.17	6.03	5.02	2.66				6.77	22.65	4.28
NE FORK ROCK C	**9674**	**15.12**	**13.46**	**19.97**	**10.51**	**4.23**	**3.23**	**0**	**0**	**9.81**	**61.21**	**4.05**
COBBLE CR	1405	2.19	1.85	1.99	0.91	1.61				1.15	7.51	3.42
CROSSROADS C	1038	1.62	2.15	1.53	1.45	0	0.82	0.27		0.59	6.81	4.20
GRAVEL	804	1.26	1.69	1.65	0.01	0.01	1.13			0.26	4.75	3.78
PEBBLE CR	1227	1.92	1.95	2.02	2.28		0.46			0.44	7.15	3.73
STONEY CR	2319	3.62	2.76	5.25	2.95		0.83	0.25		0.73	12.77	3.52
ROCKY	**6794**	**10.62**	**10.4**	**12.44**	**7.8**	**1.62**	**3.24**	**0.52**	**0**	**3.17**	**39.99**	**3.67**
DISAPPEARING C	2610	4.08	1.6	6.28	2.14	0.56				2.41	12.99	3.18
RUBBLE CR	2808	4.39	2.97	4.46	2.79	0.5				3.16	13.88	3.16
TWIN CEDAR CR	2023	3.16	0.97	2.7	2.47	3.39	0.02			2.32	11.87	3.75
UPPER ROCK CR	**7442**	**11.63**	**5.54**	**13.44**	**7.4**	**4.45**	**0.02**	**0**	**0**	**7.89**	**38.74**	**3.33**
TOTAL	**62712**	**97.99**	**78.06**	**114.35**	**67.86**	**27.02**	**10.93**	**11.14**	**0.06**	**49.87**	**359.28**	**3.67**

11/28/95STR_DENS.WK4

Figure 5-2

Rock Creek
Transient Snow Zone

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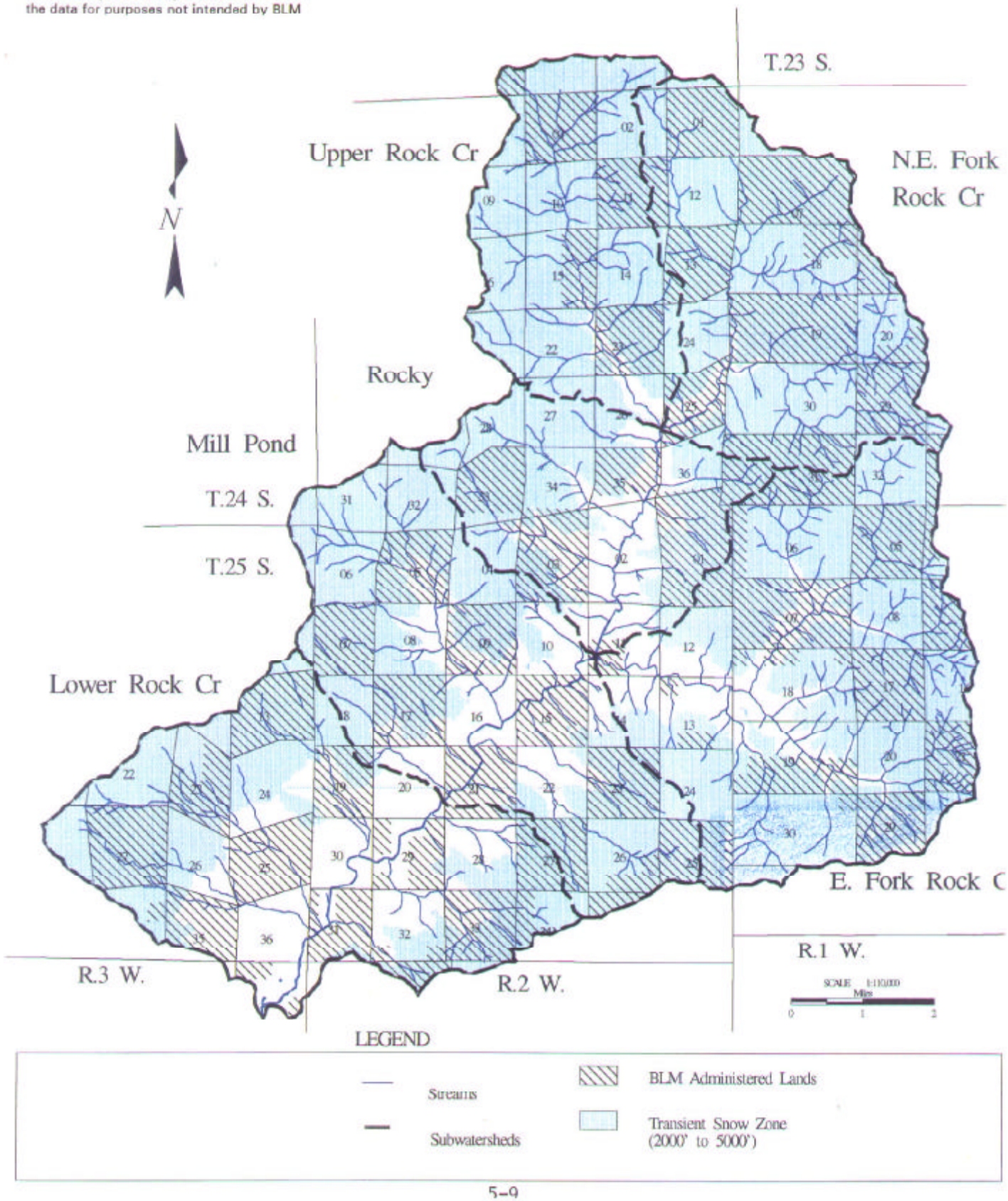

Figure 5-3

Rock Creek Roads & Streams

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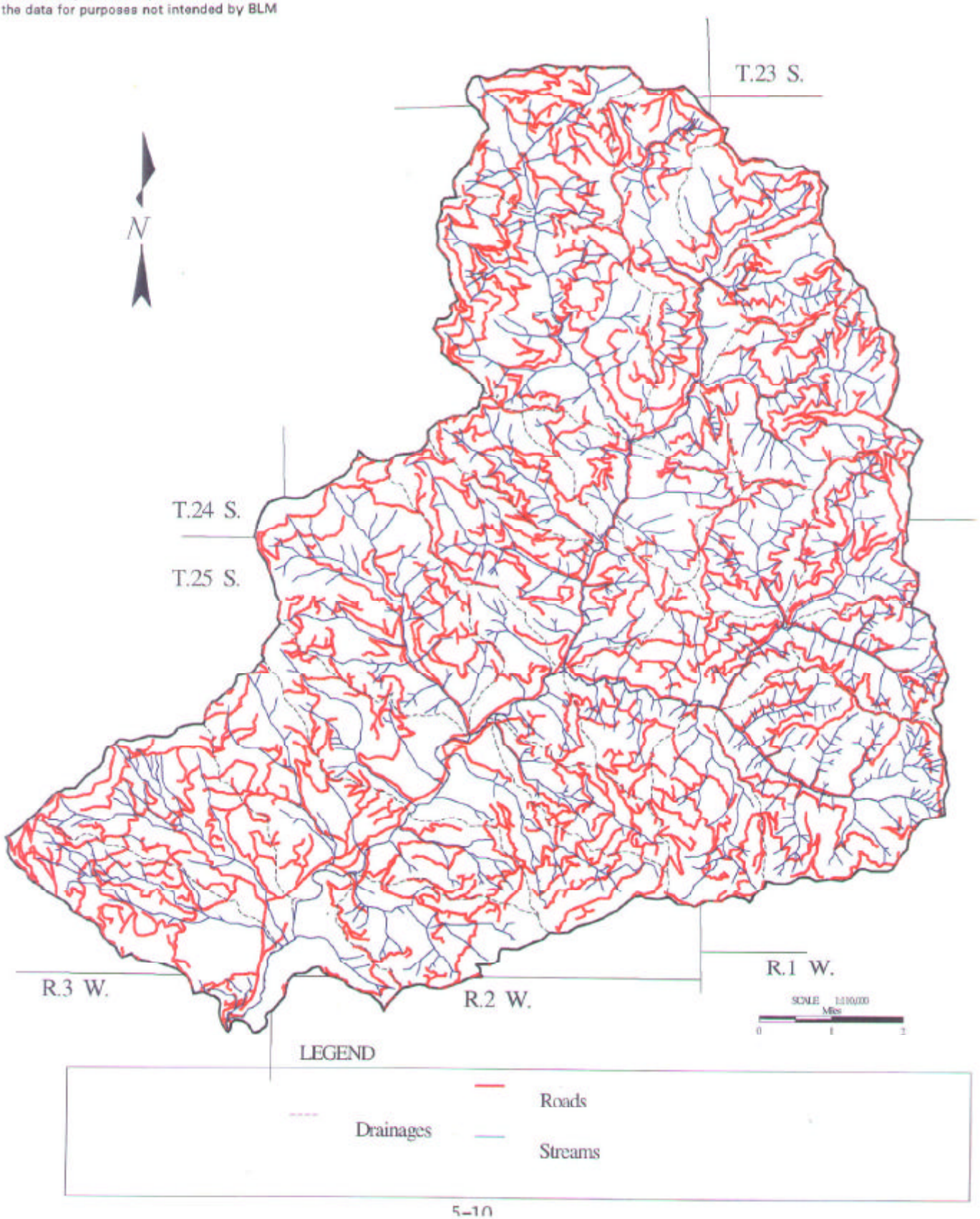


Table 5-5 - **Rock Creek Stream & Road Densities**

Subwatersheds & Drainages	Stream Density (mi/sq.mi)	Road Density (mi/sq.mi)
COUGAR CREEK	4.15	4.38
EAST FORK	6.08	3.88
LOWER EAST FORK	3.17	4.99
MACE CREEK	4.17	5.27
NORTH FORK	4.65	5.67
SURPRISE CREEK	4.27	4.21
UPPER EFK	4.27	6.31
WAPITI	5.80	5.30
EF ROCK CREEK	**4.51**	**4.98**
CONLEY CREEK	3.23	3.72
HIATUS CREEK	2.05	2.40
KELLY	3.24	5.10
MCCOMAS CREEK	3.26	5.89
MILL POND	3.00	5.29
TAYLOR	2.45	5.25
LOWER ROCK CREEK	**2.96**	**4.91**
HARRINGTON CREEK	3.36	4.51
MILLER CREEK	2.84	4.62
ROCK CAMP	4.05	3.31
ROCK REC	3.95	4.22
SHOUP CREEK	2.94	4.15
WOODSTOCK CREEK	3.34	6.48
MILL POND	**3.31**	**4.59**
BLUFF CREEK	4.10	4.90
HUCKLEBERRY CREEK	3.42	4.89
NE FORK	4.51	5.34
UPPER NE FORK	4.93	6.86
UPPER TWIN CEDAR CREEK	3.57	5.97
ZIG ZAG CREEK	4.28	5.19
NE FORK ROCK CREEK	**4.05**	**5.40**
COBBLE CREEK	3.42	5.56
CROSSROADS CREEK	4.20	4.78
GRAVEL	3.77	4.30
PEBBLE CREEK	3.73	3.12
STONEY CREEK	3.53	5.87
ROCKY	**3.67**	**4.96**
DISAPPEARING CREEK	3.18	5.56
RUBBLE CREEK	3.16	5.86
TWIN CEDAR CREEK	3.75	4.48
UPPER ROCK CREEK	**3.33**	**5.38**
ROCK CREEK WATERSHED	**3.67**	**5.00**

Table 5-6 **Rock Creek Road & Stream Crossing Densities**

Subwatersheds & Drainages	Acres	No. Road/Stream Crossings	Road Length (miles)	Crossing Density (Crossings/mile)
Cougar Cr	1854	16	12.57	1.27
East Fork	2370	32	14.45	2.20
Lower E. Fork	989	12	7.66	1.57
Mace Cr	2010	17	16.56	1.03
North Fork	1868	36	16.54	2.18
Surprise Cr	1605	16	10.53	1.52
Upper E. Fork	1920	23	18.94	1.21
Wapiti Cr	1634	27	13.50	2.00
E Fork Rock Cr	**14250**	**178**	**110.75**	**1.61**
Conley Cr	1844	7	10.67	.66
Hiatus Cr	1052	2	3.94	.51
Kelly Cr	3117	20	24.98	.80
McComas Cr	2886	29	26.51	1.09
Mill Pond	1224	7	10.11	.69
Taylor	2701	15	22.11	.68
Lower Rock Cr	**12824**	**80**	**98.32**	**.81**
Harrington Cr	4817	40	33.74	1.19
Miller Cr	2260	21	16.33	1.29
Rock Camp	851	2	4.46	.45
Rock Rec	586	8	3.86	2.07
Shoup Cr	1924	9	12.48	.72
Woodstock Cr	1290	15	13.09	1.15
Mill Pond	**11728**	**95**	**83.96**	**1.13**
Bluff Cr	1539	14	11.81	1.19
Huckleberry Cr	1478	13	11.24	1.16
NF Fork	540	9	4.60	1.96
Upper NF Fork	822	17	8.83	1.93
Upper T	1910	27	17.90	1.51
Zig Zag Cr	3385	33	27.28	1.21
NF Fork Rock Cr	**9674**	**113**	**81.66**	**1.38**
Cobble Cr	1405	11	12.23	.90
Crossroads Cr	1038	8	7.79	(.90)
Gravel	804	4	5.38	.74
Pebble Cr	1228	7	6.02	1.16
Stoney Cr	2319	21	21.26	.99
Rocky	**6794**	**(50)**	**52.68**	**(.95)**
Disappearing Cr	2611	25	22.52	1.11
Rubble Cr	2808	33	25.74	1.28
Twin Cedar Cr	2023	18	14.12	1.27
Upper Rock Cr	**7442**	**76**	**62.38**	**1.22**
TOTAL	**62712**	**592**	**489.75**	**1.21**

EROSIONAL PROCESSES

A. Geology

The Rock Creek watershed lies predominately within the Western Cascades Geologic Province and a small portion lies within the Coast Range Province along the western boundary of the watershed. *The Geology and Mineral Resources of Douglas County* (1972), characterizes the Western Cascade Provinces has having rugged topography with irregular ridges, and deep narrow valleys. The area is underlain by volcanics of the Eocene and Oligocene epochs, with fluvial sedimentary rocks being subordinate. Throughout the area there area small intrusions and localized mineral depositions of cinnabar, antimony, gold , silver, copper, and silica.

Figure 6-1 was developed in the GIS system and based on the United States Geologic Survey (USGS) 1:500,000 Geologic Map Of Oregon. The explanations were based on the *Explanation For Geologic Map of Oregon* (Walker and MacLeod,1991). The USGS survey identifies the rock units within the watershed. The predominate rock units are **Tfe**, Fisher and Eugene Formations of the Oligocene and upper Eocene epochs. The Fisher Formation, which interfingers and overlaps the Eugene formation in the upper parts is older andesitic lapilli tuff, breccia, waterlaid and airfall silicic ash. Basalt lava flows within the Fisher Formation are as old as 40 Million years old. The Eugene formation is feldspar and mica bearing sandstone and siltstone. **Tus**, Sedimentary and volcaniclastic rocks, the other predominate rock unit consist of lapilli tuff, mudflow deposits (lahars[1]), flow breccia, and volcanic conglomerate of basaltic to dacitic composition. In general, it appears that the mid portion of the main stem of Rock Creek closely follows the contact between **Tfe** and **Tus**. The map scale difference between the watershed and geologic map may account for the offset.

The **Qls**, landslide and debris-flow deposits (Holocene and Pleistocene epochs, and some Pliocene), is found in the southwest portion of the watershed in the McComas Creek, Kelly Creek, Taylor Creek and Harrington Creek compartments. The **Qls** is landslide fragments of adjacent bedrock which is unstratified.

Along the eastern edge of the watershed is **Tub**, Basaltic lava flows, which are described as basaltic and andesitic lava flows and breccias, which grades into palagonitic tuff and breccia.

Tut, Tuff, which appears to occur between the **Tfe** and the **Tus**, is describe as welded to unwelded, mostly vitric crystal and vitric ash flow tuffs of various ages. The glass in the tuff is locally altered. There are also isolated units of **Thi** Hypabyssal[2] intrusive rock of the Miocene epoch. The **Thi** unit consist of medium grained hornblende diorite and quartz diorite in small stocks and large dikes.

B. Soils

Soils were grouped as shown in **Figure 6-2**, into nine map units. Rock outcrop was also included on the map, however, it does not account for the rock outcrop component included in other map units. The

[1]Lahars are mudflows created from catastrophic events on the flanks of volcanos, which may reach 100km from the source if restricted to a confining valley.

[2]Hypabyssal rocks are intrusive rocks that have crystallized at shallow depths below the surface.

information was derived from the Draft Douglas County Soil Survey, mapped by the Natural Resource Conservation Service (NRCS). The soil map units were grouped by textural families (soil texture), mineralogy, slope (indicated by the % listed after each soil group name) and drainage (wet soils). The soil groups are: <30% ashy soils,; 30-60% ashy soils; >60% ashy soils; <30% clayey soils, 30-60% clayey soils; <30% fine-loamy; 30-60% loamy skeletal (Losk) soils (>35% rock fragments); >60% loamy skeletal; and wet soils.

The different textural classes produce different types of sediment. Clayey soils, if eroded, can produce a fine sediment with lesser amounts of sand and silt sized sediment. Fine-loamy soils can produce a fine sediment with greater amounts of silt and sand sized sediment. Loamy skeletal soils produce similar sediment as fine loamy soils along with gravel, cobbles, and stones. Ashy soils tend to produce sand to silt sized sediment. The larger, heavier sediments settle out first, while lighter, finer sediment stays suspended longer.

All soils are compactable. Compaction can reduce soil productivity, reduce waterholding capacity (may increase capacity in sandy and ashy soils), reduce infiltration and permeability, increase runoff, increase bulk density, restrict root growth, and reduce soil aeration. Clayey soils are more susceptible to compaction compared to sandy soils. Clayey soils less than 30% slope represents the soil group most susceptible to compaction from ground-based activities that may take place on slopes of less than 35%.

The natural erosional processes occurring within the Rock Creek watershed include surface erosion and mass wasting. Surface erosion includes rill, gully, and sheet erosion. Mass wasting includes debris slides and avalanches, rock slides and falls, soil slips, earth flows, slumps,and soil creep.

C. Landslide Inventory

1. Landslides Related to Management

An inventory of landslides was conducted in Rock Creek watershed by aerial photo interpretation. The landslides generally included debris slides and avalanches, soil slips, and slumps. Aerial coverage for 1964, 1978, 1983 and 1994 was available for the inventory. Aerial photo coverage for a reference condition was not available. Field verification of the inventory has not been conducted, therefore, certain limitations to the accuracy of the inventory exist at this time. Furthermore, landslides that may have occurred in forest stands may have been concealed by the forest canopy.

Table 6-1 Unverified Aerial Interpretation Landslide Inventory

PHOTO DATE YEAR	NATURAL LANDSLIDES	MANAGEMENT RELATED LANDSLIDE	TOTAL LANDSLIDES
1964	4	66	70
1978	11	131	142
1983	3	72	75
1994	3	41	44
Totals	21	310	331

During the photo coverage time period, there were approximately 331 landslides within the Rock Creek watershed. Approximately 94% of the landslides that may have occurred within the watershed may be linked to management activities (**Table 6-1**). The greatest number of landslides occurred from 1964-1978. This may have been, in part, the result of a substantial winter storm which produced the well known 1964 flood event during this period.

2. Landslides Related to Geology

The number of landslides by geologic units are shown in **Table 6-2**.

Table 6-2 Unverified Landslides by Geologic Unit

GEOLOGIC UNIT	% AREA OF WATERSHED	NUMBER OF SLIDES*	PERCENT OCCURRENCE
Tfe	45	104	30
Tus	30	170	52
Thi	4	25	8
Tut	3	4	1
Tub	6	23	7
Qls	11	6	2
Tsv	1	1	<1
TOTAL		331	

*Photo-interpretation slide inventory

The greatest number of landslides, approximately 52%, are found in the Tus geologic unit, consisting of sedimentary and volcanoclastic rocks, as well as lapilli tuff and mudflow deposits. The Tus geologic unit comprises 30% of the watershed area. The geologic unit lies predominately along the eastern half of Rock Creek watershed (Figure 6-1). Also, a large number of slides appear to be related to the Tfe geologic unit, consisting of volcanic tuffs, sandstones and siltstones. Tfe lies predominately along the western half of Rock Creek watershed and comprises 45% of the watershed area. The Tfe and the Tus geologic units comprise 75% of the watershed area and have 82% of the landslides.

3. Landslides Related to Soils

The landslides inventory shows the occurrence of landslides by soil groupings and map units (which comprise the soil groupings) containing landslides.

The number of landslides associated with the soil groups are shown in **Table 6-3**. The greatest proportion of slides occur within the Loamy skeletal >60% group, with 71% of the slides. The Loamy skeletal >60% soil grouping comprises 33% of the watershed area. The Loamy Skeletal 30-60%, which comprises 21% of the watershed area, has approximately 14% of the slides. The Loamy skeletal grouping overall comprises 54% of the watershed areas and has 85% of the slides. Based on the broad groupings of slope (slope: >60%, 30-60%, and <30%), 71% of the slides occur in the >60% grouping and the 25% occur in the

slopes ranging from 30-60% grouping.

Table 6-3 Unverified Landslides by Soil Group

SOIL GROUP (%=slope)	% AREA OF WATERSHED	NUMBER OF SLIDES*	% OCCURRENCE
Clayey 0-29%	16	6	2
Clayey 30-60%	13	33	10
Wet	3	0	-
Loamy Skeletal 30-60%	21	48	14
Loamy Skeletal >60%	33	238	71
Ashy 0-29%	7	2	1
Ashy 30-60%	4	4	1
Ashy >60	1	0	-
ROC	<1	1	.5
Fine Loamy 0-29%	2	1	.5

*Photo-interpretation slide inventory

A further break in landslide occurrence was done for slides occurring in each soil map unit. The soil map units are derived from the Draft Douglas County Soil Survey (NRCS, 1995). The greatest number of slides occurred in map units 464G, which comprises 13% of the watershed area. The 464 G map unit had 37% of the slides. Map unit 1460G , which comprises 14% of the watershed area, had 26% of the slides (**Table 6-4**). The inventory shows that soil units 1460G and 464G have 63% of the landslides. These two map units comprise 27% of the watershed area. These soil map units occur in the slope grouping of >60% (loamy skeletal).

Table 6-4 Soil Map Units Containing Unverified Landslides

SOIL MAP UNIT	% AREA OF WATERSHED	NUMBER OF SLIDES*	% OCCURRENCE
464G	13	122	37
1460G	14	86	26
463F	13	37	11
327F	11	27	8
1464G	3	22	7
901G	2	6	2
328F	1	5	2
1901F	4	6	2
345F	<1	4	1
900F	4	4	1
305E	<1	3	1
327E	8	3	1
466E	2	2	<1
1901G	1	2	<1
901F	2	1	<1
1345F	<1	1	<1
901E	2	1	<1
305F	<1	1	<1

*Photo-interpretation slide inventory

Soil units which had a hazard for slope failure - major management limitation rating (NRCS, 1995) were grouped together for the purpose of this analysis. The number of landslides associated with this hazard rating was 66%, with 63% contained in map units 1460G and 464G. Map units 1460G and 464G comprise 27% of the area of the watershed.

Figure 6-1

ROCK CREEK GEOLOGY

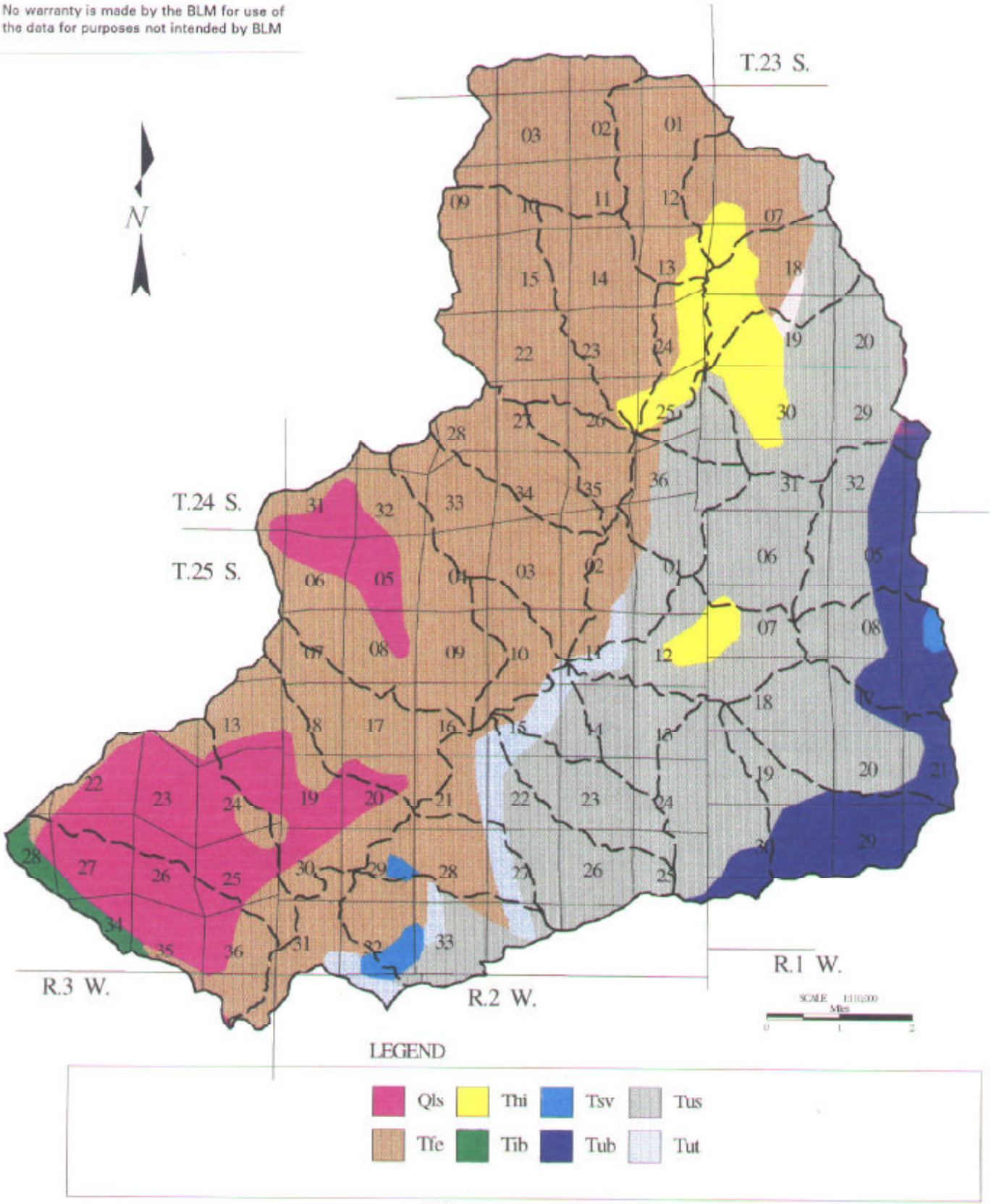
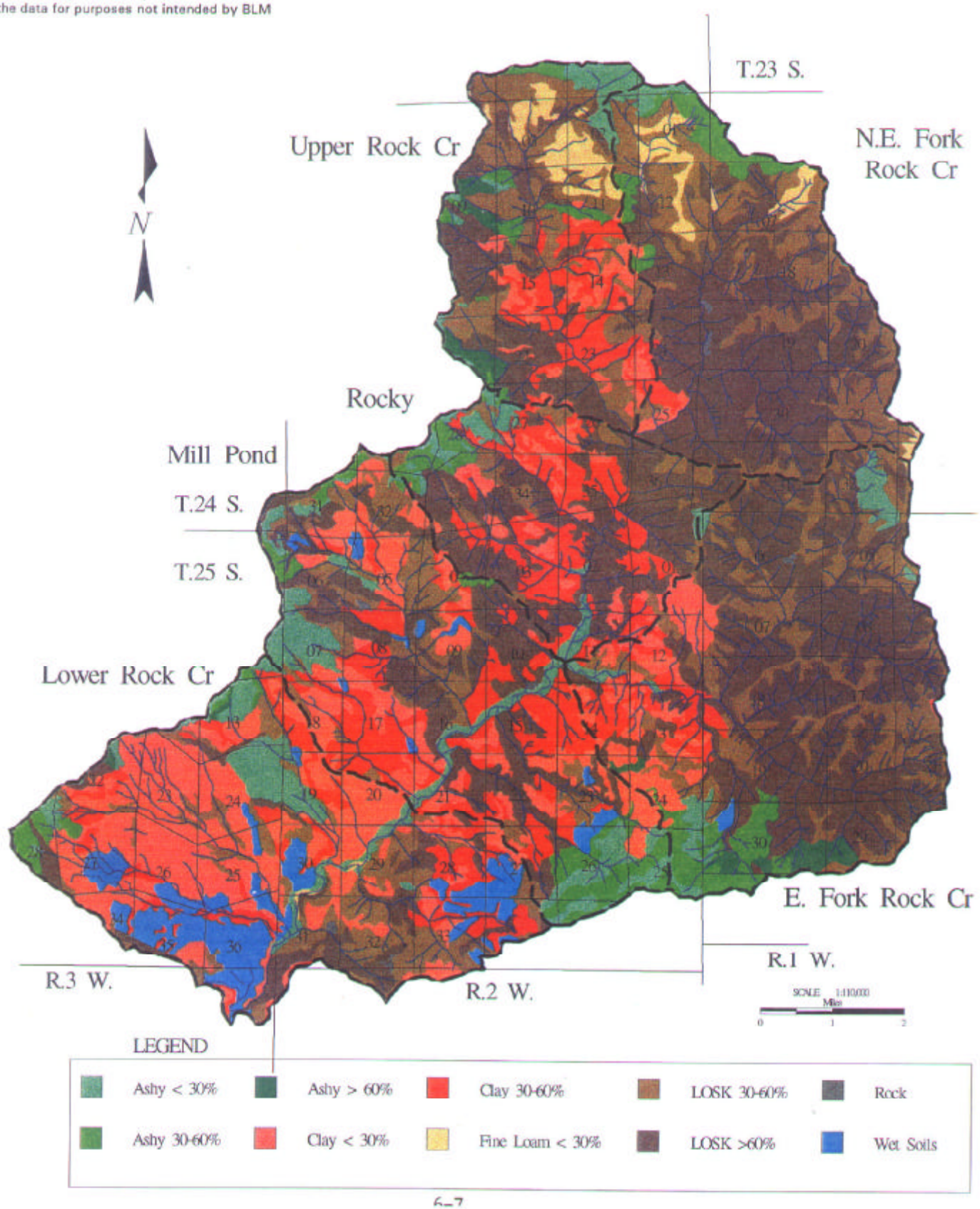


Figure 6-2

Rock Creek Soils

No warranty is made by the BLM for use of the data for purposes not intended by BLM



WATER QUALITY

A. Water Quality Conditions

1. Standards by Law

The Clean Water Act of 1977 states " (Sec 101 a.) The objective of this Act is to restore and maintain the chemical, physical, and biological integrity of the Nations' waters." The Act directs the State to set water quality standards that are not to be exceeded. Water quality will be managed to protect and recognize beneficial uses.

The Oregon Administrative Rules Antidegradation Policy (OAR 340-41-026) intent is to maintain water quality of the state. The general policy for surface waters is "to guide decisions that affect water quality such that unnecessary degradation from point and nonpoint sources of pollution is prevented, and to protect, maintain, and enhance existing surface water quality to protect all existing beneficial uses." The Standards for this policy for the Umpqua Basin is set forth in Oregon Administrative Rules (OAR 340-41-282).OAR 340-41-282 sets forth specific water quality standard which are not to be exceeded, designed to protect designated beneficial uses.

OAR 340-41-282; Table 3, identifies Beneficial Uses for the Umpqua Basin. *For All Other Tributaries to Umpqua, North & South Umpqua Rivers* the following are considered beneficial uses:

*Public Domestic Water Supply
*Industrial Water Supply
*Livestock Watering
*Salmonid Fish Rearing
*Resident Fish & Aquatic Life
*Fishing
*Water Contact Recreation
*Hydro Power
*Private Domestic Water Supply
*Irrigation
*Anadromous Fish Passage
*Salmonid Fish Spawning
*Wildlife & Hunting
*Boating
*Aesthetic Quality

2. General Water Quality

The Department of Environmental Quality (DEQ) conducted an assessment of nonpoint source (NPS) pollution related water quality conditions, the results were published in 1988 (*1988 Oregon Statewide Assessment of Nonpoint Sources of Water Pollution*). The report identified pollution type and severity. The Rock Creek watershed was rated moderate by observation for turbidity, sedimentation and streambank erosion. Moderate is defined as interfering with the designated beneficial uses, as compared to severe, which is substantial or nearly complete interference or elimination of a beneficial use. The report cited that the probable causes for disturbances were slides, road runoff, vegetation removal, and road location. The associated land uses most commonly cited included road construction, road maintenance, road use and transportation network (in general). The impacted beneficial uses were, domestic water supply, cold water fish and other aquatics. Adjoining tributaries to Rock Creek were designated no problem or no data available.

B. Sedimentation and Turbidity

Turbidity is defined as the amount of light that is scattered or absorbed by a fluid (EPA, 1990)

The DEQ has set forth in Oregon Administrative rules, Chapter 340-41-282 water quality standards for the Umpqua River Basin. The water quality characteristics that are managed to protect recognized beneficial uses include turbidity. The standards set forth that, "No more than a ten percent increase in natural stream turbidities shall be allowed, as measured relative to a control point immediately upstream of the turbidity causing activity."

The Environmental Protection Agency (EPA) published *Monitoring Guidelines to Evaluate Effects of Forestry Activities on Stream in the Pacific Northwest and Alaska* (1990). The report indicated that high turbidity levels can impact salmonids feeding and growth of salmonids and other fish species. Levels of the range of 25-70 nephelometric turbidity units (NTU, measured by photoelectric turbidimeters) impairs the ability of salmonids to find and capture food. Also, growth is reduced and gill tissue is damaged after 5-10 days of exposure to turbidities of 25 NTU.

The EPA report also indicated that turbidity can impact drinking water, recreational and aesthetic uses of water. Turbidity that reduces light penetration in water can decrease primary productivity.

No known data is available for the Rock Creek watershed.

C. pH

The DEQ has set forth in Oregon Administrative rules, Chapter 340-41-282 water quality standards for the Umpqua River Basin. The water quality characteristics that are managed to protect recognized beneficial uses include water pH. The standards identify that pH values shall not fall outside the range of 6.5 to 8.5.

Monitoring Guidelines to Evaluate Effects of Forestry Activities on Stream in the Pacific Northwest and Alaska (1990) report indicated that pH levels of greater than 9 and less than 6.5 can have an adverse affect on fish and aquatic insects. However, sub-lethal affects of higher pH levels on fish are not known.

The *Little River Watershed Analysis (1995)* pointed out that accumulation of algae in streams could affect pH. The process of photosynthesis consumes H+ ions during the daylight hours, elevating pH (more alkaline) and at night pH decreases. On shaded stream reaches or during days of cloudy weather algae photosynthesize less and pH levels are lower. In river waters not influenced by pollution, the process of photosynthesis by aquatic organisms take up dissolved CO_2 during daylight and release CO_2 at night by respiration. Daily fluctuations of pH may occur with maximum pH values reaching as high as 9.0 (Hem, 1985).

The Little River Watershed Analysis identified the following conditions that could promote algae growth and accumulations:

1. Lack of riparian shade can increase productivity of algae.
2. Presence of bedrock creates habitat for algae, but poor habitat for algae eating insects.
3. Nutrient availability (ie. increase in nitrogen).

The Analysis also identified the following conditions that could promote lower pH:

1. Riparian shade.
2. Gravel/cobble substrate and large wood in streams, which provide habitat for algae eating insects.
3. Forest stands upslope which cycle and store nitrogen in vegetation and soil so that it is not available for runoff.

No known data is available for the Rock Creek watershed.

D. Stream Temperatures

1. Past Conditions

Anecdotal accounts from a long time resident suggests that at one time Rock Creek was much colder than it is at the present (memories of Henry Weber, on file, Roseburg District Office). He remembers going to swim in the North Umpqua River because Rock Creek was too cold. Presently, the Rock Creek Fish Hatchery draws their water during the summer months from the North Umpqua River because Rock Creek is too warm. Temperature data are available for three stations in the Rock Creek watershed in 1968. Although the exact stations are not repeated in 94 and 95, the stations are close enough to compare. These data suggest that temperatures in 1968 were higher than they are today. Although the high temperatures do not compare with the peak of cutting in the watershed, they could be a product of the state forestry practices at the time. Holaday (1992) found a decreasing trend in the Steamboat Creek stream temperatures over the last 20 years. He attributed this decrease to a recovery of the riparian vegetation after a period of heavy logging without stream buffers. Although the data are inadequate to say for sure, it is possible that this same recovery could be taking place in Rock Creek. Further work is needed in areas with elevated water temperatures to determine the source.

2. Current Conditions

The DEQ has set forth in Oregon Administrative rules, Chapter 340-41-282 water quality standards for the Umpqua River Basin. The water quality characteristics that are managed to protect recognized beneficial uses include water temperature. The standards identify that no measurable increases in water temperature when stream temperatures are 58 degrees or greater and/or no more than a two degree increase when stream temperatures are 56 degrees or less.

Water temperatures for Rock Creek were monitored by Douglas County by the gaging station of Rock Creek, .3 mile downstream from McComas Creek, a 6th order stream. The period of record was 1983 to 1992, excluding 1984 and 1986, in which there was only partial data for the period of record.

The percent of time that the daily maximum and minimum temperatures were warmer than 58 degrees fahrenheit are shown in **Table 7-1**. The period of record was from June 1 to September 30, at the Rock Creek gaging station.

No baseline temperature data exists for Rock Creek. The temperature data also covers a limited period of time. Further analysis of the temperature regime of the watershed may be in order. The data does demonstrate that water temperatures at Rock Creek exceed the current standard of 58 degrees, the temperature at which if exceeded, may impact fisheries beneficial uses.

Table 7-1 **Rock Creek Summer Temperatures in Relation to Watershed Criteria**

YEAR	% TIME SUMMER DAILY MAXIMUMS EXCEEDED 58 DEGREES	% TIME SUMMER DAILY MINIMUMS EXCEEDED 58 DEGREES
1983	92°	30°
1985	93°	52°
1987	100	63
1988	91	45
1989	100	51
1990	92	71
1991	98	49
1992	100	69

NOTE: Insufficient data for 1984 and 1986 for period of record.

Also, the Rock Creek temperature data in **Table 7-1** was obtained on a 6th order stream segment. The *Cumulative Effects of Forest Practices in Oregon* indicated that the harvest of streamside vegetation, to increase summer stream temperatures is generally more critical in low order streams, such as third and fourth order streams. However, the report also pointed out a "threshold distance", a distance at which "summertime stream temperatures naturally tend to increase in a downstream direction and approach mean basin air temperature at some distance from the watershed divide" (chap. 7, pg 137). The "threshold distance" was found to be about 25 to 37 miles downstream of the headwaters divide in the Washington Cascades (although the applicability to Oregon Cascades is not known). Beyond this point, the cumulative effects of streamside vegetation removal in headwaters may have little cumulative effects on water temperature. Rock Creeks length is approximately 17.2 miles and has probably not attained the "threshold distance". The temperature data collected on the 6th order stream segment for Rock Creek may reflect the cumulative effects on water temperature due to upstream streamside vegetation removal.

The monthly mean stream temperatures for each month are shown below. The period of record is 1983 to 1992, excluding 1984.

MONTH	MEAN TEMPERATURE
June	60°F
July	64°F
August	66°F
September	61°F

Water temperature data was collected in 1994 and 1995 at seven locations within Rock Creek (**Figure 7-1**). The average maximum temperature for the warmest 14 day period in the watershed for the seven locations was determined. The 14 day temperature shows a representative period of time during the warm period and is not tied to a particular standard. The 14 day warmest period was 7/16 to 7/29 in 1994 and 7/23 to 8/5 in 1995, shown in **Table 7-2**. The seven day mean maximum temperature is also included in the **Table 7-2**.

Table 7-2 **Rock Creek Warmest 14 Day Mean Max. Temperatures**

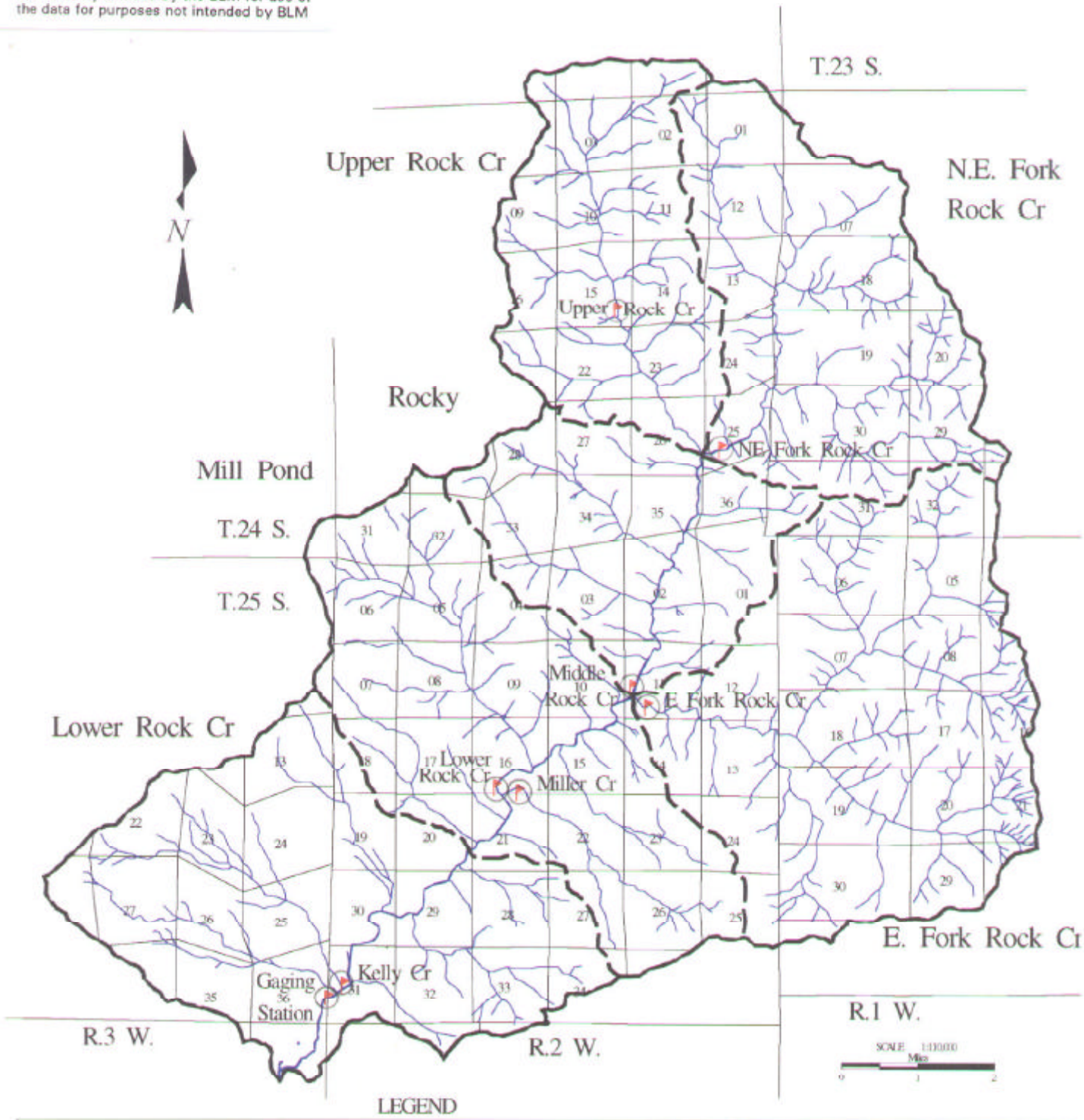
DRAINAGE	SQ MILE	1994		1995	
		7 DAY MEAN MAX TEMP	14 DAY MEAN MAX TEMP	7 DAY MEAN MAX TEMP	14 DAY MEAN MAX TEMP
East Fork	3.70	65.62	64.81	62.97	62.6
NE Fork	.84	66.53	65.66	65.32	64.45
Miller Creek	3.53	62.36	61.48	61.13	60.84
Kelly Creek	4.87	61.13	60.48	59.98	58.98
Upper Rock Creek		No Data	No Data	59.49	59.12
Rock Creek above East Fork		71.47	70.78	68.77	68.55
Rock Creek above Miller Creek		72.55	71.94	69.11	68.95

This shows the warmest 14 day period which summer mean maximums exceed the basin standard of 58 degrees, illustrating how the fisheries beneficial uses may be impacted for a given period of time.

Figure 7-1

Rock Creek
Summer Max. Stream Temp. Locations

No warranty is made by the BLM for use of the data for purposes not intended by BLM



LEGEND

Streams

Subwatersheds

Stream Temp. Locations

AQUATIC HABITAT AND SPECIES

A. Past and Current Riparian Vegetative Habitat Conditions

As is shown in **Figure 8-1 and Table 8-1** in the 1930's 97% of the vegetation within 180 feet of streams was in late seral type habitat (forests greater than 80 years of age). The height of one site potential tree (180 feet) was used in the analysis as a measure because the most critical aquatic functions occur within this streamside area. This would include not only stream shading, but also contribution of large woody debris (LWD) as trees fall into, along side, or near streams. Stands between 80 and 120 years function marginally for LWD contribution. At this stage large dead and fallen trees begin to be present in the stand and contribute LWD. Stands greater than 120 years are considered to be fully functional. From an historical standpoint the surrounding forests probably provided approximately 80 pieces of LWD per mile for streams which helped form and stabilize channels.

The past riparian vegetation is contrasted with current late seral type habitat of 24% (**Figure 8-2 and Table 8-2**). Overall past harvesting has greatly reduced the late seral riparian habitat on both federal and private lands. Considering only federal lands, analysis shows approximately 55% of riparian habitat is currently functioning in the late seral stage (**Table 8-3**). Riparian habitat varies considerably from drainage to drainage. Rock Camp, Huckleberry Creek, and Upper NE Fork represent drainages with higher than 80% of its riparian vegetation in late seral age classes. Lower East Fork and Cobble Creek drainages are examples of drainages that have 10% or less of its riparian areas functioning as late seral type habitat.

On private lands, the riparian habitat is primarily in early seral stages, with a moderate proportion of 40 year old habitat. State forest practices adopted in 1995 require a minimum 20 foot no-cut buffer on most streams and other restrictions on riparian harvesting. However because of past harvesting, the overall picture of riparian condition in the watershed will continue to show little or no late seral riparian habitat on private lands for several decades. The exception to this picture of private lands is in the lower portion of the drainage where several hundred acres are owned by private residents who continue to maintain their lands in mature and old-growth habitat (**Figure 8-2**).

There is a lack of the mid-seral stages represented in the riparian habitat throughout the watershed. The age class, 40-80 years of age, is referred to in the ROD, p. B-3, as the thinning stage. In the watershed, currently less than 2% of federal riparian areas are in this stage of development. The next seral age class, 80-120 years of age is considered mature forest habitat and there is less than 3% represented within federal riparian areas. The consequence of this lack of mid-seral and mature forest habitat is that, for the next 80 years there will not be an appreciable increase in the amount of old growth riparian habitat within this watershed. Some silvicultural treatments in the thinned stands may accelerate the development of late seral characteristics, such as larger diameter trees and multi-storied canopies, however, this will only increase the amount of late seral riparian habitat by 2% over the next 40 years. Treatments in younger stands, such as pre-commercial thinning, could be done to develop diversity of species composition and structure within riparian zones and to accelerate their development toward the maturation stage.

B. Fish Distribution and Current Conditions

Several stocks of anadromous fish use the Rock Creek watershed; summer and winter steelhead, spring chinook salmon, coho salmon, sea-run coastal cutthroat trout, and Pacific lamprey. All of these fish contribute to the respective North Umpqua stock. On the North Umpqua River at Winchester is a dam that allows for an almost complete count of all of the upstream salmon and steelhead that use the North Umpqua

River. This is a very useful and accurate index of the salmon and steelhead populations in Rock Creek. Currently, the National Marine Fisheries Service (NMFS) has proposed that the Umpqua River basin coastal cutthroat trout be listed as endangered, and coastal coho salmon range wide be listed as threatened under the endangered species act. Typically, after a one year waiting period with proposed status, a species is either listed or removed from consideration at the time. The one year wait period on cutthroat is overdue, but there is a congressional moratorium on new listings while the endangered species act is up for reauthorization. Long term analysis of the Winchester dam coho counts, however, suggests that the wild population of coho in the North Umpqua has remained somewhat stable over the last 30 years. The Oregon Department of Fish and Wildlife (ODFW) considers the Pacific lamprey in the Umpqua basin to be depressed, and are a stock of concern. The remainder of the stocks, summer and winter steelhead and spring chinook salmon, are considered to be healthy. In addition to these anadromous stocks, there are a variety of resident fish species, including cutthroat trout, rainbow trout, sculpins, dace, redside shiners, squawfish, and suckers. No population data are available for any of these species, but they are generally considered to be healthy.

There are over 54 miles of known fish bearing streams in the Rock Creek watershed, most of them anadromous (**Figure 8-3**). Few fish distribution surveys have been done on private lands. The fish distribution data on private land that is presented in this analysis was either interpolated by upstream information on BLM lands or was readily available from ODFW. There is a high probability that there are additional miles of fish bearing streams on private land, as well as on government land at the mouths of some of the small tributaries. There are several known barriers to anadromous fish, both natural and manmade. Waterfalls on Conley Creek, upper Rock Creek, Northeast Fork, Miller Creek, Zig Zag Creek, Cougar Creek, and Cobble Creek limit anadromous fish distribution. A culvert on Kelly Creek blocks 1.5 miles of historical coho habitat, and a culvert on McComas Creek blocks another 2 miles of habitat to coho and steelhead.

Limited coho spawning survey data are available for Rock Creek in 1994. Main Rock Creek had the highest number of fish, averaging 9.25 fish/mile and 13 total redds. Harrington Creek had 2.5 fish/mile and 3 redds. One redd and no fish were observed in McComas Creek. No fish or redds were observed in East Fork, Northeast Fork, or Kelly Creek. These data were gathered with ODFW volunteer surveyors, often with no experience in doing spawning surveys. It is possible that these numbers could be biased towards fewer fish. 1995 BLM coho spawning surveys in Harrington, McComas and Kelly Creeks indicate higher spawning numbers in these streams than is suggested by the earlier volunteer surveys. 1995 surveys indicate heavy coho use in the lower 1/2 mile of Woodstock Creek as well.

Juvenile fish traps were operated in McComas, Harrington, and East Fork Rock Creeks in 1993. The McComas Creek trap was operated from March 16 through July 1. Seven cutthroat, 60 steelhead, and 250 coho were captured. The coho were mostly fry, with a peak emergence in mid-April. The Harrington Creek trap was operated from May 6 through July 1. One cutthroat, 12 steelhead, and 14 coho were captured. The East Fork trap was put in approximately 1/2 mile below the confluence of East Fork and the North Fork of the East Fork. It was operated from May 20 through July 1 and captured 162 steelhead and 2 coho. Although the East Fork and Harrington Creek traps were put in after the peak of coho emergence, the relative low numbers in East Fork suggest that upper East Fork Rock Creek and North Fork of the East Fork are not as much of coho producers as the lower Rock Creek tributaries.

C. Current Aquatic Habitat Conditions

Approximately 30 miles of channel stability surveys have been completed in the Rocky, Millpond, East

Fork, and Lower Rock Creek subwatersheds. These surveys are mostly on non-fish bearing streams and were done using a methodology that was developed by the U.S. Forest Service (Pfankuch) and adapted to the Umpqua basin. Most of the streams rate as a high "fair" to a low "good", with a few "poor" reaches and a few "excellent" reaches. The exception is the Rocky subwatershed. Seventy-three percent of the stream channels surveyed in the Rocky subwatershed rate as "good" or "excellent".

ODFW stream habitat surveys are available for 18 streams in the Rock Creek watershed (**Figure 8-4 and Table 8-4**). The streams rate from "poor" to "good", with most of them rating as "fair". The best habitat is in the Northeast Fork and Upper Rock Creek. The poorest reaches are in lower Rock Creek, lower Shoup Creek, middle Woodstock Creek, upper Harrington Creek, and the uppermost reach of Rock Creek. The most common limiting habitat factor is a lack of large wood, along with a lack of pools. Overall, excess fine sediment is not considered to be a major factor in limiting fish populations in Rock Creek. However, certain drainages have noticeable sedimentation in the spawning gravels as indicated with the ODFW surveys (**Table 8-4**). These are some of the lower gradient tributaries such as Kelly, McComas, Miller, Taylor, Conley, and Woodstock Creek drainages.

LWD interacting with the stream channel is the dominant habitat forming mechanism for aquatic species in the Rock Creek watershed. *The Cumulative Effects of Forest Practices in Oregon* (Oregon State University, 1995) identified that riparian trees periodically falling into streams as the most important source of LWD. Another source includes the episodic occurrence of upslope mass wasting and debris torrents which deliver large wood to the system. The report pointed out that large wood recruitment can greatly be diminished by short rotation riparian harvest along large portions of a stream. Recruitment from coniferous second growth does not occur until approximately 100 years after harvest. As species composition changes to a deciduous (hardwood) dominated system, the recruitment of woody debris occurs after approximately 50 years. However, recruitment consist of pieces that are smaller and are subject to more rapid decay. Thus hardwoods contribute less significant effects to long term channel features.

As stated earlier, approximately 3,615 acres (55%) of federal forests are presently in age classes that would contribute LWD to the riparian areas (**Table 8-3**). Over the next 40 years the amount of acreage will only be increased by 2% (116 acres). As shown in **Table 8-4** this results in a deficit of LWD available for recruitment along stream sides. Salvage of LWD in riparian habitats of all ages would not be recommended in order to maintain the current effectiveness of the remaining habitat for LSH species.

D. Watershed Implications for Fish

One of the major issues in Rock Creek is the status of the sea-run coastal cutthroat trout. There are a host of factors that have most likely led to the decline in the Winchester dam cutthroat counts, including factors outside of the scope of this analysis. However, several things going on in the Rock Creek watershed have the potential to influence the cutthroat populations. Research suggests that the streams that traditionally have the highest coho numbers also have the highest number of sea-run cutthroat. The cutthroat, however, exploit different spawning and rearing habitats than the coho and steelhead. Cutthroat typically spawn in small, low gradient streams. These areas are often above the limits of coho and steelhead, or are too small for coho and steelhead. These spawning areas are sometimes in the floodplain of larger streams, and may have fish in them only at certain times of the year. These streams are often associated with the earthflow terrain, and some may even be intermittent. Incidentally, these streams are easily overlooked as having fisheries potential and have been the most susceptible to past land management practices. The low gradient of these streams have made them premier road locations. The traditional cutthroat and coho producing streams are in some of the lower Rock Creek tributaries (East Fork, Lower Rock Creek, and Millpond

subwatersheds) and have low amounts of the late seral riparian type habitat (**Tables 8-2 and 8-3**).

The habitat in these stream reaches is in a worse condition than the traditional steelhead dominated areas such as Northeast Fork. These stream reaches are deficient in LWD, and have a high width/depth ratio. LWD creates pools and spawning areas for the fish, and is the primary habitat producer in low gradient areas that cutthroat prefer. LWD is especially important in creating winter refuge areas. Recent research has shown that one of the best predictors of age 1+ cutthroat standing crop is the severity of the preceding winter (House 1995). This research suggests that winterkill of coastal cutthroat trout increases with the magnitude and duration of winter freshets. This finding may help explain why cutthroat trout populations are declining, while other stocks remain healthy. Sea-run cutthroat trout may remain in the freshwater streams up to five years before migrating to saltwater. This would put them at a much higher risk of winterkill than a fish that remains in freshwater only one or two years. A lack of LWD to create winter habitat would probably affect cutthroat trout more than other species of anadromous salmonids.

Another factor that may be affecting cutthroat are elevated water temperatures. Stream temperatures affect fish in several ways, including egg incubation time, migration timing, metabolism, behavior, and mortality. Different species of fish have different upper lethal temperatures. Cutthroat have the lowest upper lethal maximum temperature of any of the salmonid species occurring in the Rock Creek watershed (Bell 1986). Maximum stream temperatures for two of the Rock Creek temperature stations in 1994 were above the lethal maximum for cutthroat trout (**Table 7-2**). Analysis of the stream temperatures throughout Rock Creek indicate that temperature can be a limiting factor in at least some summers. Increases in stream temperature below the thermal maximum of fish can cause stress and indirect mortality. Above and below certain threshold temperatures feeding and growth stops in fish. The fish are forced to use all of their energy for maintenance of body functions. Since smoltification of some salmonids is size dependant, an alteration of the growth cycle could delay the seaward migration of salmon and steelhead smolts. Any delay would put the fish at risk of winterkill for an additional winter. Since cutthroat have the lowest temperature tolerance of any of the salmonids that use the Rock Creek watershed, an increase in stream temperatures would negatively affect cutthroat more than coho or steelhead.

There is a positive correlation between the quality of fish habitat (ODFW aquatic habitat inventory ratings, **Table 8-4**) and the amount of the riparian area in late seral habitat (**Figure 8-2 and Table 8-2**). There is also a positive correlation between the hydrologic recovery and the percentage of the channel stability surveys that rate as "good" or "excellent", with the exception of Lower Rock Creek subwatershed. This apparent link between the good fish habitat and the intactness of the riparian system reinforces the importance for developing and preserving late seral habitat within one site potential tree of streams. In most cases, the condition of the riparian habitat is well outside of the reference range (compare **Table 8-1 and 8-2**). These areas will probably not reach their full habitat potential until there is a significant recovery of the riparian areas. Instream restoration projects in these areas would be a temporary fix until the function of the ecosystem could be restored.

There is no apparent correlation between road densities and the amount of sediment in the streams. The best habitat, Northeast Fork, is in a canyon type habitat. This section of the stream is dominated by steep, canyon-like banks. The dominant habitat forming feature is large boulders that create plunge pools. The steep, canyon walls preclude valley bottom road building. This prevented wood removal by past land management activities. This is some of the best steelhead habitat in the watershed. It is also some of the most resistant to habitat degradation due to land management, even though it has a high frequency of road related landslides. The land use allocation for this area is dominated by late successional reserve which makes it the least susceptible to habitat modification as a result of future management. Restoration should

look at reducing road related threats to the aquatic systems. No instream work is recommended for this area.

Much of the riparian reserve system throughout Rock Creek is disconnected or separated from the streams for some reason, usually by roads. This creates "islands" of habitat that, although important, do not recolonize readily or contribute LWD as effectively to streams.

A 1972 report by the Oregon State Game Commission states minimum and optimum flow recommendations for fish migration, spawning and rearing (**Table 8-6**). With the exception of September, average flows are above the recommended minimums. August and October average flows are close to the recommended minimums, and are below the recommended optimums. These average monthly flows are from the 1958-1973 period, and it is not known how or if these average flows have changed since then. However, it is possible that in some low water years, late summer flows in conjunction with high water temperatures can be limiting factors to the fisheries production of the Rock Creek watershed. Low water can delay or block the migration of fish species, causing them to utilize less productive spawning habitats. The species most susceptible are the fall spawning fish such as the coho and chinook salmon. Further hydrograph analysis and current flow data are required to determine to what extent that low flows limit fish production. A potential solution is to work with water users, including the fish hatchery, to encourage limited or no water withdrawals in the critical periods of low water years.

Table 8-6 **Optimum Flow Recommendations vs Average Flows**

	Recommended Minimum	Recommended Optimum	Average, 1958-1973
Jan-Apr	80	136	438, min by month 855, max by month
May	60	80	270
June	40	53	105
July	30	53	50
August	30	53	30
September	40/90	80/136	32
October	90	136	91
November	90	136	449
December	80	136	744

As stated previously, culverts on Kelly and McComas creeks are barriers to approximately 3.5 miles of historical coho habitat. Additionally a 1991 culvert inventory identified two culverts that are at risk of failing soon. These culverts are on the Northeast Fork in section 13 and on Woodstock Creek at the mouth. There are no fish passage concerns for the Northeast Fork culvert because it is above the limits of fish distribution. However, the habitat that this threatens is the best habitat in the watershed. The Woodstock Creek culvert currently is an obstacle to coho salmon, and a complete barrier at periods of low flow.

Immediately below this culvert is a large alcove created by an old stream channel. Alcove habitats are rare in this watershed. These off-channel habitats are very important for coho salmon. This habitat is not fully seeded because of a very limited amount of spawning habitat that is available above it. Improving fish passage at this culvert would enhance approximately 1.5 miles of historical coho habitat.

Figure 8-1

1936 Riparian Habitat Types

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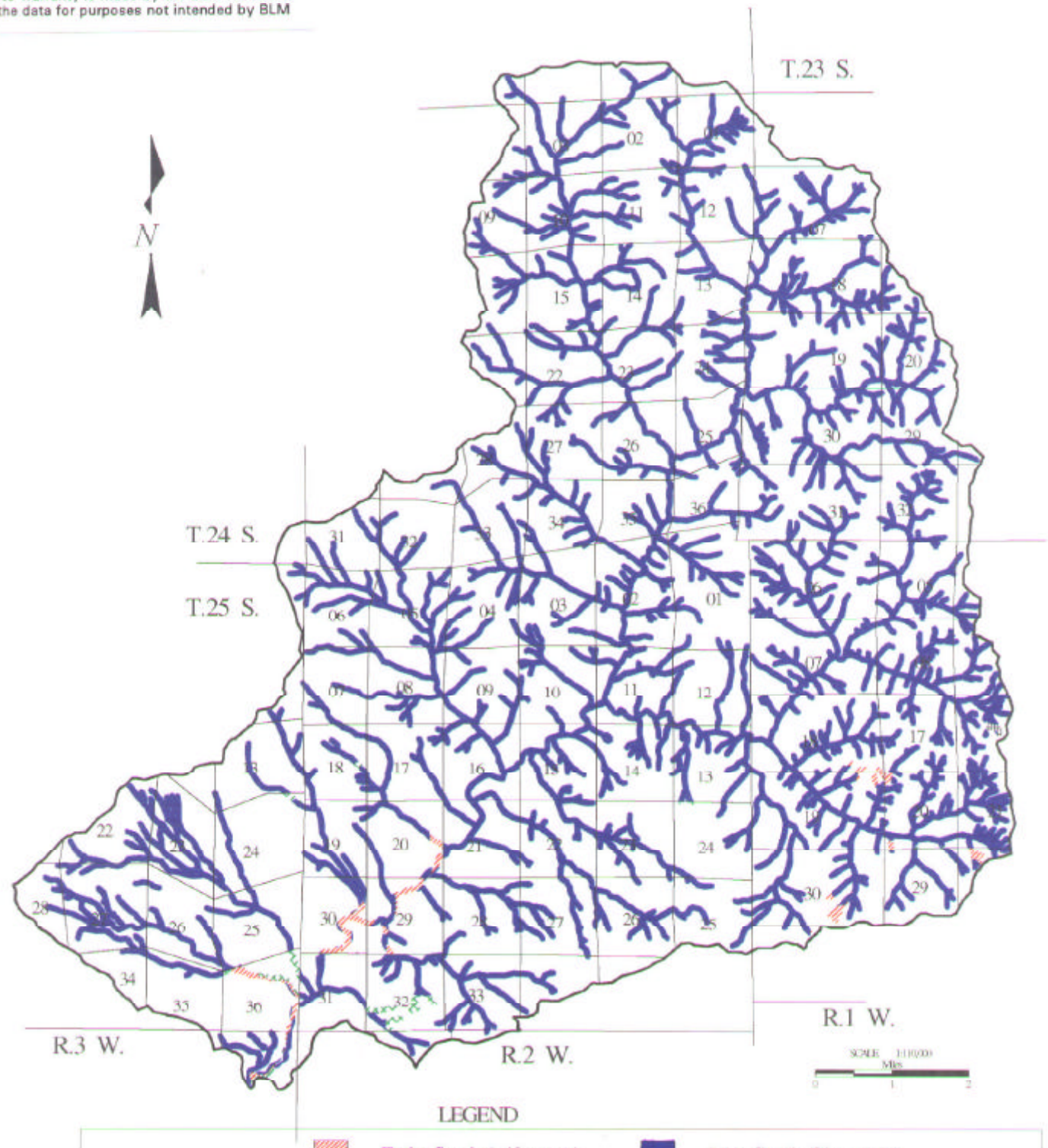

Table 8-1

EARLY, MID AND LATE SERAL RIPARIAN HABITAT
REGRESSED TO 1936 - ALL OWNERSHIP

DRAINAGE	AGE_CLASS 0-40	%	41-80	%	80+	%	TOTAL ACRES
COUGAR CR	49	10%	4	1%	455	90%	508
EAST FORK	38	4%	0	0%	875	96%	913
LOWER EFK	0	0%	3	1%	235	99%	238
MACE CR	2	0%	0	0%	406	100%	408
NORTH FORK	0	0%	0	0%	478	100%	478
SURPRISE CR	0	0%	0	0%	493	100%	493
UPPER EFK	0	0%	0	0%	532	100%	532
WAPITI CR	0	0%	0	0%	591	100%	591
TOTAL EF ROCK CR	**89**	**2%**	**7**	**0%**	**4065**	**98%**	**4161**
CONLEY CR	10	3%	25	6%	359	91%	394
HIATUS CR	30	17%	38	21%	112	62%	180
KELLEY CR	0	0%	17	3%	640	97%	657
MCCOMAS CR	53	9%	18	3%	525	88%	596
MILL POND	18	7%	0	0%	235	93%	253
TAYLOR CR	56	13%	6	1%	353	85%	415
TOTAL FOR LOWER ROCK CR	**167**	**7%**	**104**	**4%**	**2224**	**89%**	**2495**
HARRINGTON CR	0	0%	0	0%	1104	100%	1104
MILLER CR	1	0%	0	0%	443	100%	444
ROCK CAMP	0	0%	0	0%	197	100%	197
ROCK REC	0	0%	0	0%	161	100%	161
SHOUP CR	11	3%	5	1%	349	96%	365
WOODSTOCK CR	0	0%	0	0%	280	100%	280
TOTAL FOR MILL POND	**12**	**0%**	**5**	**0%**	**2534**	**99%**	**2551**
BLUFF CR	0	0%	0	0%	432	100%	432
HUCKLEBERRY CR	0	0%	0	0%	336	100%	336
NE FORK	0	0%	0	0%	164	100%	164
UPPER NE FK	0	0%	0	0%	239	100%	239
UPPER T	0	0%	0	0%	438	100%	438
ZIG ZAG CR	2	0%	0	0%	956	100%	958
TOTAL FOR NE FK ROCK CR:	**2**	**0%**	**0**	**0%**	**2565**	**100%**	**2567**
COBBLE CR	0	0%	0	0%	316	100%	316
CROSSROADS CR	0	0%	0	0%	292	100%	292
GRAVEL	0	0%	0	0%	190	100%	190
PEBBLE CR	0	0%	0	0%	307	100%	307
STONEY CR	0	0%	0	0%	535	100%	535
TOTAL FOR ROCKY	**0**	**0%**	**0**	**0%**	**1640**	**100%**	**1640**
DISAPPEARING CR	0	0%	0	0%	551	100%	551
RUBBLE CR	0	0%	0	0%	626	100%	626
TWIN CEDAR CR	0	0%	0	0%	466	100%	466
TOTAL FOR UPPER ROCK CR	**0**	**0%**	**0**	**0%**	**1643**	**100%**	**1643**
TOTAL BY AGE CLASS	270	2%	116	1%	14671	97%	15057

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Figure 8-2

Current Riparian Habitat Types

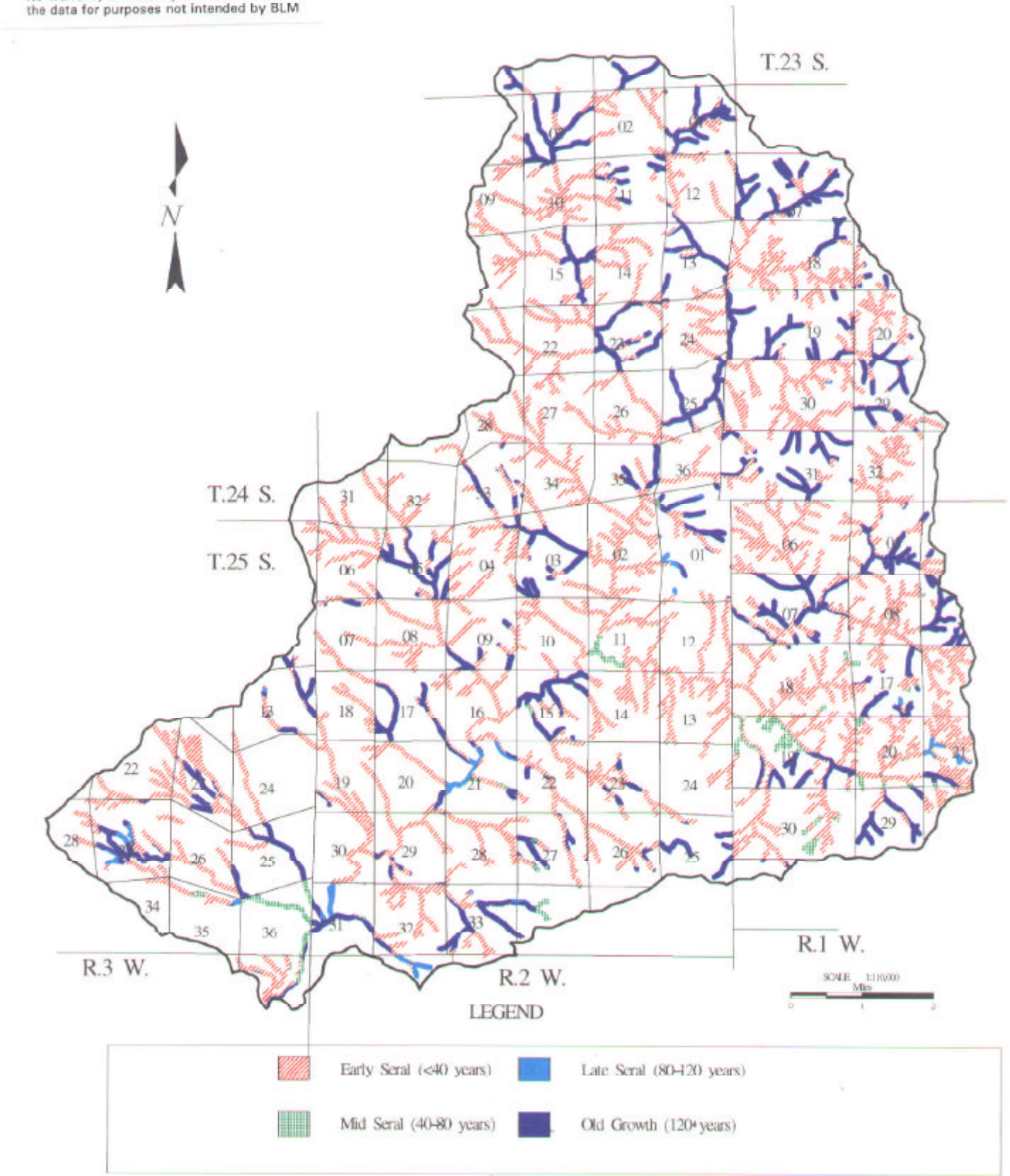

Table 8-2

EARLY, MID AND LATE SERAL RIPARIAN HABITAT

CURRENT CONDITION ALL OWNERSHIP

	AGE_CLASS								TOTAL
DRAINAGE	**0-40**	**%**	**41-80**	**%**	**81-120**	**%**	**121+**	**%**	**ACRES**
COUGAR CR	232	46%	120	24%	0	0%	156	31%	508
EAST FORK	778	85%	35	4%	30	3%	71	8%	914
LOWER EFK	232	97%	7	3%	0	0%	0	0%	239
MACE CR	318	78%	25	6%	0	0%	65	16%	408
NORTH FORK	375	78%	16	3%	0	0%	87	18%	478
SURPRISE CR	373	76%	0	0%	0	0%	119	24%	492
UPPER EFK	381	72%	0	0%	0	0%	150	28%	531
WAPITI CR	474	78%	7	1%	1	0%	124	20%	605
TOTAL EF ROCK CR	**3163**	**76%**	**210**	**5%**	**31**	**1%**	**772**	**18%**	**4175**
CONLEY CR	246	62%	31	8%	0	0%	119	30%	396
HIATUS CR	71	39%	14	8%	40	22%	56	31%	181
KELLEY CR	487	74%	15	2%	15	2%	140	21%	657
MCCOMAS CR	364	61%	74	12%	40	7%	119	20%	597
MILL POND	207	82%	9	4%	0	0%	36	14%	252
TAYLOR CR	335	81%	0	0%	3	1%	77	19%	415
TOTAL FOR LOWER ROCK	**1710**	**68%**	**143**	**6%**	**98**	**4%**	**547**	**22%**	**2498**
HARRINGTON CR	910	82%	0	0%	0	0%	194	18%	1104
MILLER CR	334	75%	11	2%	18	4%	81	18%	444
ROCK CAMP	129	65%	3	2%	0	0%	65	33%	197
ROCK REC	104	65%	4	3%	0	0%	53	33%	161
SHOUP CR	244	67%	0	0%	26	7%	95	26%	365
WOODSTOCK CR	218	78%	6	2%	0	0%	56	20%	280
TOTAL FOR MILL POND	**1939**	**76%**	**24**	**1%**	**44**	**2%**	**544**	**21%**	**2551**
BLUFF CR	350	81%	0	0%	0	0%	82	19%	432
HUCKLEBERRY CR	131	39%	0	0%	0	0%	205	61%	336
NE FORK	108	66%	0	0%	0	0%	56	34%	164
UPPER NE FK	155	65%	0	0%	1	0%	83	35%	239
UPPER T	237	54%	0	0%	2	0%	199	45%	438
ZIG ZAG CR	620	65%	0	0%	2	0%	334	35%	956
TOTAL FOR NE FK ROCK C	**1601**	**62%**	**0**	**0%**	**5**	**0%**	**958**	**37%**	**2564**
COBBLE CR	314	99%	0	0%	0	0%	2	1%	316
CROSSROADS CR	259	89%	6	2%	19	6%	8	3%	292
GRAVEL	151	79%	0	0%	0	0%	39	21%	190
PEBBLE CR	189	62%	5	2%	6	2%	105	34%	306
STONEY CR	407	76%	2	0%	0	0%	125	23%	535
TOTAL FOR ROCKY	**1320**	**81%**	**14**	**1%**	**25**	**2%**	**280**	**17%**	**1638**
DISAPPEARING CR	331	60%	0	0%	0	0%	219	40%	550
RUBBLE CR	586	94%	0	0%	0	0%	40	6%	626
TWIN CEDAR CR	310	66%	0	0%	0	0%	156	34%	466
TOTAL FOR UPPER ROCK	**1227**	**75%**	**0**	**0%**	**0**	**0%**	**415**	**25%**	**1642**
TOTAL BY AGE CLASS	**10960**	**73%**	**391**	**3%**	**203**	**1%**	**3515**	**23%**	**15068**

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Table 8-3

EARLY, MID AND LATE SERAL RIPARIAN HABITAT

CURRENT CONDITION FEDERAL OWNERSHIP

DRAINAGE	AGE_CLASS 0-40	%	41-80	%	81-120	%	121+	%	TOTAL ACRES
COUGAR CR	55	25%	6	3%	0	0%	156	72%	218
EAST FORK	222	65%	16	5%	30	9%	71	21%	339
LOWER EFK	17	72%	7	28%	0	0%	0	0%	24
MACE CR	38	38%	0	0%	0	0%	61	62%	99
NORTH FORK	137	57%	16	7%	0	0%	87	36%	240
SURPRISE CR	89	43%	0	0%	0	0%	119	57%	208
UPPER EFK	109	42%	0	0%	0	0%	150	58%	259
WAPITI CR	111	46%	7	3%	1	0%	124	51%	242
TOTAL EF ROCK CR	**778**	**48%**	**52**	**3%**	**31**	**2%**	**768**	**47%**	**1628**
CONLEY CR	76	38%	9	4%	0	0%	115	58%	199
HIATUS CR	11	14%	3	4%	26	32%	40	50%	79
KELLEY CR	186	57%	0	0%	0	0%	139	43%	325
MCCOMAS CR	161	49%	7	2%	40	12%	119	36%	326
MILL POND	52	55%	9	10%	0	0%	32	35%	94
TAYLOR CR	161	73%	0	0%	3	1%	57	26%	221
TOTAL FOR LOWER ROCK	**645**	**52%**	**28**	**2%**	**68**	**5%**	**502**	**40%**	**1243**
HARRINGTON CR	211	52%	0	0%	0	0%	194	48%	406
MILLER CR	110	53%	10	5%	18	9%	71	34%	209
ROCK CAMP	6	8%	3	5%	0	0%	65	88%	74
ROCK REC	33	37%	4	5%	0	0%	53	58%	90
SHOUP CR	89	43%	0	0%	26	12%	94	45%	208
WOODSTOCK CR	143	70%	6	3%	0	0%	56	27%	204
TOTAL FOR MILL POND	**592**	**50%**	**23**	**2%**	**44**	**4%**	**533**	**45%**	**1191**
BLUFF CR	97	54%	0	0%	0	0%	82	46%	179
HUCKLEBERRY CR	41	17%	0	0%	0	0%	205	83%	245
NE FORK	27	33%	0	0%	0	0%	56	67%	83
UPPER NE FK	18	17%	0	0%	1	1%	83	82%	102
UPPER T	79	29%	0	0%	2	1%	193	70%	275
ZIG ZAG CR	147	31%	0	0%	0	0%	334	69%	480
TOTAL FOR NE FK ROCK C	**409**	**30%**	**0**	**0%**	**3**	**0%**	**952**	**70%**	**1363**
COBBLE CR	16	90%	0	0%	0	0%	2	10%	18
CROSSROADS CR	12	26%	6	14%	19	42%	8	18%	44
GRAVEL	24	38%	0	0%	0	0%	39	62%	63
PEBBLE CR	104	47%	5	2%	6	3%	105	48%	221
STONEY CR	105	45%	2	1%	0	0%	125	54%	233
TOTAL FOR ROCKY	**261**	**45%**	**14**	**2%**	**25**	**4%**	**280**	**48%**	**579**
DISAPPEARING CR	115	35%	0	0%	0	0%	214	65%	329
RUBBLE CR	18	31%	0	0%	0	0%	40	69%	58
TWIN CEDAR CR	68	31%	0	0%	0	0%	156	69%	226
TOTAL FOR UPPER ROCK	**202**	**33%**	**0**	**0%**	**0**	**0%**	**410**	**67%**	**613**
TOTAL BY AGE CLASS	**2886**	**44%**	**116**	**2%**	**171**	**3%**	**3444**	**52%**	**6617**

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Figure 8-3

Rock Creek Fish Distribution

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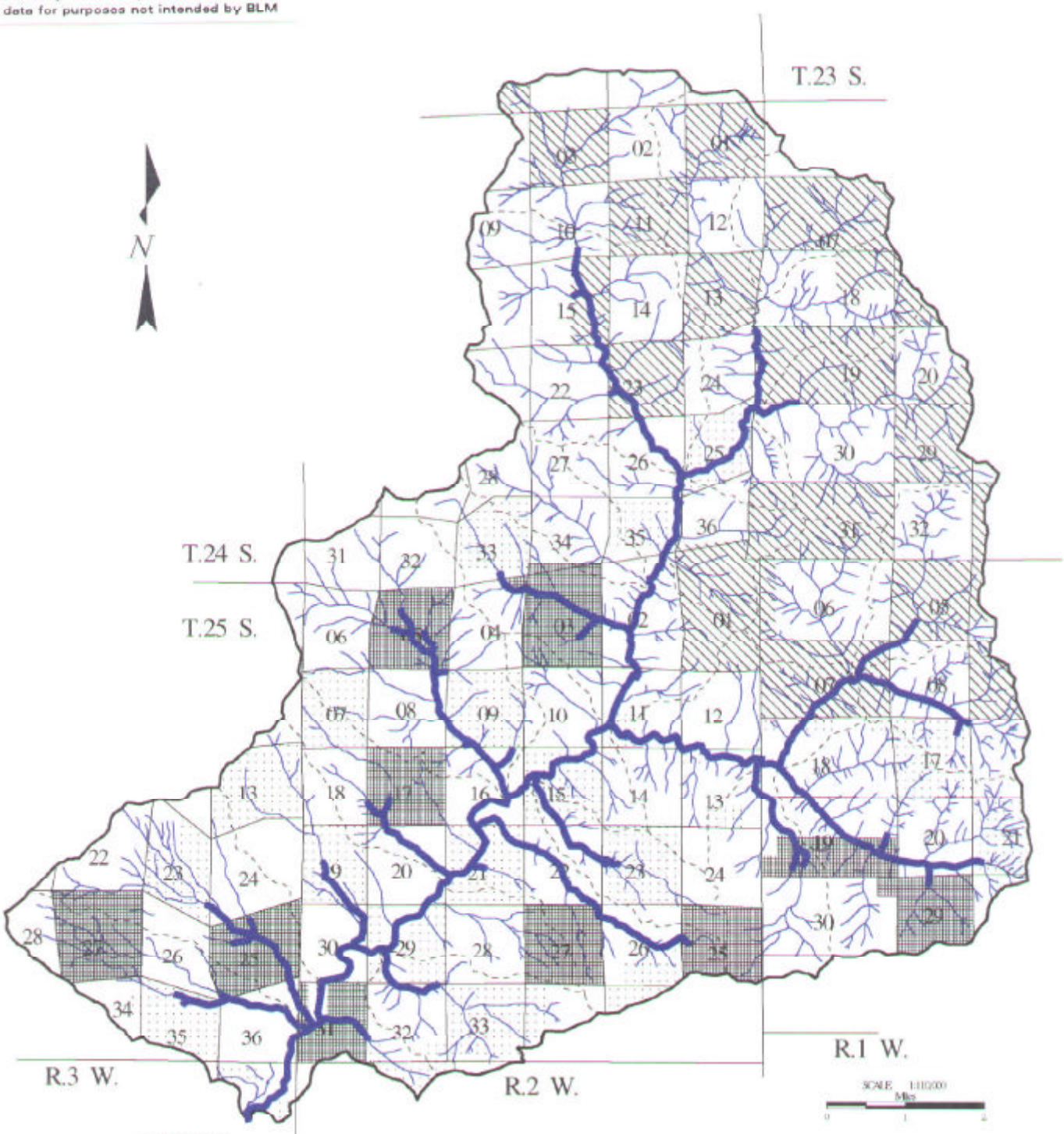
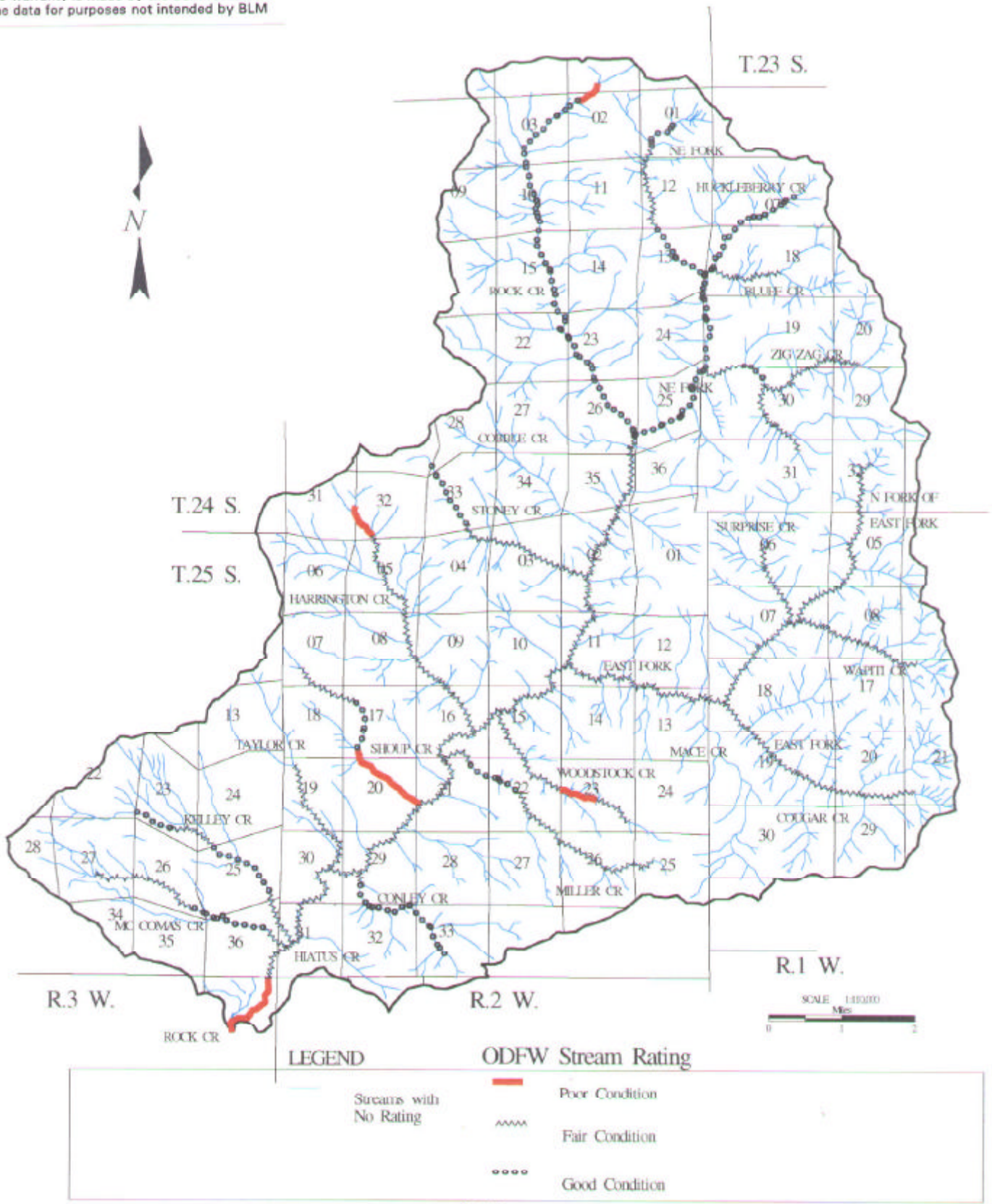


Figure 8-4

AQUATIC HABITAT CONDITION (ODFW)



ODFW STREAM HABITAT SURVEYS

Table 8-4

	% Pool Area	Residual Pool Depth (m)	Riffle W/D Ratio	% Fines in Riffles	% Gravel in Riffles	Riparian Vegetation (dom/ sub-dom)	Riparian Conifer Size	% Shade	LWD pieces per 100m	LWD volume per 100m	Rating
Rock Creek Reach 1	27	1.4	no riffles	no riffles	no riffles	hdwd/conifer	small	58	1.1	2.0	(42) poor
Reach 2	28	1.2	47	13	32	alder	small	56	1.5	3.4	(48) fair
Reach 3	33	1.2	29	6	21	alder	small	66	3.6	6.4	(53) fair
Reach 4	26	0.9	17	15	42	conifer/hdwd	small	76	33.7	67.7	(68) good
Reach 5	10	0.8	17	13	44	conifer/hdwd	small	81	24.5	68.2	(70) good
Reach 6	5	0.4	no riffles	no riffles	no riffles	conifer/hdwd	small	54	6.5	14.9	(31) poor
McComas Creek Reach 1	10	0.4	11	16	49	conifer/hdwd	medium	96	5.7	10.7	(54) fair
Reach 2	12	0.5	7	27	26	conifer/hdwd	old growth	95	6.3	23.5	(75) good+
Reach 3	14	0.6	14	37	38	conifer/hdwd	medium	92	7.8	19.8	(57) fair
Reach 4	3	0.8	no riffles	no riffles	no riffles	conifer/hdwd	old growth	97	3.7	21.0	(49) fair
Kelly Creek Reach 1	10	0.6	12	13	36	hdwd/conifer	medium	95	6	11.3	(55) fair
Reach 2	11	0.4	11	20	32	conifer/hdwd	old growth	95	10.9	48	(72) good
Reach 3	4	0.4	14	22	40	conifer/hdwd	medium	81	7.1	16.3	(55) fair
Reach 4	8	0.6	10	28	40	conifer/hdwd	old growth	98	6.5	19.1	(70) good
Taylor Creek	9	0.6	22	35	30	conifer/hdwd	large	94	6.5	25.4	(61) fair+
Conley Creek Reach 1	28.9	0.71	30.4	16	51	conifer/hdwd	small	72	3.3	1.3	(51) fair
Reach 2	5.9	0.6	15.3	23	38	conifer/hdwd	medium	87	28.0	64.5	(71) good
Reach 3	4.4	0.4	15.1	31	35	conifer/hdwd	medium	87	29.6	46.3	(66) good
Shoup Creek Reach 1	13	0.3	28	11	53	alder	small	94	7.4	15.0	(43) poor
Reach 2	17	0.4	13	10	50	conifer/hdwd	medium	91	20.4	45.2	(71) good
Reach 3	6	0.4	12	20	30	conifer/hdwd	small	88	17.0	46.0	(61) fair+

ODFW STREAM HABITAT SURVEYS

Table 8-4

	% Pool Area	Residual Pool Depth (m)	Riffle W/D Ratio	% Fines in Riffles	% Gravel in Riffles	Riparian Vegetation (dom/ sub-dom)	Riparian Conifer Size	% Shade	LWD pieces per 100m	LWD volume per 100m	Rating
Miller Creek Reach 1	13	0.3	12	32	30	conifer/hdwd	medium	93	6.1	3.5	(51) fair
Reach 2	22	0.6	15	21	39	conifer/hdwd	medium	98	7.7	41.9	(67) good
Reach 3	13	0.6	15	21	34	conifer/hdwd	small	92	6.9	16	(56) fair
Reach 4	12	0.4	4	55	28	conifer/hdwd	small	92	2.7	5	(52) fair
Reach 5	1	0.5	8	55	29	conifer/hdwd	large	100	3.1	7.9	(58) fair
Woodstock Creek Reach 1	73	0.4	7	22	29	alder	medium	95	4.2	13.5	(53) fair
Reach 2	5	0.7	no riffles	no riffles	no riffles	alder	medium	95	4.2	15.9	(35) poor
Reach 3	2	0.5	no riffles	no riffles	no riffles	conifer/hdwd	old growth	69	7.1	39.5	(45) fair-
Harrington Creek Reach 1	10	0.5	26	11	36	hdwd/conifer	small	88	5.4	7.5	(48) fair
Reach 2	13	0.6	24	15	45	conifer/hdwd	small	93	6.7	34.3	(53) fair
Reach 3	5	0.5	no riffles	no riffles	no riffles	conifer/hdwd	medium	89	3	11.6	(35) poor
East Fork Rock Creek Reach 1	22	0.7	30	10	44	alder	small	83	1.4	3.1	(45) fair-
Reach 2	20	0.5	32.3	8	33	alder	small	92	7.3	7.5	(46) fair-
Reach 3	25	0.5	22	8	44	alder	small	93	11.8	23	(54) fair
Reach 4	1	0.4	13	0	60	hdwd/conifer	small	99	5.2	10.5	(49) fair
North Fork of East Fork Rock Creek Reach 1	19	0.6	13	11	37	conifer/hdwd	medium	100	1	1.6	(55) fair
Reach 2	7	0.5	14	7	41	conifer/hdwd	large	98	2.8	11.2	(62) fair+
Reach 3	10	0.5	11	14	40	conifer/hdwd	large	99	4.8	9.7	(60) fair+
Reach 4	2	0.3	12	21	46	conifer/hdwd	large	99	12.4	28	(59) fair
Wapiti Creek Reach 1	4	0.5	13	7	35	conifer/hdwd	medium	98	6	11.4	(59) fair
Reach 2	4	0.4	11	9	49	conifer/hdwd	medium	100	5	13	(57) fair
Reach 3	1	0.5	13.3	16	45	conifer/hdwd	medium	99	8.7	21.9	(57) fair

ODFW STREAM HABITAT SURVEYS

Table 8-4

	% Pool Area	Residual Pool Depth (m)	Riffle W/D Ratio	% Fines in Riffles	% Gravel in Riffles	Riparian Vegetation (dom/ sub-dom)	Riparian Conifer Size	% Shade	LWD pieces per 100m	LWD volume per 100m	Rating
Surprise Creek	6	0.5	13	15	48	conifer/hdwd	large	99	6.6	21	(60) fair+
Stony Creek Reach 1	26	0.4	21	28	27	conifer/hdwd	large	77	10.3	32.9	(56) fair
Reach 2	13	0.4	21	5	38	conifer/hdwd	large	69	16.3	75	(62) fair+
Reach 3	9	0.5	43	0	50	conifer/hdwd	large	76	12.5	51	(66) good
Northeast Fork Rock Creek Reach 1	18	1.0	16	4	31	conifer/hdwd	large	89	3.2	12	(64) good-
Reach 2	40	1.0	17	2	29	conifer/hdwd	large	78	18.7	107.2	(71) good
Reach 3	36	1.0	16	3	24	hdwd/conifer	large	71	8	17.1	(64) good-
Reach 4	7	0.6	14	8	36	conifer/hdwd	large	84	12.9	36.7	(67) good
Reach 5	27	0.5	20	14	35	conifer/hdwd	small	43	13	36	(60) fair+
Reach 6	9	0.5	9	0	52	conifer/hdwd	large	75	8	30	(72) good
Zig Zag Creek Reach 1	20	0.5	13	7	30	hdwd/conifer	medium	89	3.5	10.1	(59) fair
Reach 2	46	0.9	11	0	35	conifer/hdwd	large	74	4.3	15.6	(72) good
Reach 3	16	0.5	18	5	21	conifer/hdwd	large	89	4.8	14	(61) fair+
Reach 4	12	0.5	10	3	28	conifer/hdwd	medium	80	5.4	12.8	(59) fair
Huckleberry Creek Reach 1	34	0.6	9	0	40	hdwd/conifer	large	59	13.9	41.7	(75) good+
Reach 2	21	0.7	10	3	35	conifer/hdwd	old growth	88	12.5	29.6	(81) good+
Reach 3	6	0.3	8	22	37	conifer/hdwd	large	93	28.8	136.5	(69) good
Bluff Creek	36	0.4	10	24	29	conifer/hdwd	medium	68	7.6	11.9	(57) fair

Figure 8-5

Overlap of Roads & Riparian Habitat (within 180 feet of Streams)

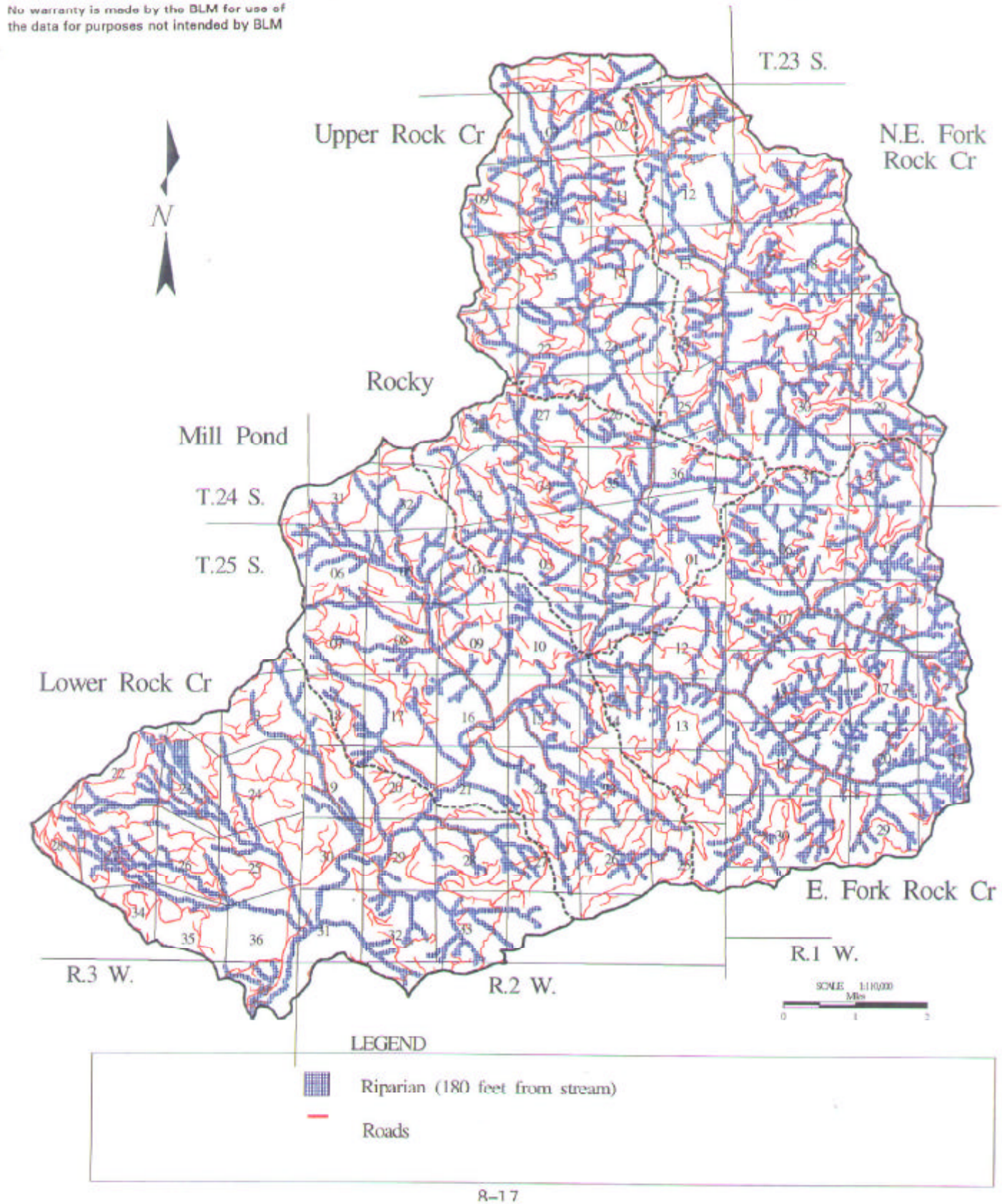


Table 8-5

OVERLAP of ROADS & RIPARIAN HABITAT
(within 180 feet of streams)

DRAINAGES	Riparian not Impacted by Roads		Riparian Impacted by Roads		TOTAL
	acres	%	acres	%	acres
COUGAR CR	497	98%	12	2%	509
EAST FORK	882	96%	32	4%	915
LOWER E FK	231	97%	8	3%	239
MACE CR	395	97%	14	3%	409
NORTH FORK	449	94%	31	6%	480
SURPRISE CR	477	97%	16	3%	493
UPPER E FK	512	96%	21	4%	532
WAPITI CR	576	95%	29	5%	605
TOTAL FOR E F ROCK CR	**4019**	**96%**	**163**	**4%**	**4182**
CONLEY CR	388	98%	8	2%	395
HIATUS CR	179	99%	2	1%	181
KELLEY CR	634	96%	23	4%	658
MCCOMAS CR	572	96%	26	4%	599
MILL POND	243	96%	10	4%	253
TAYLOR CR	402	96%	15	4%	417
TOTAL FOR LOWER ROCK CR	**2418**	**97%**	**84**	**3%**	**2502**
HARRINGTON CR	1070	97%	36	3%	1106
MILLER CR	429	97%	15	3%	444
ROCK CAMP	196	97%	7	3%	203
ROCK REC	156	97%	5	3%	161
SHOUP CR	356	97%	9	3%	365
WOODSTOCK CR	270	95%	13	5%	283
TOTAL FOR MILL POND	**2477**	**97%**	**85**	**3%**	**2562**
BLUFF CR	412	97%	14	3%	426
HUCKLEBERRY CR	324	97%	12	3%	336
NE FORK	157	96%	7	4%	164
UPPER NE FK	231	95%	13	5%	244
UPPER T	417	95%	23	5%	440
ZIG ZAG CR	923	97%	33	3%	956
NE FK ROCK CR	**2465**	**96%**	**102**	**4%**	**2567**
COBBLE CR	305	97%	10	3%	316
CROSSROADS CR	281	97%	10	3%	292
GRAVEL	186	98%	4	2%	191
PEBBLE CR	296	97%	10	3%	307
STONEY CR	517	96%	23	4%	540
TOTAL FOR ROCKY	**1586**	**96%**	**58**	**4%**	**1644**
DISAPPEARING CR	531	96%	19	4%	551
RUBBLE CR	602	96%	25	4%	626
TWIN CEDAR CR	455	97%	12	3%	468
TOTAL FOR UPPER ROCK CR	**1588**	**97%**	**56**	**3%**	**1644**
TOTAL FOR WATERSHED	**14553**	**96%**	**548**	**4%**	**15102**

RESTORATION OPPORTUNITIES AND MANAGEMENT RECOMMENDATIONS

A. Human Uses Recommendations

There exists in the Rock Creek drainage a dichotomy between the need to provide a large number of jobs through timber harvesting and the need to provide high quality water for both people and fish. Although the level of harvest on federal lands will probably be set by judicial and legislative constraints, the manner in which the harvest is accomplished should address the water quality issue. Harvests should be timed, distributed and practiced in ways that will ameliorate the effects of erosion, sedimentation and high peak flows.

The Millpond and Rock Creek recreation sites provide a significant recreation opportunity to both residents of the area, and to visitors from outside the area. The sites should continue to be managed with this primary objective in mind. Additional recreation enhancement opportunities such as the proposed group reservation camp site should be pursued. Continued maintenance and improvements should be a priority in these two areas. Where there is evidence of stream bank erosion caused by human foot traffic, action should be taken to reduce and/or repair this damage. When compatible with the recreation use of the site, opportunities should also be pursued to revegetate denuded areas both along the stream bank and in the recreation site itself.

There is an opportunity to develop a short trail into the rock arch by Chimney Rock (Section 32, T25S.R2W. If at all possible, logging and/or other non-recreational development in this 40 acre patch should be avoided.

B. Restoration of Vegetation

Treatments of stands in the Mid Seral age class (30 -80 years) should consider the seed sources used for the original planting and other restocking treatments. In order to increase the biodiversity of these stands especially if there is an indication of poor genetic variability, they should be opened up and planted with a genetic mix which represents the original variety of Douglas fir genotypes for that zone. Other tree species must be replaced in underplantings or patches. This type of manipulation can begin as early as in PCT treatments.

C. Restoration of Terrestrial Habitat and Species

The "disconnected" riparian reserves offer some unique management opportunities. These areas offer little value to the aquatic systems in the existing environment. The Record of Decision increased the prescribed riparian reserve widths due to terrestrial wildlife concerns, not aquatic values. One suggestion is to identify the disconnected riparian reserves on a project specific basis, and to consider them as areas to narrow the prescribed buffers. This should only be done, however, after a project specific analysis determines that terrestrial objectives are being met and that the ROD riparian reserves have little potential for future aquatic contributions. There are other areas outside reserves that currently provide benefits to the terrestrial and aquatic systems. If some of these areas were incorporated into the riparian reserves it would possibly increase the short term functionality of the riparian reserve system. A preliminary view of how riparian reserves could potentially be changed is shown in **Figure 9-1**. **Table 9-1 and 9-2** show the comparative difference in land use allocation acreage these changes would make. Changes that would produce the best results would most likely occur on the non-fish bearing portions of Conley, Hiatus, Taylor, Cobble, and Gravel creeks.

D. Restoration of Stream Temperatures

High stream temperatures in the Rock Creek watershed is probably the greatest concern that came out of this analysis. Temperatures will continue to lower over time with the growth of streamside vegetation. Pre-commercial thinning of young conifer stands will help speed canopy growth and shading along streams. A specific silvicultural treatment along Woodstock Creek would be to plant faster growing hardwoods along the stream to provide shade faster. LWD habitat work in streams with high temperatures should be postponed until there is a recovery of stream temperatures.

E. Restoration of Aquatic Environment and Fish

1. Culverts and Fish Passage Restoration

Currently the culverts on Northeast Fork and Woodstock creeks pose the greatest risk to high quality aquatic resources. Considering the resource values in these areas, these culverts would be the highest priorities for replacement. Additional enhancement of this unique habitat feature could be provided by adding more shade and cover to make it more attractive to fish. Kelly and McComas creek culverts would be the next priority to restore 3.5 miles of historical coho habitat. A bridge is always the preferred option for providing fish passage at all flows.

2. Road, Riparian, and Large Wood Restoration

Probably the highest priority for restoration of aquatic systems within Rock Creek would be the Upper Rock and Northeast Fork subwatersheds. Restoration work in these areas should concentrate on preservation and protection of the good habitats. Road related threats should be a priority for identification and removal. The reason for removing road related threats in these subwatersheds includes:

-These subwatersheds contain the best fish habitat
-They also have the highest road densities
-They have some of the highest occurrences of management related landslides
-These areas are in Late Successional Reserve land use and will need a lower level of road maintenance.

Instream projects are not advised in these subwatersheds because the late seral riparian habitat currently provides the needed LWD.

Restoration on the lower subwatersheds should concentrate on making inaccessible habitat accessible once again. As stated above, Kelly and McComas Creek culverts should be replaced or made passable. Riparian Reserves in these watersheds are currently lacking in functional habitat due to the large number of roads constructed within them. Unneeded roads that isolate and dissect the riparian reserves need to be identified and removed to help restore riparian functionality. Lower Rock Creek and East Fork riparian systems have historically interacted with their floodplains the most. Removing the roads that prevent this floodplain connectivity would provide the most benefit to the aquatic systems.

There are some drainages such as Harrington Creek and East Fork Creek that are dominated by alder. Although alder is a natural part of the riparian areas, it wasn't historically as dominant as it is in the current condition. A lot of these areas seem to be tied to the earthflow type terrains. These areas are the ones where large wood is the dominant habitat forming feature and also the ones that are the most important for coho and cutthroat. Silvicultural treatment may be necessary in some of these reaches in order to restore

conifers as the dominant species. Where stream temperatures are not a problem instream additions of LWD may be a feasible option in the short term. Salvage of LWD in riparian habitats of all ages would not be recommended in order to maintain the current effectiveness of the remaining habitat for LSH species.

3. Timber Harvesting Recommendations

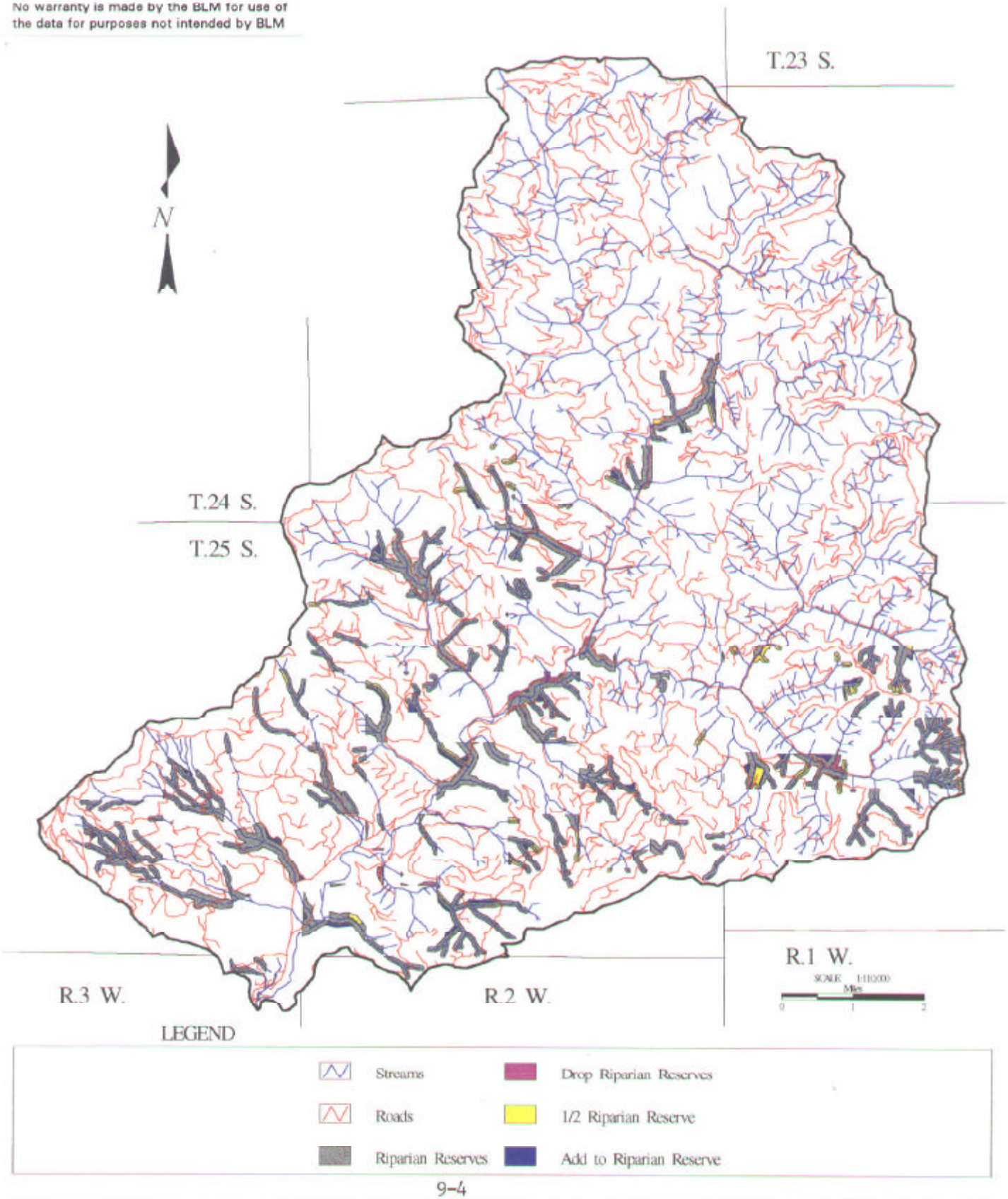
To minimize the negative impacts to the fisheries resources it is recommended that harvesting in the major fish drainages that have been heavily harvested in the past be limited to commercial thinnings. Examples of these types of drainages include Kelly, McComas, Miller, and East Fork drainages. This type of stand treatment would also enhance dispersal habitat for the Northern Spotted Owl as described in the Terrestrial Habitat and Species section. Regeneration harvests would have the least impacts to the fisheries resources in lesser important drainages and drainages that have had a high historical disturbance frequency.

F. Road Restoration and Transportation Management Objectives

Rock Creek watershed has approximately 490 miles of road. Money available for road maintenance is decreasing and long term prevention of road management induced threats to protect resources is needed. The landslides inventory (**Figure 6-3**) has shown the area of highest landslide frequency in the eastern portion of the watershed. The best fish habitat (steelhead) as described above is in the northern portions of the watershed while the most critical cutthroat trout, coho habitats occur in East Fork Rock Creek, Mill Pond, and Lower Rock Creek subwatersheds. **Table 9-3** gives a preliminary list of roads with lower level type maintenance. This list can be used as a starting point for road restoration projects to meet some of the needs described above.

Figure 9-1

Disconnected Riparian Areas



1995 VEGETATIVE AGE CLASSES within MODIFIED RESERVES

DRAINAGE	EARLY SERAL (0-40 yrs) 0-40 ac	%	MID SERAL (40-80 yrs) 40-80 ac	%	LATE SERAL (80-120 yrs) 80-120 ac	%	LATE SERAL (80-120 yrs) 120+ ac	%	TOTAL ACRES
COUGAR CR	71	15%	9	2%	0	0%	398	83%	479
EAST FORK	222	59%	13	4%	32	9%	108	29%	375
LOWER EFK	28	60%	15	33%	0	0%	3	6%	46
MACE CR	43	18%	0	0%	0	0%	192	82%	235
NORTH FORK	365	51%	23	3%	48	7%	284	39%	720
SURPRISE CR	358	45%	0	0%	40	5%	403	50%	801
UPPER EFK	450	45%	0	0%	5	1%	538	54%	993
WAPITI CR	189	34%	14	2%	5	1%	352	63%	559
TOTAL FOR E F ROCK CR	**1726**	**41%**	**74**	**2%**	**131**	**3%**	**2278**	**54%**	**4208**
CONLEY CR	74	30%	0	0%	31	12%	144	58%	249
HIATUS CR	15	5%	9	3%	68	21%	236	72%	328
KELLEY CR	245	46%	0	0%	0	0%	292	54%	537
MC COMAS CR	198	36%	10	2%	128	23%	220	40%	556
MILL POND	79	36%	23	10%	11	5%	108	49%	221
TAYLOR CR	251	57%	0	0%	3	1%	189	43%	443
TOTAL FOR LOWER ROCK CR	**863**	**37%**	**42**	**2%**	**241**	**10%**	**1189**	**51%**	**2334**
HARRINGTON CR	330	43%	0	0%	0	0%	437	57%	766
MILLER CR	148	45%	23	7%	52	16%	105	32%	328
ROCK CAMP	16	10%	5	3%	0	0%	138	87%	159
ROCK REC	42	34%	7	6%	0	0%	73	60%	122
SHOUP CR	121	33%	0	0%	53	15%	192	52%	365
WOODSTOCK CR	197	59%	9	3%	0	0%	129	38%	335
TOTAL FOR MILL POND	**853**	**41%**	**44**	**2%**	**105**	**5%**	**1073**	**52%**	**2075**
BLUFF CR	270	33%	2	0%	1	0%	535	66%	808
HUCKLEBERRY CR	174	16%	19	2%	0	0%	865	82%	1058
NE FORK	76	30%	0	0%	0	0%	174	70%	250
UPPER NE FK	68	28%	0	0%	1	0%	173	72%	242
UPPER T	361	30%	0	0%	25	2%	799	67%	1184
ZIG ZAG CR	543	29%	11	1%	11	1%	1335	70%	1901
TOTAL FOR NE FK ROCK CR	**1491**	**27%**	**32**	**1%**	**38**	**1%**	**3882**	**71%**	**5443**
COBBLE CR	8	90%	0	0%	0	0%	1	10%	9
CROSSROADS CR	65	22%	10	3%	153	53%	63	22%	291
GRAVEL	31	40%	0	0%	0	0%	48	60%	79
PEBBLE CR	311	37%	17	2%	85	10%	420	50%	834
STONEY CR	140	40%	3	1%	0	0%	211	60%	354
TOTAL FOR ROCKY	**556**	**35%**	**30**	**2%**	**237**	**15%**	**743**	**47%**	**1567**
DISAPPEARING CR	393	31%	0	0%	0	0%	877	69%	1270
RUBBLE CR	34	16%	0	0%	0	0%	179	84%	214
TWIN CEDAR CR	441	48%	0	0%	1	0%	473	52%	915
TOTAL FOR UPPER ROCK CR	**868**	**36%**	**0**	**0%**	**1**	**0%**	**1529**	**64%**	**2398**
TOTAL FOR WATERSHED	**6399**	**38%**	**222**	**1%**	**763**	**4%**	**10093**	**59%**	**16826**

Table 9-1

Table 9-2 ACREAGE COMPARISON OF CHANGED RESERVES

DRAINAGE	BEFORE CHANGE RESERVES	AREAS DROPPED	AREAS ADDED	NET MODIFIED RESERVES
COUGAR CR	470	13	22	479
EAST FORK	389	30	17	375
LOWER EFK	46	0	0	46
MACE CR	246	16	5	235
NORTH FORK	739	19	0	720
SURPRISE CR	801	0	0	801
UPPER EFK	993	0	0	993
WAPITI CR	560	7	6	559
TOTAL FOR E F ROCK CR	4244	86	50	4208
CONLEY CR	251	21	20	249
HIATUS CR	323	5	11	328
KELLEY CR	527	4	14	537
MC COMAS CR	554	6	8	556
MILL POND	233	15	3	221
TAYLOR CR	451	8	0	443
TOTAL FOR LOWER ROCK CF	2338	59	55	2334
HARRINGTON CR	767	8	8	766
MILLER CR	337	9	0	328
ROCK CAMP	173	16	2	159
ROCK REC	122	5	5	122
SHOUP CR	348	9	27	365
WOODSTOCK CR	332	2	4	335
TOTAL FOR MILL POND	2078	49	46	2075
BLUFF CR	808	0	0	808
HUCKLEBERRY CR	1058	0	0	1058
NE FORK	242	5	13	250
UPPER NE FK	245	3	0	242
UPPER T	1184	0	0	1184
ZIG ZAG CR	1901	0	0	1901
TOTAL FOR NE FK ROCK CR	5438	8	13	5443
COBBLE CR	18	9	0	9
CROSSROADS CR	291	0	0	291
GRAVEL	78	4	5	79
PEBBLE CR	834	0	0	834
STONEY CR	366	22	10	354
TOTAL FOR ROCKY	1586	34	14	1567
DISAPPEARING CR	1270	0	0	1270
RUBBLE CR	214	0	0	214
TWIN CEDAR CR	915	0	0	915
TOTAL FOR UPPER ROCK CR	2398	0	0	2398
TOTAL FOR WATERSHED	**18083**	**232**	**178**	**18025**

Table 9-3 NATURAL SURFACED ROADS (Field Verified)

Road #	Sur-Type	Land Use	Drain Needs	Sediment Problems	LandSlide Poten.	Veg OverGrown	PCT &/or CT	LWD Avail	Poten. Maint. Level	Comments
25-2-28.1	NAT	GFMA	√	√					2	Walk or check during drier weather
25-2-23.7	NAT	GFMA	√	√					2	blocked off at main 23.1 road
25-2-25.2	NAT	CONN							1	jeep road
25-2-25.3	NAT	CONN							2	
25-2-26.1	NAT	GFMA	√	√		*			2	
25-2-13.1	NAT	GFMA								dirt road
25-2-9.0 A	NAT	LSR	√	√					1	ridge top, potential close
25-2-9.0 C	?	GFMA								
25-2-9.1	NAT	LSR	√	√			*		2	
25-2-5.1	NAT	LSR	*	*			*		2	potential close
25-2-5.2	NAT	LSR	*	*			*		2	potential close
25-2-1.0	NAT	LSR	√	√		*			CLOSE	tractor road off landing, rip,
25-2-11.1	NAT	LSR	√	√			√		2	
24-2-31.2	NAT/ROCK	LSR			*		*	*	2	possible decommission since unit
24-2-31.4	NAT	LSR	√	√		*	√		1	overgrown jeep road
24-2-25.1	NAT	LSR	*					*	2	dirt road before crushed rock
24-2-7.0	NAT	LSR	*				*		1	
25-2-19.5	NAT	GFMA	√	√			*		3	dirt road, accesses most of section
25-2-19.7	NAT	GFMA	√	√			*		3	accesses section 19
25-3-13.7	NAT	GFMA	√			*			1	
25-3-23.1	NAT	GFMA							1	could be ripped
25-3-35.3	NAT	GFMA				*			CLOSE	8" trees growing in road

√ = need to check further
* = currently exists on the ground

Table 9-3 **ROCK SURFACED ROADS (Field Verified)**

Road #	Sur-Type	Land Use	Drain Needs	Sediment Problems	LandSlide Poten.	Veg OverGrown	PCT &/o CT	LWD Avail	Poten. Maint. Level	Comments
25-2-23.0	ROCK	CONN	*						3	
25-2-23.4	ROCK	GFMA							1	tie rd,mislabeled natural surf, GIS
25-2-27.1	ROCK	CONN	*						3	
25-2-26.2	ROCK	GFMA	*				*		2	Needs drainage on private portion
25-1-19.0	ROCK	CONN	*	*	*				2	Described natural surface, needs long
25-1-19.0	ROCK	CONN	*	*	*		*		2	Described natural surface, needs long
25-1-18.2	ROCK	GFMA	*	√	*		*		2	Needs long term, low maint drain
25-1-7.3	ROCK	LSR	√	√	√	*			CLOSE	Needs long term, low maint drain could
25-1-7.8	ROCK	LSR	√	√	*	*	√		CLOSE	Currently closed because of brush &
25-1-7.9	ROCK	LSR	*	*			*		1	could close after PCT
25-2-11.1	ROCK	LSR	*		*		*		3	
25-1-1.0	ROCK	LSR					*		2	Ridge top road
25-1-1.2	ROCK	LSR	*	*	*		*		1	Decommission last 1/4 mile?
25-2-7.0	ROCK	LSR					*		2	Portion in Section 31
24-1-31.0	ROCK	LSR	*	*	*		*		3,1	Decommission last 1/4 mile?
24-1-31.3	ROCK	LSR	*		*		*		2	
24-2-25.1	ROCK	GFMA	*	*	*		*		3	Portion in 24-2-25 needs long term, low
24-2-25.1	ROCK	LSR	*		*		*		1	Portion in 24-1-19 needs long term low
24-1-30.0	ROCK	LSR					*		3	tie rd,mislabeled natural surf, GIS
24-1-17.0	ROCK	LSR	*	*	*		*		1	Portion in 24-1-19, Major landslide
25-3-13.8	ROCK	GFMA	*		*		*		1	Sidecast cracking off, needs long term low
25-3-23.0	ROCK	GFMA	*				*		3	needs long term low maint drain
25-3-35.0	ROCK	GFMA	*						3	needs culvert or drain dip in section 34
	ROCK									

√ = need to check further

* = currently exists on the ground

Road Maintenance Levels

BLM Maintenance Levels The assigned maintenance level reflects the appropriate maintenance that best fits the planned management activities. Funding is not available to maintain all roads at their assigned levels. Roads will be prioritized for maintenance needs or may be maintained at lower levels depending upon funding.

Level 1 This level is the minimum maintenance required to protect adjacent lands and resource values. These roads may be blocked and not open for traffic or may be open to restricted traffic. Passenger car traffic is not a consideration. (Minimum standards for Level 1) Emphasis is given to maintaining drainage and runoff patterns as needed. Grading, brushing, or slide removal is not performed unless roadbed drainage is being adversely affected, causing erosion. Closure and traffic restrictive devices are maintained.

Level 2 This level is assigned to roads where the management objectives require the road to be opened seasonally or for limited traffic. Traffic is generally administrative with some public use. Typically, these roads are passable by high clearance vehicles. Passenger car traffic is not a consideration. (Minimum standards for Level 2) Drainage structures are to be inspected within a 3 year period and maintained as needed. Grading is conducted as necessary to correct drainage problems. Brushing is conducted as needed to allow administrative access. Slides may be left in place provided that they do not adversely affect drainage.

Level 3 This level is assigned to roads where management objectives require the road to be open seasonally or year round for commercial, recreation, or administrative access. Typically, these roads are natural or aggregate surfaced, but may include low use bituminous surfaced road. They are single land roads with turnouts. These roads may be negotiated by passenger cars travelling at prudent speeds to maintain driver safety for the road conditions. User comfort and convenience are not considered a high priority. (Minimum standards for Level 3) Drainage structures are to be inspected at least annually and maintained as needed. Grading is conducted to provide a reasonable level of riding comfort and driver safety at prudent speeds for the road conditions. Brushing is conducted as needed for driver safety. Slides adversely affecting drainage would receive high priority for removal, otherwise they will be removed on a scheduled basis.

MONITORING AND PUBLIC PARTICIPATION

A. Monitoring Priorities and Possibilities

1. Fish

There are several monitoring needs in the Rock Creek watershed. Consistency in spawning surveys is needed to remove some of the doubt that is associated with using untrained volunteers. Index spawning reaches have been established on BLM lands. In addition, annual production estimates are needed. The most reliable way to obtain this kind of information is with a juvenile fish outmigrant trap, also known as smolt trap. These traps are costly both in dollars and manpower. However, they provide reliable data on the overwinter survival of juvenile fish and the production of the system. This information, along with spawning escapement data, can be used to evaluate the effectiveness of land management and restoration practices. Summer juvenile standing crop estimates in Rock Creek would help pinpoint important rearing areas. Summertime population estimates should be initiated as time and money permit.

2. Other Areas for Monitoring
   - Stream temperatures will continue to be monitored.
   - Analysis on existing gaging station data.

3. Monitoring/Inventory if Time and Budgets Permit
   - Turbidity and suspended sediment monitoring (to fill the data gap for sedimentation).
   - Inventory of existing culverts
   - Cavity dweller habitat

B. Public Participation

During the watershed analysis process for Rock Creek, local residents were interviewed as well as key landowners contacted. Interviews were conducted to gather information for the Human Uses section. People interviewed included Bill Otto,the manager for the Rock Creek Fish Hatchery, the proprietor for the Idleyld store, and local residents; Pat Lee, Herman Engler, Don Morrison, Kenneth and Lillian Taylor. The watershed analysis team from Weyerhaeuser Company in Eugene were also involved. Bill Moore of Seneca Timber Co. and Dick Beebe of Roseburg Resources Company were also contacted.

On December 5th the existing details of what had been gathered in watershed analysis up to that point were presented with the purpose of generating discussion about management options and needs as well as receive feedback about the validity of the preliminary findings. Five individuals from the Weyerhaeuser Co. watershed analysis team were involved as well as Dave Loomis from ODFW. Others were invited but were not able to come. Their feedback helped to focus attention on the landslides inventory and how much sediment was or is being delivered to streams. This was not possible although some general associations were made in the analysis. The people from Weyerhaeuser thought that the presentation provided good connections with the processes within the watershed although they disagreed with some of the conclusions in the presentation. The feedback given has helped the interdisciplinary team more effectively finalize the Rock Creek watershed analysis.

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