Calapooya Creek Watershed Analysis

5th Field Watershed
(Associated with the city of Oakland, OR
HUC #1710030301)

Roseburg District BLM

Updated as of
October 1999
Version 1.1

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OVERVIEW OF CALAPOOYA CREEK WATERSHED

A. Introduction

This watershed assessment is one of several assessments that have taken place for Calapooya Creek. This particular assessment will focus most directly upon the federal portion of the watershed. Since the federal portion of this watershed is very small (only 7%), more specific analysis for major landowners will be left for others to develop and finalize.

It is worth mentioning here the other assessments that have taken place to date for portions or all of Calapooya Creek. In September, 1997, Weyerhaeuser Company finalized a watershed analysis for the Upper Calapooya Creek area which is in the northeast headwaters of Calapooya Creek. Eighty-four percent (26,084 acres) of the land in this area is owned and managed by Weyerhaeuser Company. This analysis provides a very detailed assessment of the processes and management solutions to be applied to Weyerhaeuser lands. Copies of this assessment are held at Weyerhaeuser's regional office at 785 North 42^{nd} Street, Springfield, OR 97478.

Two other analyses have been conducted but they focused more energy on the human component of the Calapooya Creek Watershed. The *Calapooya Watershed Assessment and Enhancement Plan* was developed and finalized by a University of Oregon student team on May 17, 1999. Its main purpose was to assess the socioeconomic conditions, biophysical conditions as well as opportunities and constraints. Another assessment, *An Assessment of Community-based Adaptive Watershed Management in Three Umpqua Basin Watersheds*, was conducted by Geoffrey Habron as part of his PhD dissertation submitted in July of 1999. Geoffrey Habron developed an assessment of the private landowner values within Calapooya Creek Watershed (as well as Myrtle Creek and Deer Creek) and used it to show the areas most likely to have successful collaborative restoration work in a multi-ownership watershed. This work has great potential for helping land use and watershed planners identify areas for restoration work. All of these works are referenced here and used to some extent in developing this assessment.

B. General Description

Size and Location: Calapooya Creek Watershed contains approximately **157,194** acres. Calapooya is a discreet watershed located in the northern part of Umpqua Valley. The headwaters begin in the lower Cascades northeast of the city of Sutherlin approximately 20 miles (**Figure 1-1**). The city of Sutherlin actually is not in the watershed. Calapooya Creek enters into the Umpqua southwest of Sutherlin approximately 7 miles and mostly consists of low gradient riverine type habitat which flow into the Umpqua river. The Umpqua River system which includes the North, South, and lower Umpqua River encompasses approximately 4,684 square miles that flows 200 miles from the Cascade crest through the Oregon Coast Range to the Pacific Ocean.

Specific Description: Calapooya consists of 5 subwatersheds and stretches approximately 27 miles east to west. This watershed also contains portions of I-5 Interstate Highway as well as State Highway 138 (**Figure 1-1**). The elevation ranges (**Figure 1-3**) from about 320 feet at the confluence of Calapooya Creek and the Umpqua River in the southwest portion, to approximately 3,700 feet on Brown Mountain at the southeastern tip of the watershed, to 4,443 feet at Middle Mountain on the eastern border in the Cascades. This watershed is made up of 5 major subwatersheds: South Calapooya, North Calapooya, Evans Butte, Nonpareil, and Brown Mountain. These subwatersheds are also divided into 22 drainages (**Figure 1-5, Table 1-1**).

Climate and Vegetation: Average annual rainfall ranges from 40 to 50 inches along the Umpqua River, to 80 to 90 inches in the upper elevations to the east. Most of the precipitation occurs in the form of rain since most of the watershed has elevations below 2,500 feet. The majority of the landscape is dominated by seedling and young second growth Douglas-fir. This is a result from harvesting the older timber stands during the last 100 years and replanting of those lands to Douglas-fir. The valley bottoms maintain a mixture of oak and madrone agriculture/pasture lands.

People and Recreation: This watershed has a high percentage of agricultural landowners. State Highway 138 which joins state highway 38 at Elkton is a major connector route between the Umpqua Valley and the Pacific Coast. Douglas County maintains a small park called Kanipe Memorial. There is no major BLM recreation development in this watershed.

C. Ownership and Federal Land Use Allocations

The following is a breakdown of the private land owners and federal administration (**Figure 1-6)**. Except for Weyerhaeuser Company, a breakdown of the major private land owners was not obtained for this analysis because of the large number of land owners in this watershed.

Land Owner	Acres	Percent of Watershed
Government (BLM)	11,661	7.4%
Weyerhaeuser Co.	27,861	17.7%
Private Industrial Lands	25,995	16.5%
Private Non-Industrial Lands	89,714	57.0%
State and Douglas County	1,963	1.2%

Of the **157,194** acres within Calapooya Creek watershed, approximately 11,661 acres is federally managed under the following Forest Plan and Roseburg District RMP land use allocations (**Figure 1-7, Table 1-2**) (note: these acreages are estimates based on computer generated maps):

	Acres, Fed Lands	% Fed Lands	% of Watershed
Late Successional Reserves (LSR)	788 ac	7%	0.5%
Other Reserves	3,678 ac	32%	2.4%
Connectivity	1,548 ac	13%	1.0%
General Forest Management Area (GFMA)	5,647 ac	48%	3.7%

1. Late Successional and Other Reserves

The management objectives for all reserves are to protect and enhance old-growth forest conditions. Of the 4,466 acres of reserves in Calapooya, approximately 1836 acres (41% of reserves in Calapooya) are currently in late-successional type forests (76+ years) (**Figure 1-8, Table 1-3**).

The Other Reserve Areas as shown on **figure 1-7**, include riparian reserves, unmapped pre-1994 northern spotted owl (NSO) core areas, designated habitat areas such as bald eagle habitat, and areas withdrawn because they are considered not suitable for timber production (TPCC).

The riparian reserves were established on 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 was used as representing the average site-potential tree height of the Calapooya watershed (ROD, pg. 9). 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. Actual intermittent streams are unmapped and known fish bearing streams are estimated based on a fish presence/absence inventories and professional knowledge on the ground. For this analysis the total amount of riparian reserves was estimated for mapping purposes so that third order streams and larger received a 360 foot buffer while the documented first and second order streams received 180 foot buffers. Actual projects would use on-the-ground stream information to establish Riparian Reserves.

In Calapooya watershed there are six Residual Habitat Areas. These areas of about 100 acre in size were located around pre-1994 nesting owls and are expected to provide some protection for suitable owl nesting groves. They are not, in themselves, expected to be capable of supporting pairs of nesting owls, but rather to provide nesting habitat in the future while the surrounding forest stands mature.

Areas designated as not suitable for timber production (TPCC withdrawn) are much smaller and scattered.

As part of the Late Successional Reserve land use allocation, several areas were reserved from timber management in order to protect potential nesting habitat for the marbled murrelet. These areas in the eastern portion of the watershed are described as marbled murrelet reserves as opposed to designated critical habitat. These areas were selected because they contain potential habitat based on the presence of several key habitat elements within the estimated range of the species. The elements include large diameter (32 inch+ DBH) trees, a canopy layer height equal to or greater than ½ the site potential tree height, structural deformities, mossy large limbs or other conditions which create nesting platforms

2. Matrix Lands

a. Connectivity

The objective of these lands is commercial harvest on a 150 year cycle while providing 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. Calapooya contains approximately 1548 acres of Connectivity. Within this land designation there are approximately 582 acres in young pre-commercial age class (0 to 25 years), 410 acres potentially available for a commercial thinning (25 to 75 years), and 556 acres available for regeneration harvest (80+ years) (**Figure 1-9, Table 1-5**).

b. 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 5647 acres of GFMA in Calapooya. Within this land designation there are approximately 1891 acres in young pre-commercial age class (0 to 25 years), 2038 acres potentially available for a commercial thinning (25 to 75 years), and 1718 acres available for regeneration harvest (80+ years) (**Figure 1-10, Table 1-6**).

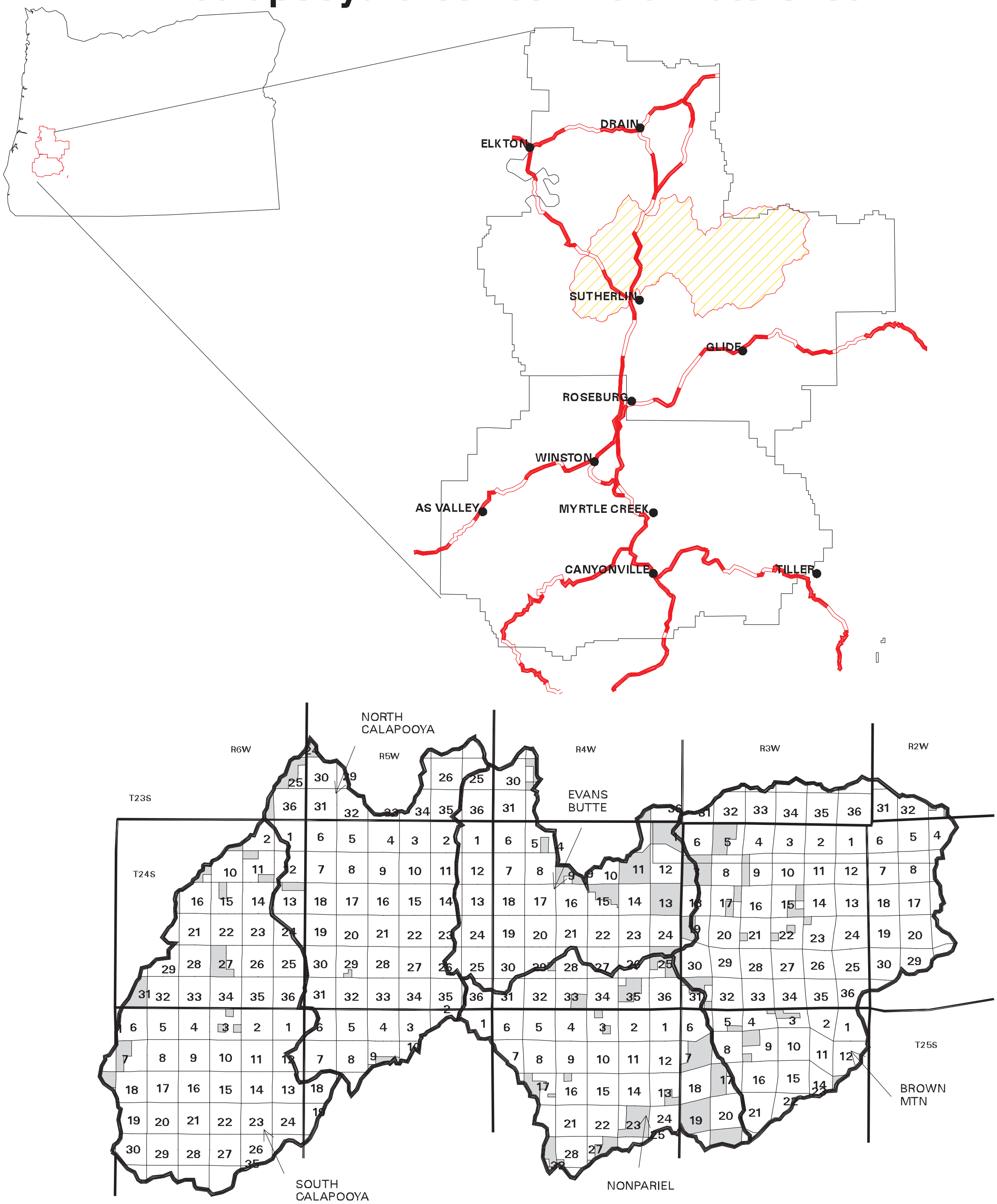
Figure 1-11 depicts the current and potential timber harvest areas planned on federal lands in the Calapooya Creek Watershed. Coon Creek commercial thinning is currently the only active timber sale in the watershed. Under the NFP guidelines timber harvest areas have been planned out for the next 4 years on matrix lands. The following is a breakdown of the planned harvest acreage shown in **Figure 1-11**.

Current Timber Sales (Coon Creek CT)	297 acres
Sold and Injuncted Timber Sale (Pine Creek Regeneration TS)	44 acres
Potential Regeneration Harvest Areas (Planning for Next 4 Years)	1367 acres
Potential Commercial Thinning Areas (Planning for Next 4 Years)	31 acres

The area silviculturist has also identified timber stands needing commercial thinning within the next 5 years. These stands still need more planning but generally have been identified in the following areas: T.24 S., R.4 W., Sections 11, 13, and 35.

Figure 1-1

Calapooya Creek 5th Field Watershed



Vicinity Map

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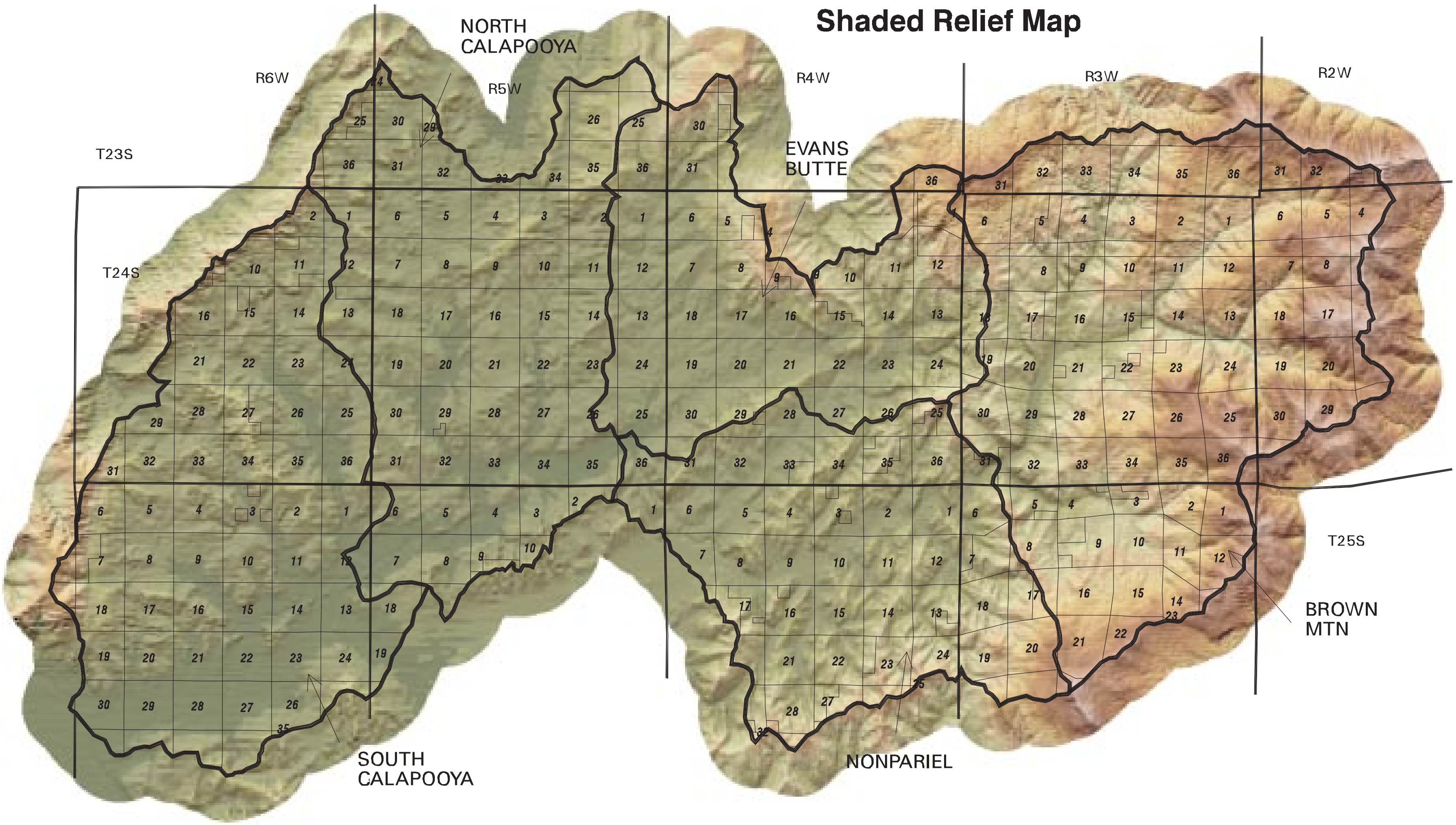
Analytical Watershed
BLM Managed Lands

N

Figure 1-2

Calapooya Creek Watershed

Shaded Relief Map



Scale 1:200000

0 1 2 3 4 5 6 Miles

N

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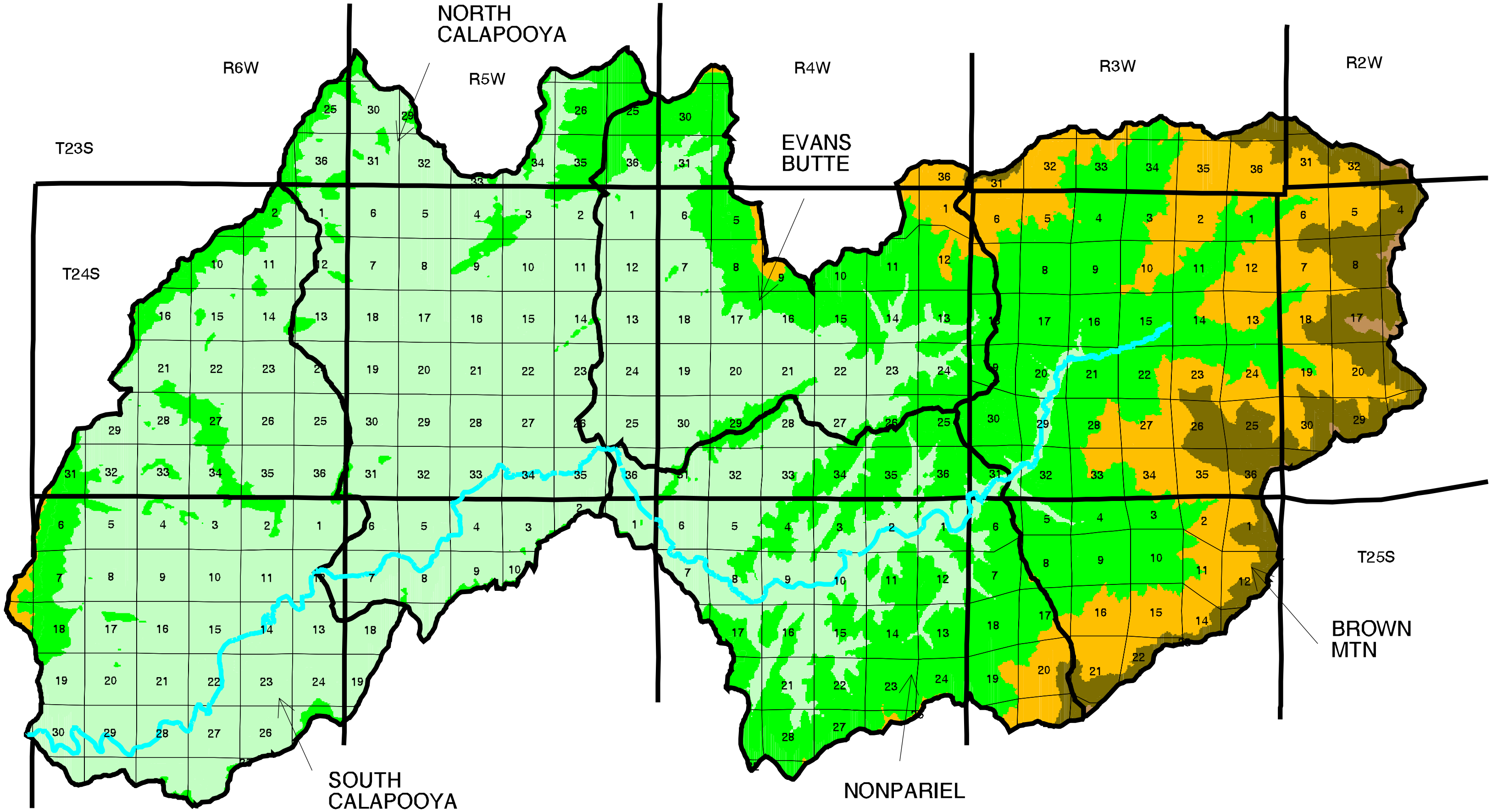
Figure 1-3

Calapooya Creek Watershed - Elevation



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Scale 1:200000

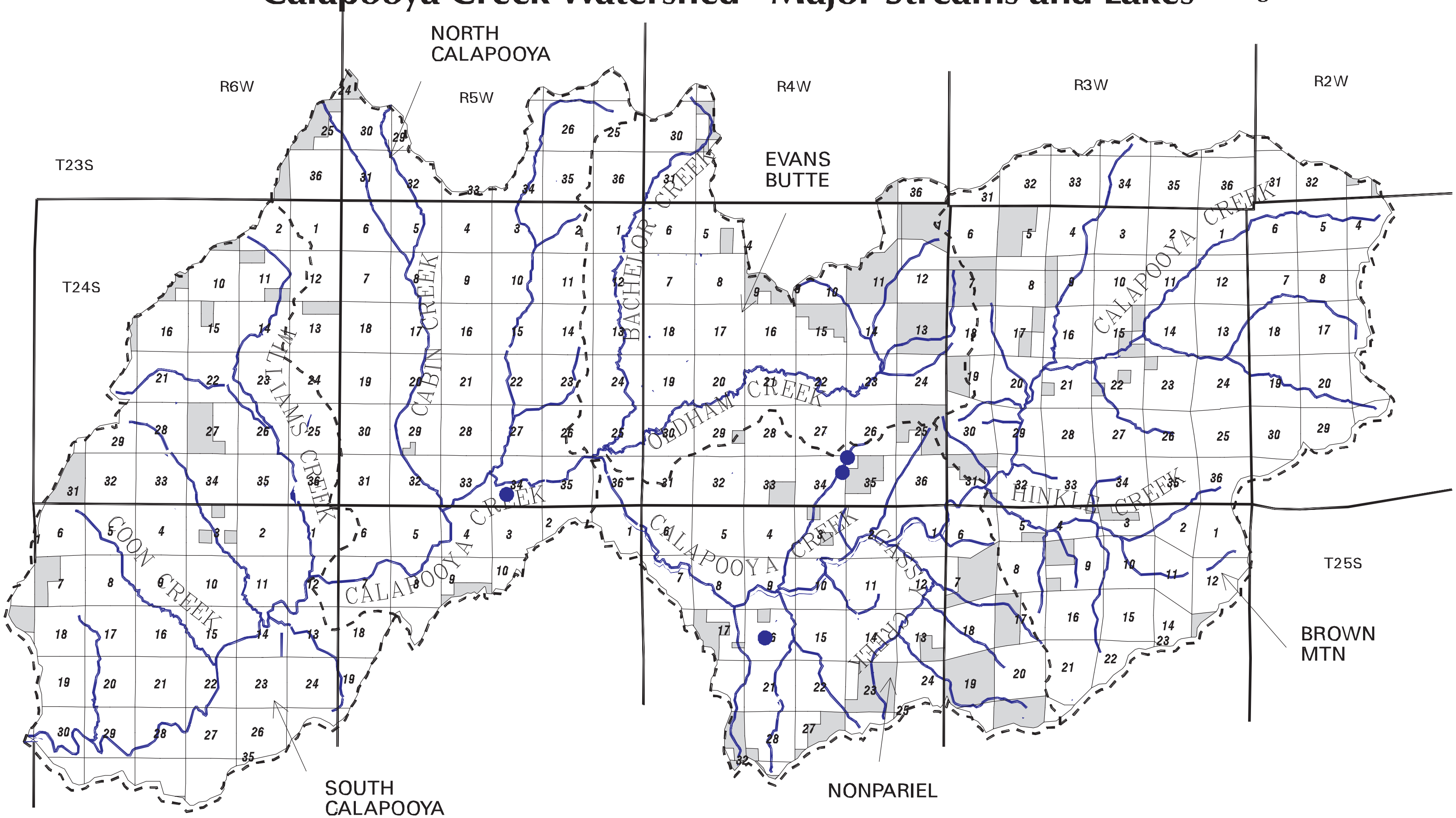
1 0 1 2 3 4 5 6 Miles

Elevation in Feet
- 500 - 1000
- 1500 - 2000
- 2500 - 3000
- 3500 - 4000
- 4500

N

Calapooya Creek Watershed - Major Streams and Lakes

Figure 1-4



Scale 1:200000

0 1 2 3 4 5 6 Miles

Lakes and Ponds

Springs

Major Streams

Watershed Boundaries

N

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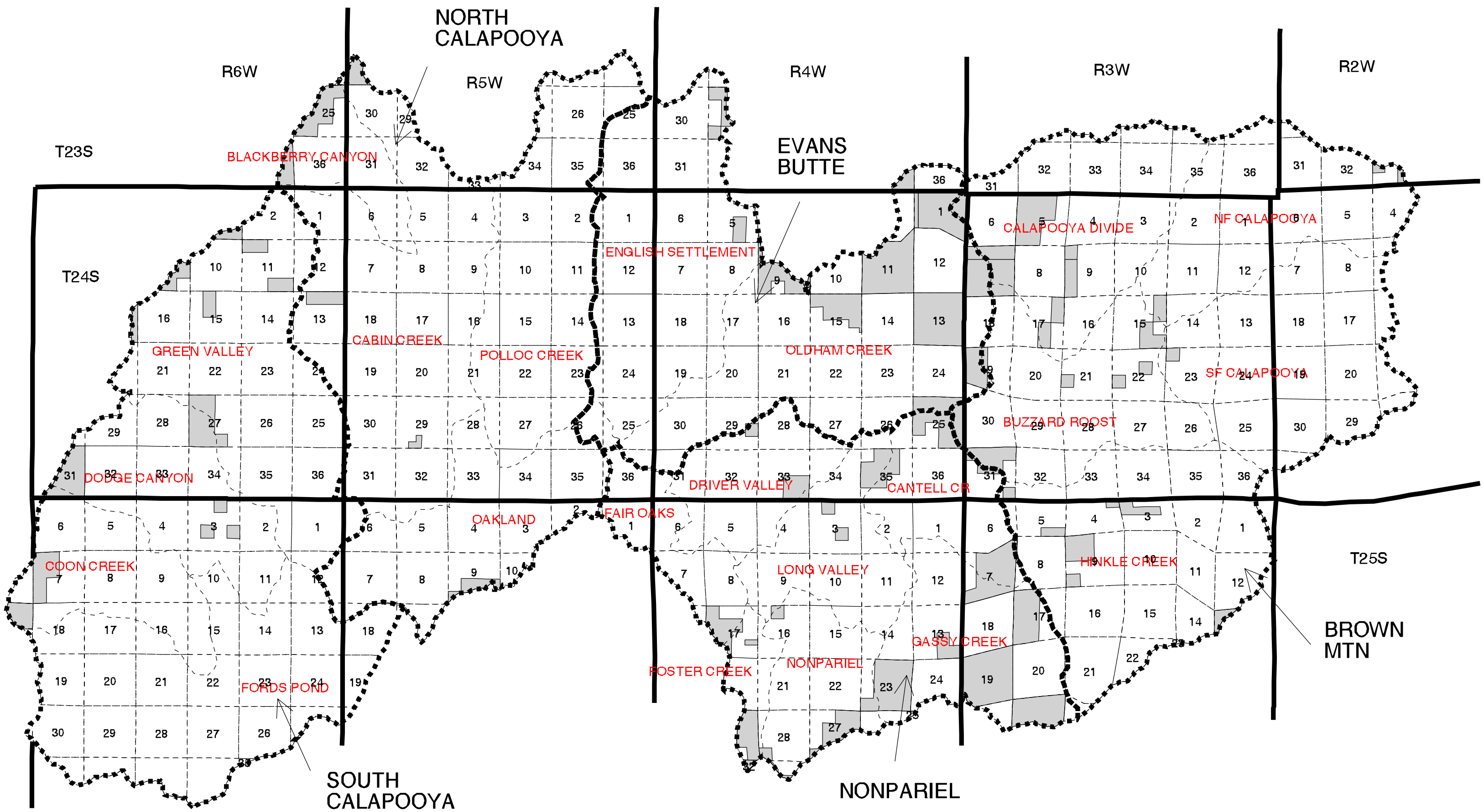
Figure 1-5

Calapooya Creek Subwatersheds and Drainages



Scale 1:200000

1 0 1 2 3 4 5 6 Miles

Calapooya Drainages

Calapooya Subwatersheds

BLM

N

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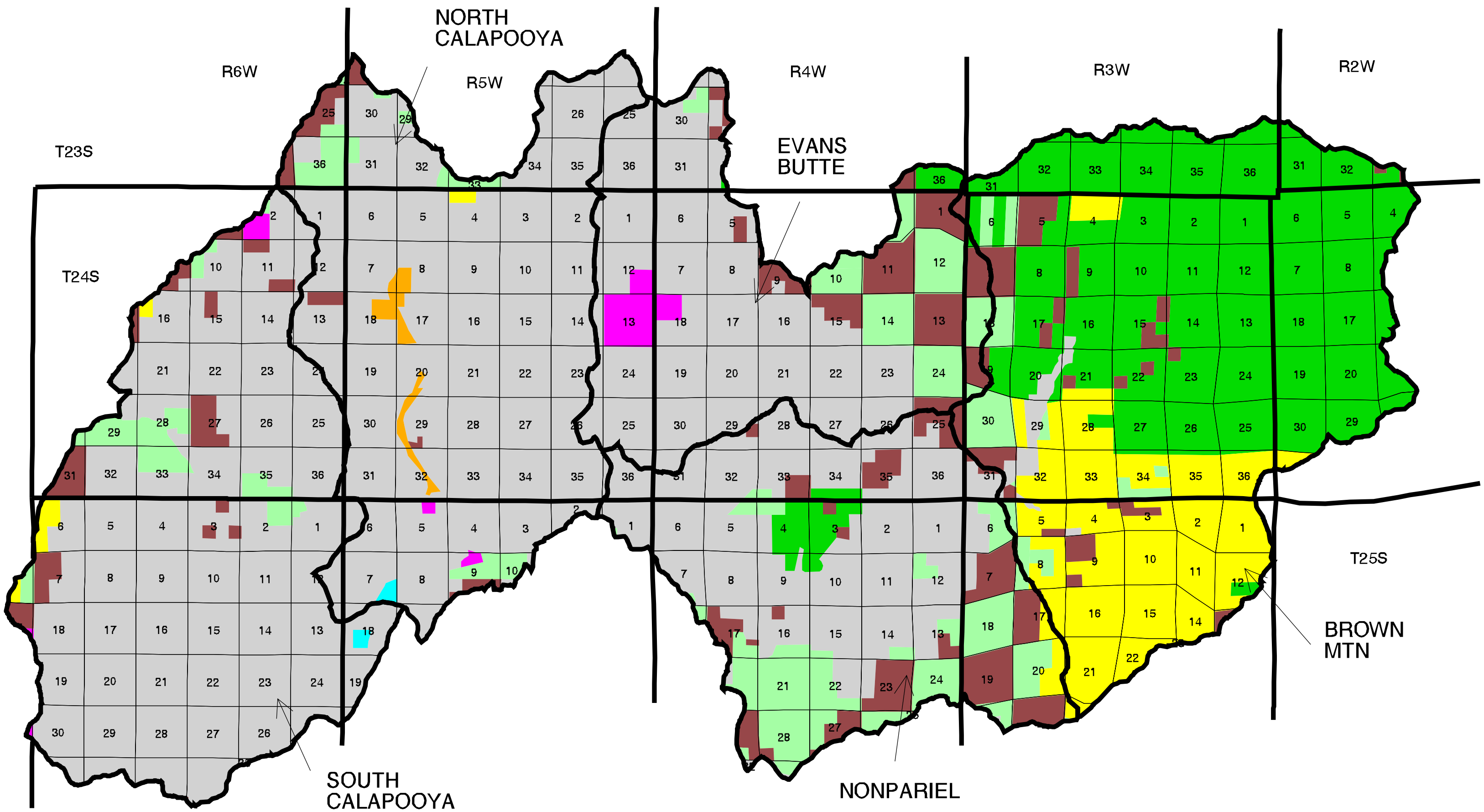
Table 1-1

CALAPOOYA CREEK SUBWATERSHEDS AND DRAINAGES						
Subwatersheds	**Drainages**	**BLM**		**Private/Other**		**Total**
		Acres	**%**	**Acres**	**%**	**Acres**
	Buzzard Roost	662	9	6625	91	7288
	Calapooya Divide	1039	13	7100	87	8139
	Hinkle Creek	511	5	10547	95	11059
	NF Calapooya	118	2	7276	98	7394
	SF Calapooya	50	0.5	9001	99.5	9051
Brown Mountain		**2380**	**6**	**40549**	**94**	**42929**
	English Settlement	236	2	9850	98	10086
	Oldham Creek	2924	22	10202	78	13126
Evans Butte		**3160**	**14**	**20052**	**86**	**23212**
	Cantell Creek	700	19	2994	81	3694
	Driver Valley	170	4	3638	96	3808
	Fair Oaks	179	7	2493	93	2671
	Foster Creek	288	24	935	76	1223
	Gassy Creek	2034	33	4046	67	6080
	Long Valley	296	7	4138	93	4434
	Nonpariel	346	9	3303	91	3649
Nonpariel		**4013**	**16**	**21547**	**84**	**25560**
	Blackberry Canyon	379	15	2095	85	2474
	Cabin Creek	271	2	12557	98	12828
	Oakland	113	2	6961	98	7074
	Polloc Creek	0	0	9111	100	9111
North Calapooya		**763**	**2**	**30724**	**98**	**31487**
	Coon Creek	432	9	4286	91	4718
	Dodge Canyon	596	10	5319	90	5914
	Fords pond	7	0.1	12375	99.9	12382
	Green Valley	606	6	10384	94	10990
South Calapooya		**1641**	**5**	**32364**	**95**	**34005**
TOTAL WATERSHED		**11957**	**8**	**145236**	**92**	**157193**

Figure 1-6

Calapooya Creek Watershed - Ownership



Scale 1:200000

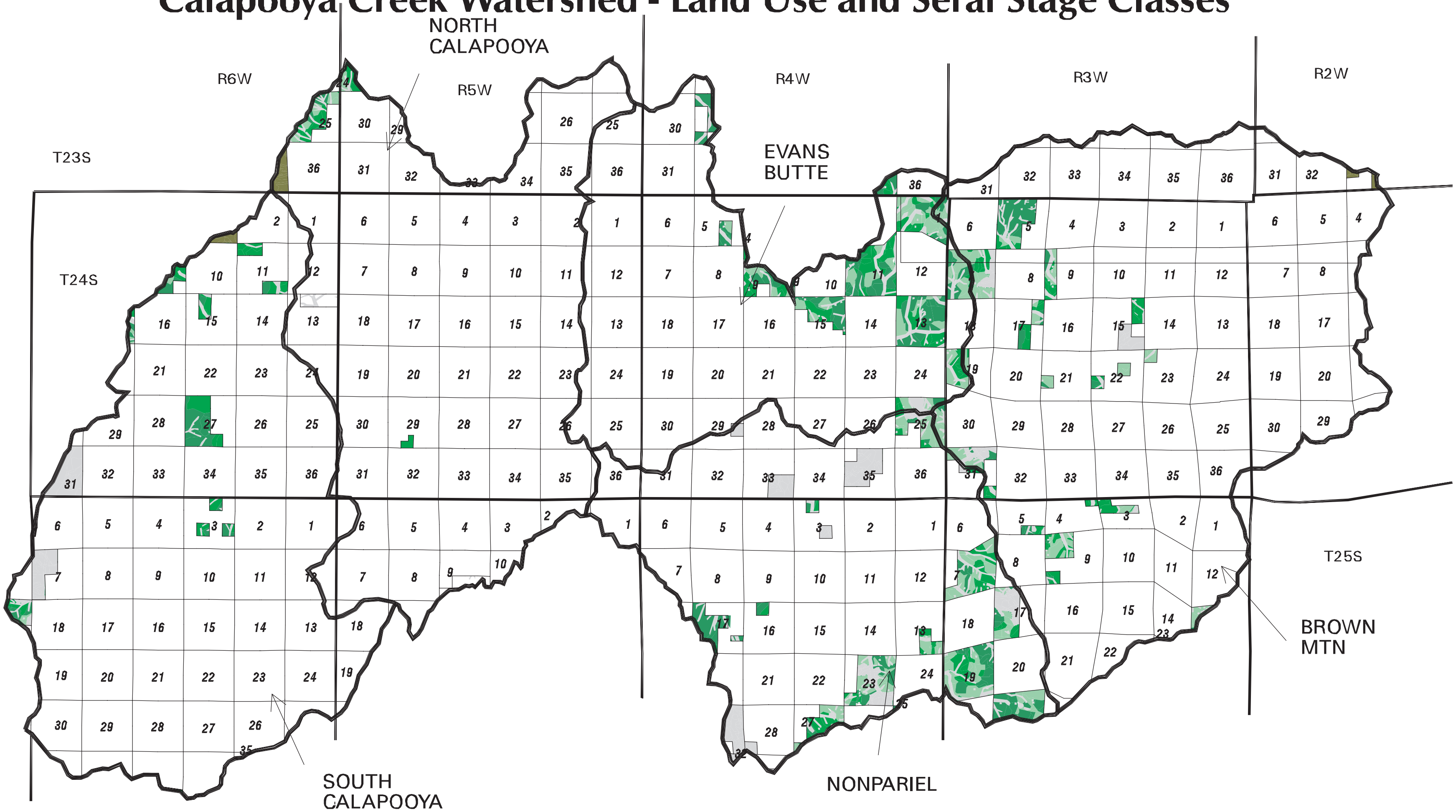
1 0 1 2 3 4 5 6 Miles

- BLM Land - 11,661 acres
- Private Industrial Lands - 13,968 acres
- Private Non-Industrial Lands - 89,714 acres
- State Lands - 164 acres
- Douglas County Land - 1,237 acres
- Oregon Dept. of Transportation - 562 acres
- Weyerhauser - 27,861 acres
- Ford Foundation -12,027 acres

N

Figure 1-7

Calapooya Creek Watershed - Land Use and Seral Stage Classes



Scale 1:200000

0 1 2 3 4 5 6 Miles

Late Successional Reserves

Other Reserve Areas

MATRIX LANDS

Early Seral Stage (0-30 yrs)

Mid Seral Stage (31-80 yrs)

Late Seral Stage (81-200 yrs)

N

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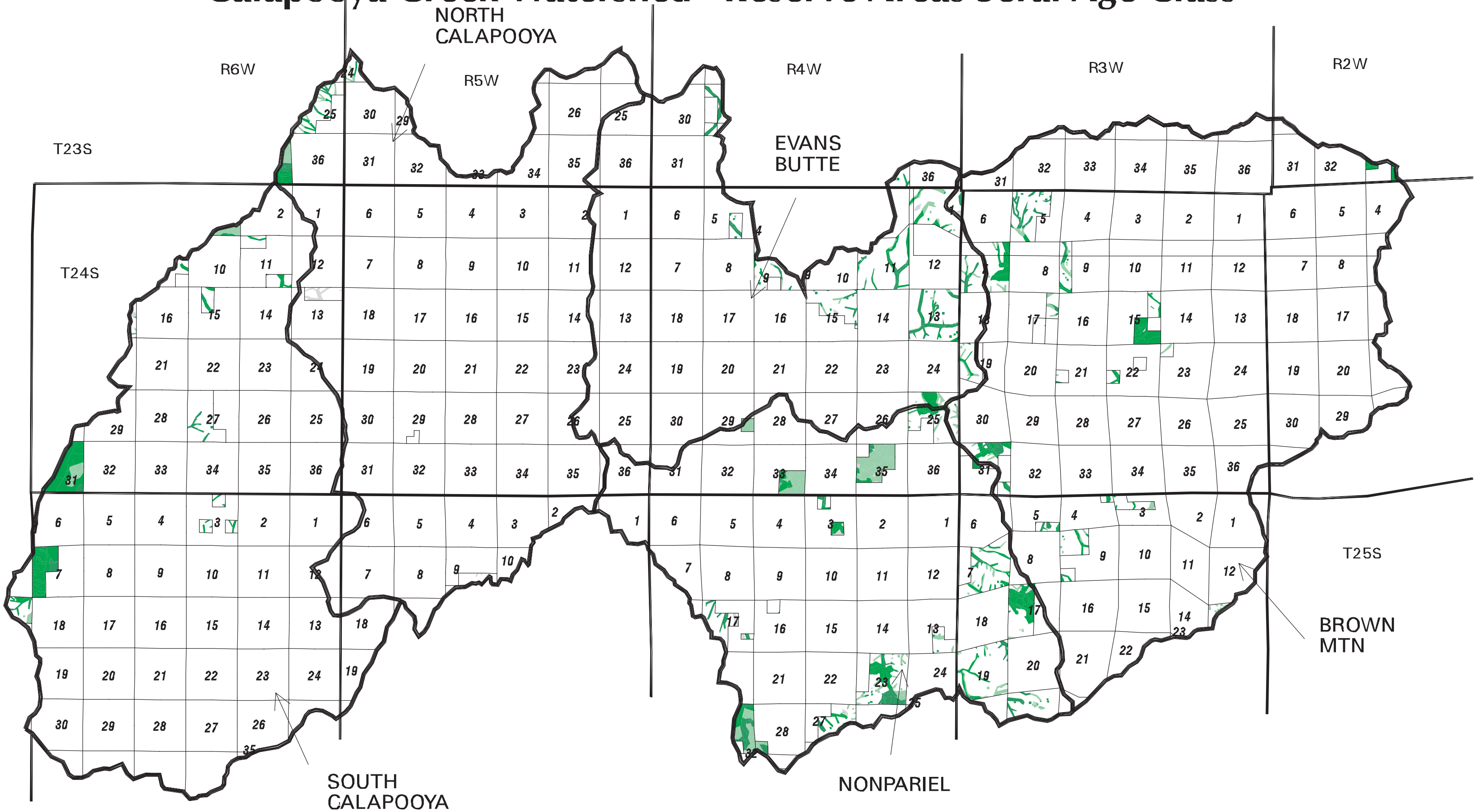
Figure 1-8

Calapooya Creek Watershed - Reserve Areas Seral Age Class



Scale 1:200000

0 1 2 3 4 5 6 Miles

- Early Seral Stage (0-30 Years)
- Mid Seral Stage (31 to 80 Years)
- Late Seral Stage (80 to 200 Years)
- Non-Forest Areas

N

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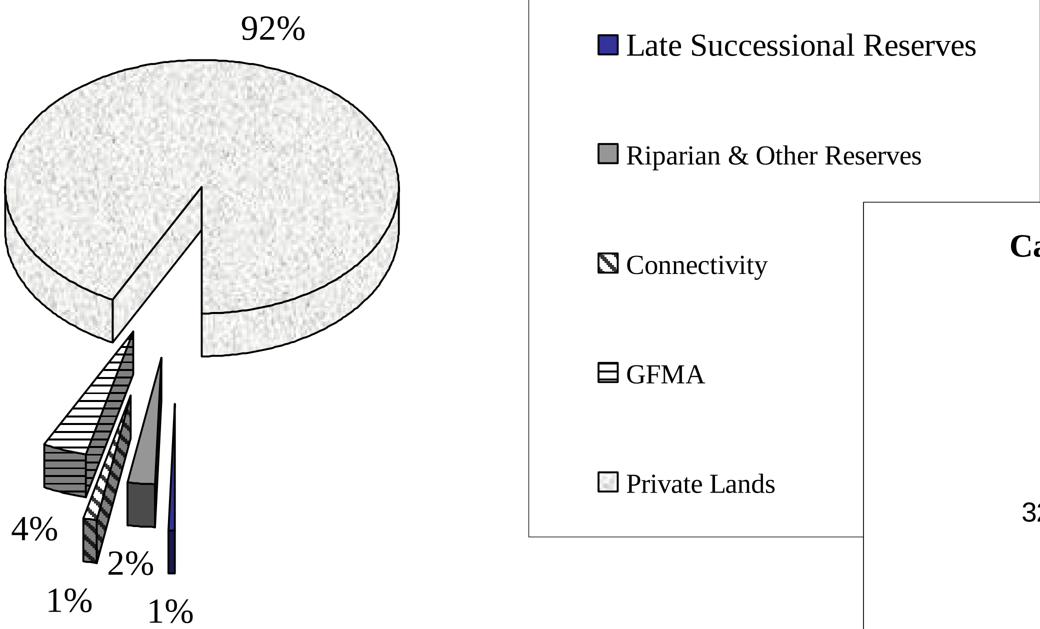
Table 1-2 **CALAPOOYA PUBLIC LAND USE ALLOCATIONS AND PRIVATE LANDS**

	Late Successional Reserves		Riparian & Other Reserves		Connectivity		GFMA		Private Lands		TOTAL
Subwatersheds	acres	%	acres	%	acres	%	acres	%	acres	%	**ACRES**
Brown Mountain	45	0.1%	803	2.0%	85	0.2%	1422	3.5%	38152	94.2%	40506
Evans Butte	0	0.0%	1031	4.5%	811	3.5%	1317	5.7%	19793	86.2%	22952
Non-Pareil	0	0.0%	1380	5.4%	586	2.3%	2014	7.9%	21547	84.4%	25527
North Calapooya	122	0.4%	179	0.6%	66	0.2%	161	0.5%	30724	98.3%	31253
South Calapooya	620	1.8%	285	0.8%	0	0.0%	733	2.2%	32364	95.2%	34002
TOTAL	788	0.5%	3678	2.4%	1548	1.0%	5647	3.7%	142580	92.4%	154241

Chart 1-1 **CALAPOOYA PUBLIC LAND USE ALLOCATION AND PRIVATE LANDS**



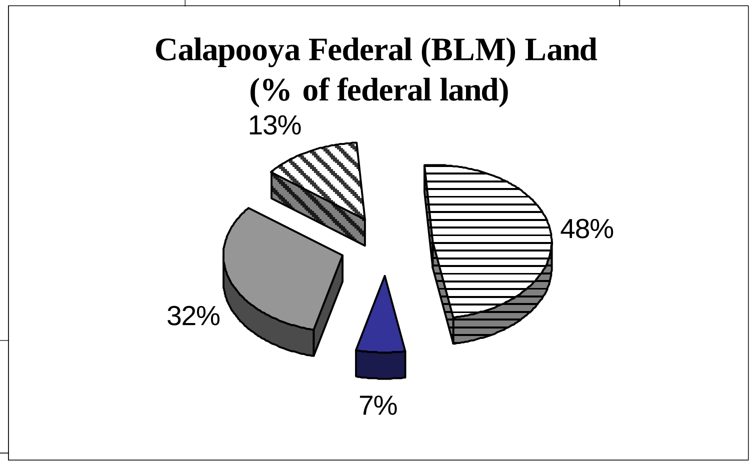


Table 1-3 CALAPOOYA **ALL BLM RESERVES**, AGE CLASSES

	Acres by Age Classes						TOTAL
Subwatersheds	0-5 yrs	6-15 yrs	16-25 yrs	26-45 yrs	46-75 yrs	76+ yrs	**ACRES**
Brown Mountain	16	82	56	277	35	381	848
Evans Butte	59	110	68	436	82	277	1031
Non-Pareil	93	156	255	297	152	426	1380
North Calapooya	44	37	36	63	0	121	302
South Calapooya	31	31	58	127	26	632	906
TOTAL	243	416	474	1199	296	1836	4465

Chart 1-2 Calapooya Watershed BLM Reserves Age Classes

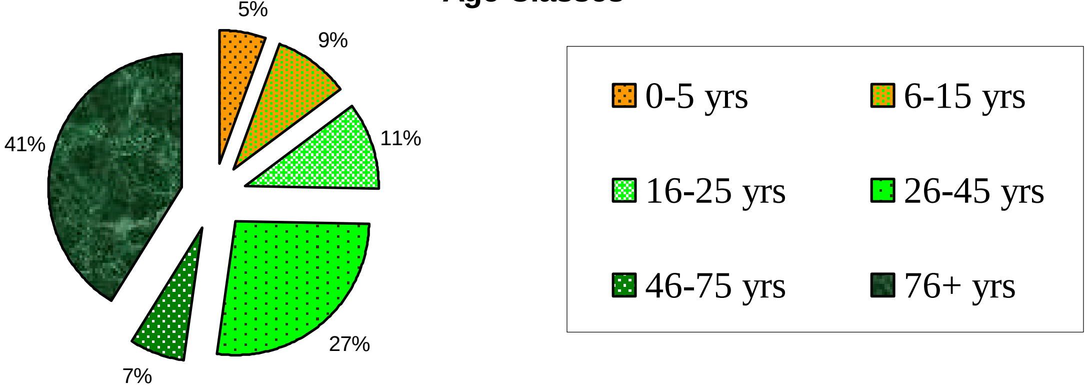


Table 1-4 CALAPOOYA, AGE CLASSES

BLM RIPARIAN RESERVES & RIPARIAN AREAS IN LSR's

	Age Classes						TOTAL
Subwatersheds	0-5 yrs	6-15 yrs	16-25 yrs	26-45 yrs	46-75 yrs	76+ yrs	**ACRES**
Brown Mountain	15	81	56	277	35	342	806
Evans Butte	59	110	68	436	82	277	1031
Non-Pareil	93	156	255	297	152	426	1380
North Calapooya	20	37	36	50	0	83	226
South Calapooya	6	5	35	97	24..7	239	381
TOTAL	193	389	451	1157	270	1365	3824

Chart 1-3 Calapooya Watershed BLM Riparian Reserves & Riparian Areas, Age Classes

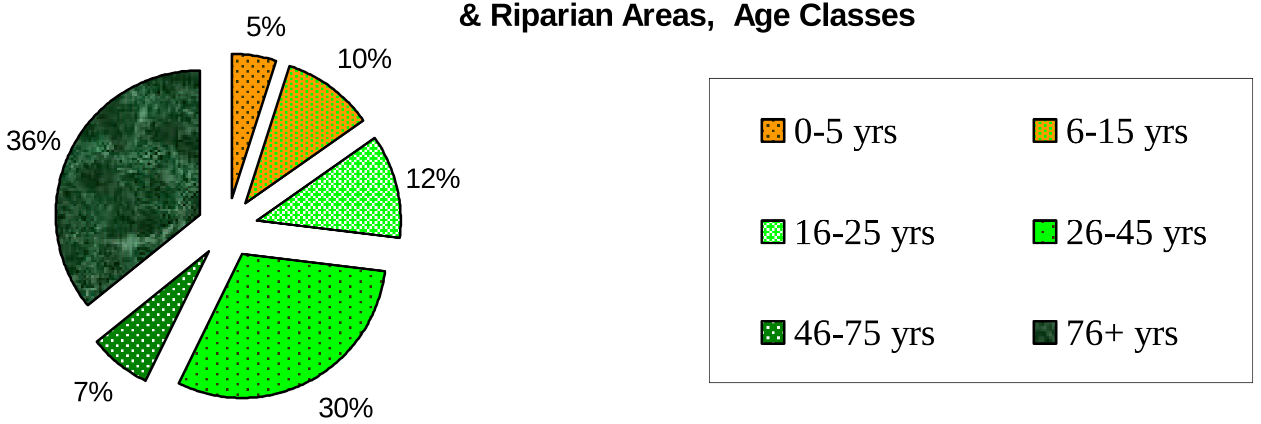
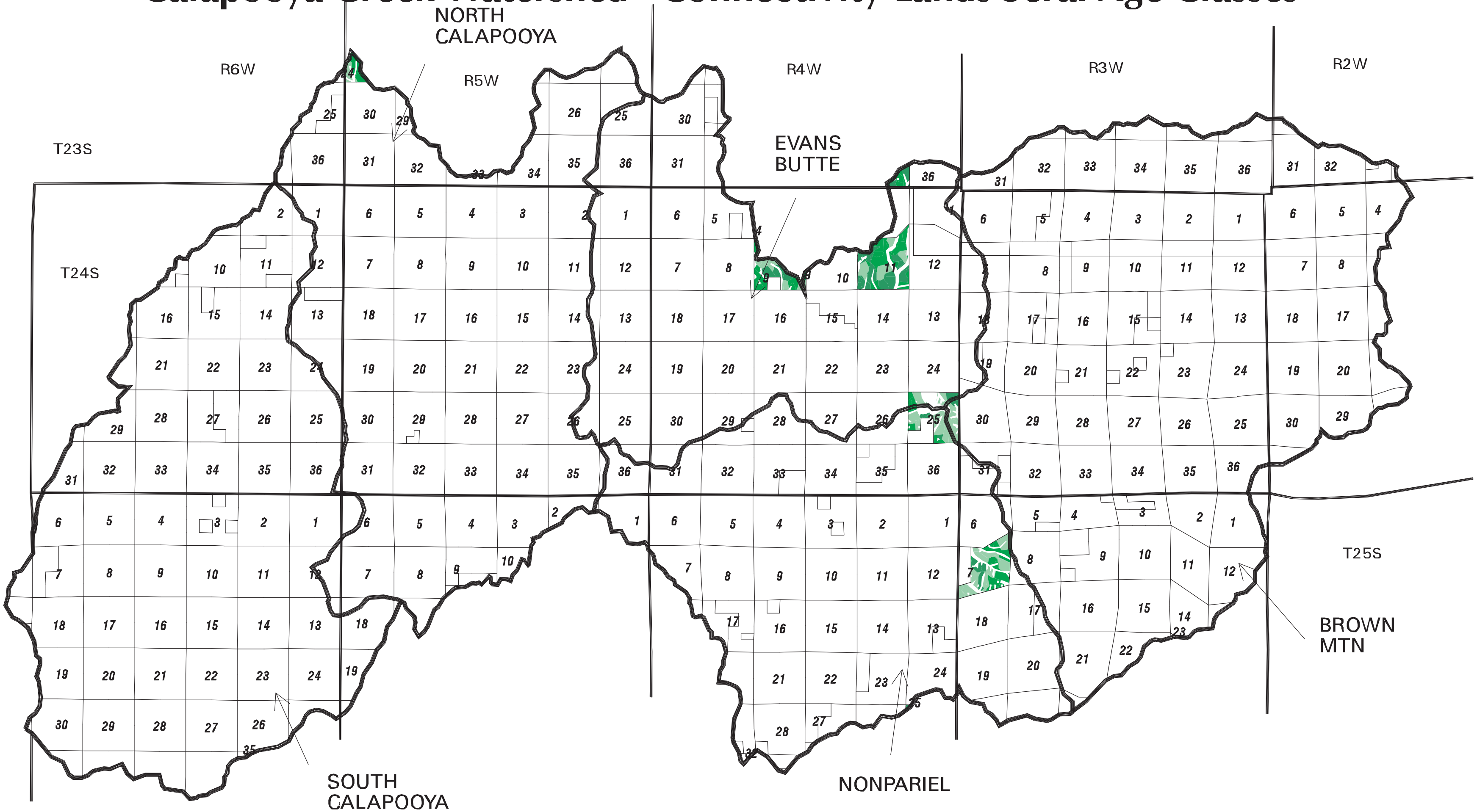


Figure 1-9

Calapooya Creek Watershed - Connectivity Lands Seral Age Classes



Scale 1:200000

0 1 2 3 4 5 6 Miles

- Early Seral Stage (0 to 30 years)
- Mid Seral Stage (31 to 80 years)
- Late Seral Stage (81 to 200 years)
- Non-Forest Areas

N

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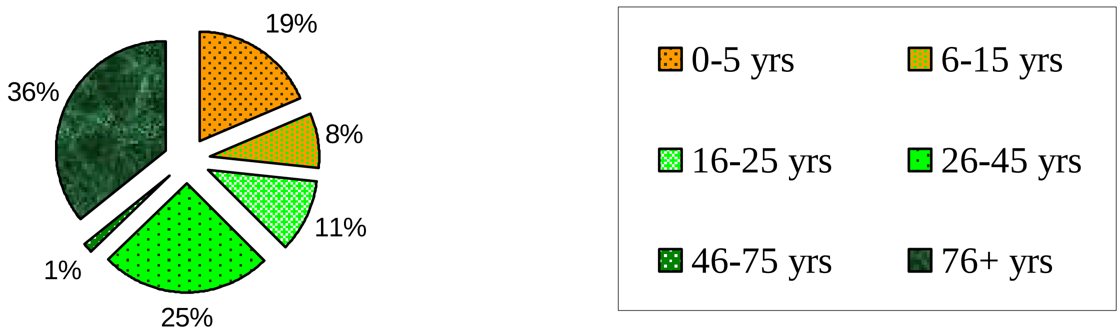
Table 1-5 CALAPOOYA **CONNECTIVITY**, AGE CLASSES

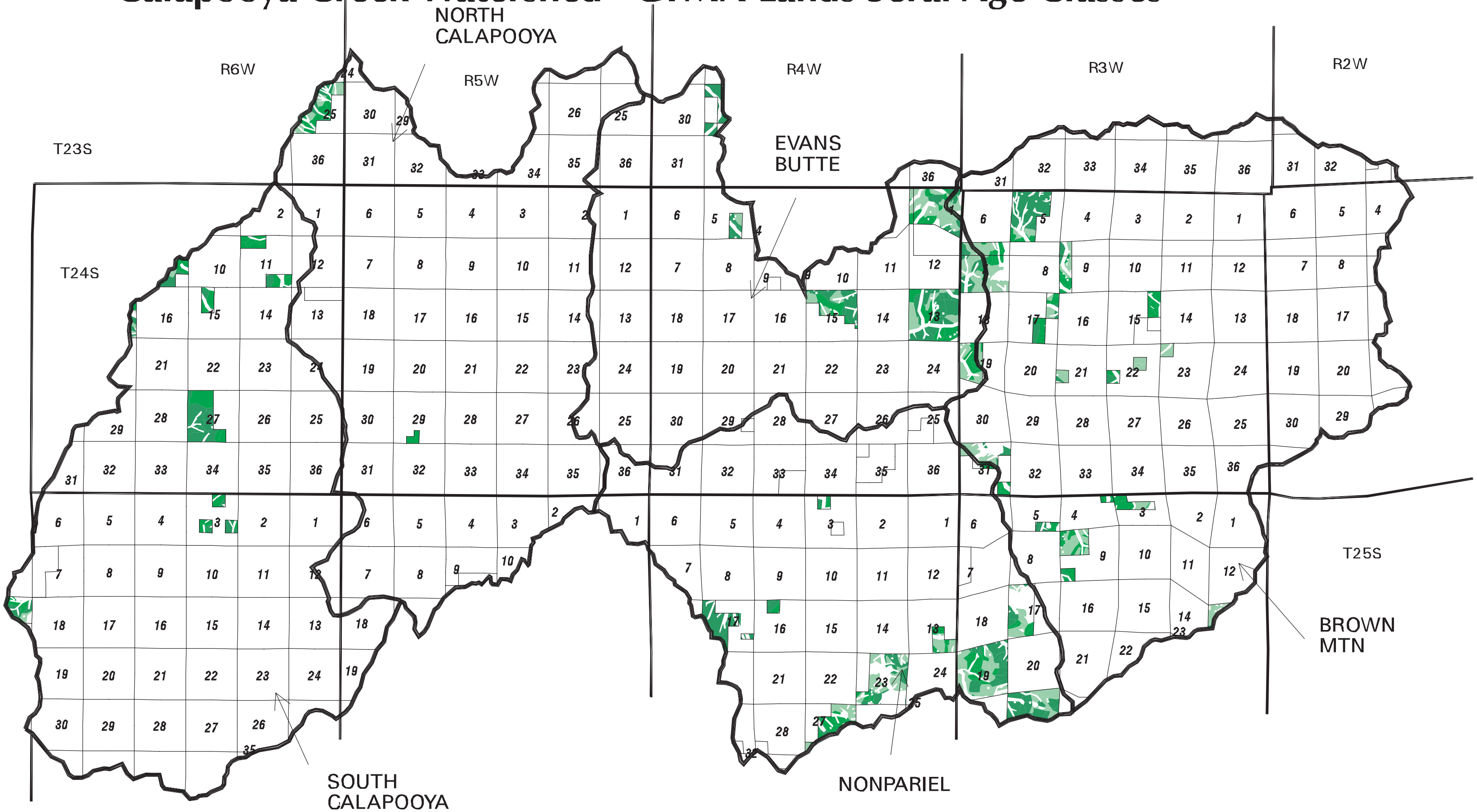
	Age Classes						TOTAL
Subwatersheds	0-5 yrs	6-15 yrs	16-25 yrs	26-45 yrs	46-75 yrs	76+ yrs	**ACRES**
Brown Mountain	19	15	0	50	0	1	85
Evans Butte	94	46	60	262	11	339	811
Non-Pareil	177	42	108	77	11	172	586
North Calapooya	0	20	1	0	0	45	66
South Calapooya	0	0	0	0	0	0	0
TOTAL	289	124	169	388	22	556	1548

Chart 1-4 Calapooya Watershed BLM Connectivity Age Classes



Calapooya Creek Watershed - GFMA Lands Seral Age Classes

Figure 1-10



Scale 1:200000

0 1 2 3 4 5 6 Miles

- Early Seral Stage
- Mid Seral Stage
- Late Seral Stage
- Barrens and Other Areas

N

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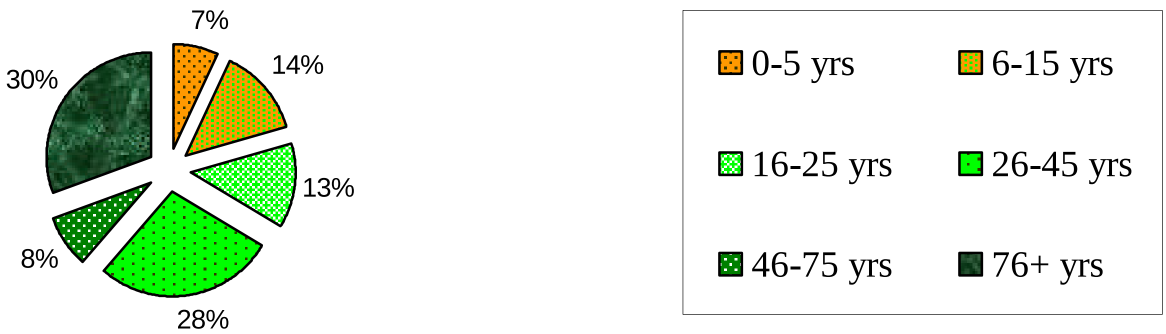
Table 1-6 CALAPOOYA **GFMA**, AGE CLASSES

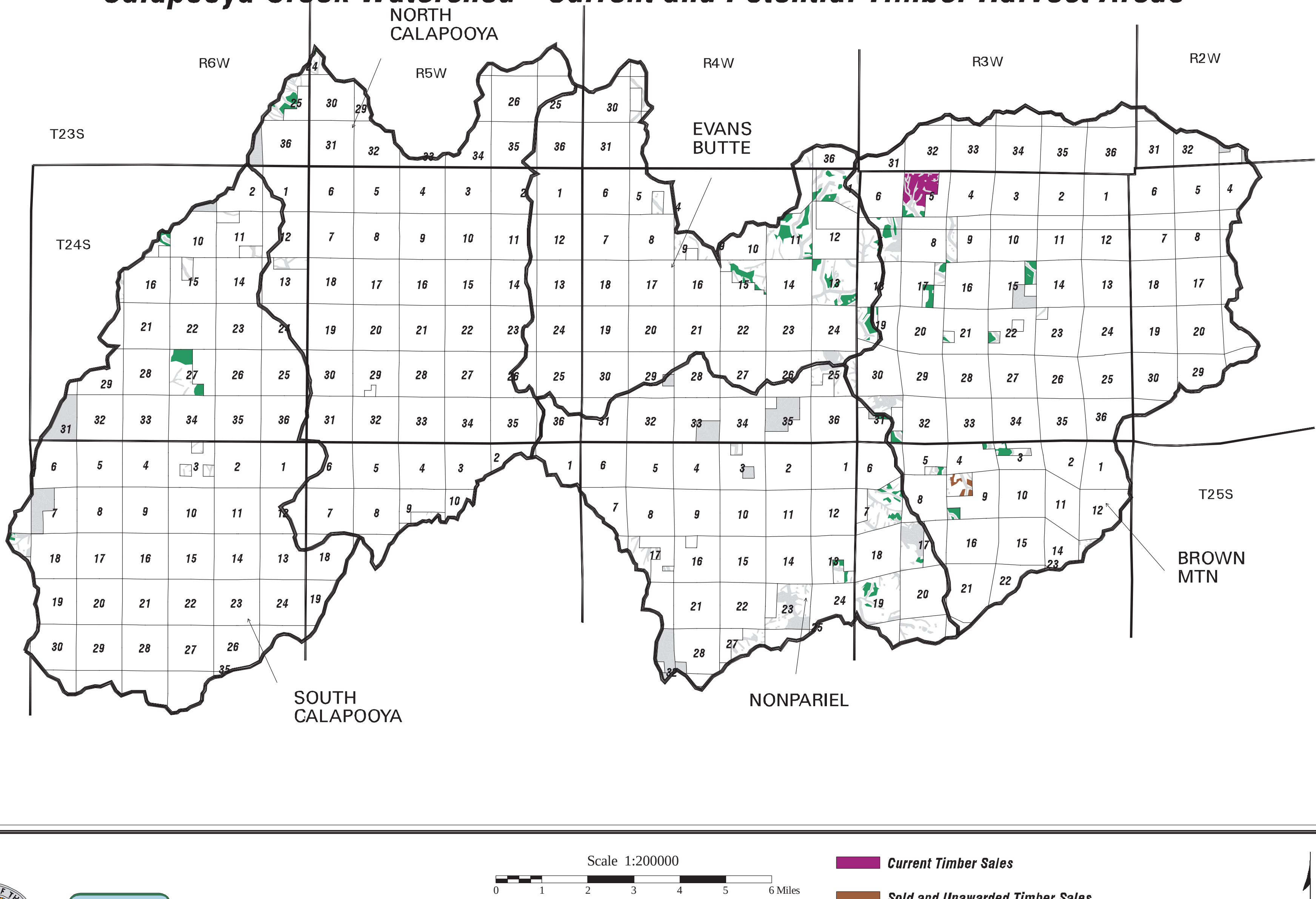
	Age Classes						TOTAL
Subwatersheds	0-5 yrs	6-15 yrs	16-25 yrs	26-45 yrs	46-75 yrs	76+ yrs	**ACRES**
Brown Mountain	78	212	152	345	87	548	1422
Evans Butte	153	196	123	422	126	298	1317
Non-Pareil	153	318	401	470	231	442	2014
North Calapooya	0	36	14	18	5	89	161
South Calapooya	9	8	39	318	17	342	733
TOTAL	393	770	728	1572	466	1718	5647

Chart 1-5 Calapooya Watershed BLM GFMA Age Classes



Calapooya Creek Watershed - Current and Potential Timber Harvest Areas

Figure 1-11



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- *Current Timber Sales*
- *Sold and Unawarded Timber Sales*
- *Potential Regeneration Harvest Areas*
- *Potential Commercial Thinning Areas*
- *Reserve Areas*

HUMAN USES

A. Key Questions

1. What are the current human uses and trends in the watershed?

2. Where are the primary locations for human uses in the watershed?

3. What are the public concerns and values pertinent to the watershed?

4. Are there treaty or tribal rights in the watershed?

5. Who are the people most closely associated with and potentially concerned about the watershed?

6. What changes in human interactions have taken place since historic contact and how has this affected the native ecosystem?

7. What human effects have fundamentally altered the ecosystem?

B. Characterization

The dominant human uses in the Calapooya Creek watershed are timber production, agriculture, transportation, and urban development. 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 economically important use of the watershed today. Beginning in the 1850s, timber harvest has grown from supplying local lumber markets to a niche in the international market.

Agricultural activity, which was the basis of Euro-American settlement in the 1850s and provided the economic backbone for many years, originally focused on subsistence farming. Over the years market or commercial production replaced subsistence farming. Various cereal and fruit crops have been important in the past, but the current emphasis appears to be on livestock, both cattle and sheep.

The western portion of the Calapooya Creek watershed has been a transportation corridor for as long as written records have been kept and probably for millennia before that. When the first Euro-Americans came through the Umpqua basin, fur trappers in circa 1819-21, they probably entered by way of Pass Creek, moved south via Yoncalla Creek, crossed over into the Calapooya Creek drainage, and eventually continued south into Sutherlin Creek. The Applegate Trail, Highway 99, and Interstate 5 have all followed roughly the same route. The watershed has also provided a corridor downstream from the highlands of the Calapooya Divide to the main Umpqua and eventually the ocean.

Urban development is largely restricted to the city of Sutherlin, which is the fastest growing community in Douglas County, with a population of about 6,360 in 1997. Although located primarily in the Sutherlin Creek drainage, Sutherlin is expanding westward into the Calapooya drainage towards Ford’s Pond and the golf course. Service-related uses, such as providing food, gas, lodging, and other essentials to tourists and commercial travelers is especially prevalent in this locale adjacent to I-5. Oakland, with a population of about 870 in 1997, is the only other incorporated community in the watershed.

C. Current Conditions

Because of the limited BLM ownership in the watershed and the limited ability of BLM to affect human uses, no effort was made to quantify the extent of the major human uses in the watershed. Previous major efforts at documenting human uses in the vicinity, such as the Milltown Hill EIS and the Northern Douglas County Cooperative Water Resources Study, revert to looking at Douglas County as a whole. This is probably a result of the lack of data for the specific area and/or the amount of time that would be required to extract the data. A more recent study focusing on declining water quality and salmonid populations in the Calapooya watershed (Dilday et al. 1999) suffers from the same lack of specific data.

Some insights, however, into users attitudes and perceptions can be gleaned from the dissertation recently completed by Geoffrey Habron (1999). Although limited to agricultural landowners and generalized for Calapooya Creek, Myrtle Creek and Deer Creek, interviews and surveys conducted by Habron point out four social themes that will influence the effectiveness of potential watershed restoration programs: 1) individual independence; 2) the importance of private property rights; 3) an aversion to government interference; and 4) a belief in environmental resilience.

Integrating social and ecological suitability in an attempt to focus watershed conservation, Habron (**Figure 2-1** [Figure 32 in dissertation], and 1999:184-191) concludes, when only considering Calapooya watershed, that the Upper subwatershed should be the first priority for restoration efforts. This is based on its high social and ecological suitability ratings. The uppermost subwatershed, the Headwaters, rates second in priority due to its high ecological suitability, but low social suitability. The mid-drainage Bachelor subwatershed is rated as a middle priority due to its moderate ecological suitability and low social suitability. The two lowermost subwatersheds, the Lower and Middle, although high in social suitability, are somewhat lacking in ecological suitability, and hence, are considered by Habron to be the lowest priority for restoration efforts. Habron does not advocate avoiding any subwatershed, but rather putting the bulk of the efforts in those subwatersheds where the highest return could be expected.

D. Past Conditions for Reference

Human uses in the Calapooya Creek watershed probably span at least the last 8,000 years and reflect the activities common to much of the West, including broad-spectrum hunting and gathering, fur trapping, subsistence and commercial agriculture, transportation, logging and lumbering, mining, and recreation.

Prehistoric use of the watershed prior to Euroamerican entry is little known at this time. Only three archaeological sites have been recorded to date, and none of those have been examined in any detail. The sites include lowland seasonal campsites and an upland rock shelter. The scarcity of recorded sites is related to the limited federal activity in the drainage and the consequent dearth of cultural resource inventories. The only formal non-BLM inventory in the drainage failed to locate any prehistoric resources, but pointed out that they should be abundant (Ross 1974, Levy 1975).

The Yoncalla, related to the many Kalapuyan bands of the Willamette Valley, were by most accounts the resident American Indian group in the watershed. They followed a way of life that involved seasonal use of a wide variety of plant and animal resources. Operating out of winter villages, they would move about the landscape, hunting, fishing, and collecting plants as they became available. Salmon and camas provided the bulk of the diet, but were supplemented by numerous other foodstuffs, such as nuts, berries, seeds, roots, waterfowl, and large and small game.

Although the specifics are undocumented for the watershed, it appears that the Yoncalla practiced burning as a land management tool. When David Douglas, the English botanist, passed through the area in the fall of 1826 he noted that the Indians in the upper Willamette Valley were burning the lowlands. Various reasons have been ascribed to this practice. One reason was to keep the vegetation cleared out to provide better hunting visibility along the valley bottoms. A related reason was to provide better foraging habitat for large game. Further to the south, in the Cow Creek vicinity, it has been noted that burning was conducted to ready the tarweed plant suitable for harvesting. Comments by early settlers in the area suggest that the creek bottoms were largely grasslands and required little clearing for agricultural purposes, perhaps suggestive of an active indigenous burning regime.

Euro-American entrance into the area occurred between 1819 and 1821 when trappers employed by the Northwest Fur Company passed through the area on an expedition to explore the Umpqua Basin. The Hudson's Bay Company entered the area in the mid-1820s and set up a base at the "Old Establishment" near the confluence of Calapooya Creek and the Umpqua River. Within ten years the Company had moved to their outpost near Elkton.

Euro-American settlement began in earnest in the late 1840s after the Applegate brothers and their party had pioneered the Applegate Trail as a southern alternative entry into the Willamette Valley. Perhaps the first home in the watershed was the cabin built by the Cornwall family during the winter of 1846. Built on Cabin Creek, the structure was intended to provide shelter only temporarily as the family wintered over on their way to the Willamette Valley. By 1850 the Sutherlin and Oakland areas were being homesteaded and used for subsistence farming. The 1860 census for the larger Umpqua watershed indicates that 55% of the population considered themselves agriculturalists, with another 22% listed as laborers, presumed to be agriculture-related. Specialized trades and professionals accounted for another 15%.

Subsistence agriculture remained the core of economic activity in the watershed for quite some time. The 1880 and 1890 censuses both indicate that agriculture and associated labor accounted for nearly two-thirds of the late-century work force. Craftsmen and professionals comprised 12-13% of the work force. In 1880 logging and lumbering occupied 5% of the population, while the figure had dropped to 3% by 1890.

The coming of the O&C railroad in 1872 opened the watershed to a number of new economic activities. It also resulted in the moving of Oakland from its original location to the site of "new" Oakland, adjacent to the O&C tracks. The actual construction of the railroad provided a new, but temporary, source of employment. But more importantly, it provided an impetus to the lumbering industry in the form of a demand for railroad ties and bridge and trestle construction materials. The railroad would eventually provide the means for distributing the watershed's resources to the larger regional and ultimately international markets.

Mercury mining developed in the Calapooya watershed in the late 1870s, with the Bonanza and Nonpareil mines being the most prominent. The Nonpareil Mine initially led in production, but was out of business by 1932. The Bonanza Mine, however, remained in production until the 1960s, nearly leading the country in flasks produced in 1940.

Although lumbering began in the watershed in the mid-1850s, with the establishment of sawmills by Felix Starr and John F. Sutherlin, it would be nearly a century before the industry attained its preeminent status in the economic activity of the area. The development boom in Southern California and subsequent demand for lumber around the turn of the century provided the first glimpse of what was to come. Small gyppo mills and generally low production figures dominated the industry in the watershed until the late 1940s when larger operators such as Weyerhaeuser and Georgia-Pacific began to make their presence felt. The post-war boom and associated housing demands fueled the large-scale development of the industry. With rail and highway networks in place, north County lumber entrepreneurs were able ship their products nationwide to meet the demands and usher in another phase of economic development.

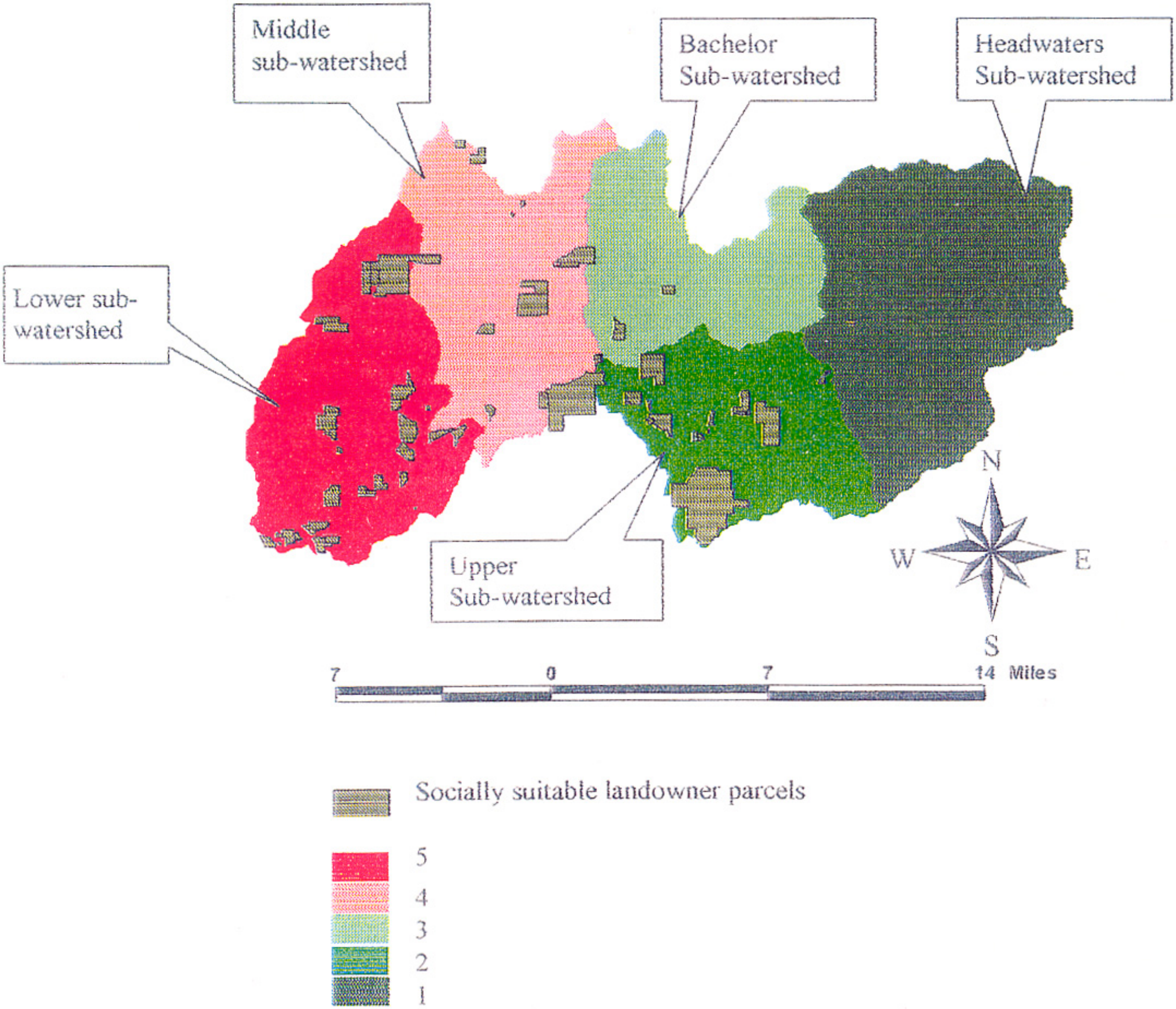


Figure 32. Location of socially suitable landowner parcels within ecological suitable Calapooya Creek sub-watersheds. 1=most ecologically suitable, 5=least ecologically suitable.

VEGETATION

A. Vegetation and Fire History Key Questions

1. What are the past and current representative vegetative seral stages in the watershed?
2. How has fire historically influenced this ecosystem?
3. What are the silvicultural opportunities and recommended treatments within the next 5-10 years?

B. Historical and Current Vegetation Maps

In order to compare past and present vegetative conditions found in the Calapooya watershed, a 1936 vegetative type map was used to compare with 1992 satellite imagery that was reclassified into vegetative age classes and diameters across all lands in Calapooya watershed (**Figures 3-1 and 3-2, Tables 3-1 through 3-6**). These maps give descriptions of forest types in Douglas County in terms of diameter class and species and show general changes in vegetative patterns. Although the scale of these maps is large and detail lacking, the information can be used with caution to compare changing vegetative conditions. The diameter classes from these type maps were correlated to seral age classes. Thus for the 1936 data, the diameter class of 0 to 6 inches was correlated to forest stands that are between 0 and 30 years of age (Early Seral), 6 to 20 inches with 30 to 80 years (Mid Seral) and greater than 20 inches were correlated to forest stands of greater than 80 years (Late Seral). For the 1992 data, the diameter class of 0 to 10 inches was correlated to forest stands that are between 0 and 30 years of age (Early Seral), 11 to 19 inches with 30 to 80 years (Mid Seral) and greater than 19 inches were correlated to forest stands of greater than 80 years (Late Seral). Conditions described from the 1936 map were used to approximate historical conditions found in the watershed. The 'natural range of conditions' for vegetation can only be approximated since no vegetative type maps exist for this watershed prior to 1936.

1. 1936 Vegetation Map

This information and data came from a map of **Forest Resources of the Douglas Fire Region**. This map was digitized, attributed and included in the districts GIS system. Information came from a survey of the Douglas Fir Region conducted by H.J. Andrews and R.W. Cowlin. Little direct information is available but it was started in the late 1920's and completed in the mid 1930's. The map was produced in 1936 and results published in 1940 (USDA Miscellaneous Publication 389).

Since the Oregon and California Re-vested Grant Lands were outside National Forest Lands, these lands were surveyed in a different way. The next paragraph is found on Page 147 of the referenced publication - ***Field Procedures***.

"*Each mapper visited the county seat and created a base map of roads and trails. The mapper then familiarized himself with the county road system and began mapping. They would map as much as possible from roads and trails. Picking points that would give the best view of the country and using as a control the roads, streams and other features on the base map and the type areas already entered on the vellum map from office records, he oriented himself with a compass and mapped all that could be seen. Each type area was viewed from several vantage points to determine its exterior boundaries. In this region of dense cover and irregular, often rugged topography, once under forest cover it is difficult to see out and great care was necessary to avoid overlooking any small farms, pasture lands, burns or small second growth areas.*"

2. 1992 Vegetation Map

This map, for total, BLM and non-BLM lands, is based on a reclassified 1992 Landsat Thematic Imagery.

Landsat Imagery data has a pixel size of 30 by 30 meters. Features on the ground less than 30 meters in size would probably not be identified on the imagery. During the rectification process, the pixel size was re-sampled from 30 meters to 25 meters.

Vegetation maps derived from satellite data strive to attain an overall accuracy of 80%. Some land cover types having unique energy reflectance properties are easier to identify using image classification techniques, and therefore are classified more accurately. Other land cover types that reflect similar amounts of energy can bring about mis-classification. Examples of this include: Water and shadow, agriculture fields and recent clearcuts, dense brush and small hardwood stands.

To perform supervised classification there is a need for training data. This imagery utilized two (2) sources of data for training: the 1985 BLM 5-point inventory data and aerial photo interpreted polygons. The 5-point inventory data has a number of disadvantages:

- it falls onto BLM Land
- it was created in 1985
- it is biased toward conifer stands

Using aerial photos can be inconsistent when numerous individuals are performing the interpretations. Aerial photo coverage is for BLM land only.
(Source: Nighbert, Jeff; Julie O'Neil and Allen Byrd 1997 **Western Oregon Digital Image Project: WODIP Guide Book,** Bureau of Land Management; Portland, OR.)

B. Fire History

Fire history is evident in nearly every naturally occurring forest stand in western Oregon. Forest structure and species composition is dependant on the frequency and intensity of past fires.

An average fire return interval (FRI) for all Oregon Douglas-fir type forests over the past few centuries has been estimated at 150 years (Agee, 1993). Agee states "..fire frequency estimates were made using a variety of methods and periods and probably do not reflect the actual fire record of any single decade or century of the current millennium". Working at the H.J.Andrews forest in 1987 Dr.Teensma calculated a mean fire return interval for stand replacement fires of 130-150 years. Lightning caused fires occur every year in the Cascades and Coast Range. If not for fire suppression, lightning caused fires would kill trees and create openings in stands every summer.

A fire regime is a generalized description of the role fire plays in an ecosystem. A fire regime is defined in terms of frequency and intensity (Agee, 1981a). For this analysis, the watershed can be described as a combination of two of Agee's six fire regimes:

Fire regime 5: Long return interval crown fires and severe surface fires in combinations (100-300 year return intervals).

Fire regime 6: Very long return interval crown fires and severe surface fires in combination (over 300 year return intervals).

Specific fire history data for this watershed has not been collected. By interpreting historical records and maps and with a professional knowledge of fire behavior and fire effects, general assumptions will be made and used as the basis of this analysis.

C. 1914 Oregon State Forest Type Map

In 1914, Oregon State forester, F. A. Elliott, commissioned development of a map of the state. The extent of prehistoric and historic forest fires is shown, as are commercial timber stands, burned areas successfully reforested and burned areas not reforested. This map has been digitized on computer and **figure 3-3** shows how the Calapooya watershed was classified in 1914. Hypothetical descriptions of the vegetation are provided for these areas based on knowledge of fire behavior, fire effects, forestry, and history.

The 1914 map makes no distinction between mature timber (old growth) and younger stands of merchantable size. It is highly unlikely that the area classified as merchantable timber was a continuous block of "old growth" timber. Man caused and lightning caused fire (the result is the same) has likely been the dominant natural disturbance in this area for hundreds, perhaps thousands of years before white settlement. It is likely that most of the timber stands present in the watershed in 1914 originated from stand replacement fires and to a lesser degree, wind related disturbances.

The 1914 map labeled as "Burned Areas - Not Re-stocking" is considered to have been caused by stand replacement fires that occurred at least 10-15 years earlier. Approximately 1% (1,121 acres) of the watershed was determined to be in this classification. Many large fires occurred around the turn of the century in the Northwest. These burned areas were probably the result of severe surface and crown fires. "Early season crown fires, or crown scorch fires in poor seed years, may be associated with a lack of early regeneration after a fire." (Agee 1993). In Coast Range forests, tree recruitment or reestablishment can take 50 years or more. Because of this, the fire that caused these burns may have occurred in the 1870's. By 1936 nearly all these acres were classified as timbered.

The area classified as “Brush and Non-Timber Areas” occupied much of the private land holdings in and around the valleys and river bottom lands. These areas may have resulted from earlier stand replacement fires that consumed any existing tree canopy. More likely, repeated Indian and settler burns may have eventually consumed the majority of conifers in these foothill areas. The native Indians used fire to improve forage for game. Grasslands were burned in the late summer. It must be assumed that some of these fires burned more than grasslands, perhaps becoming stand replacement fires in the timbered areas higher up on the ridges. Repeated burnings probably contributed to the large amount of "Brush and Non-Timber Areas” shown on the 1914 map. Fires are known to have burned all summer until the fall rains extinguished them. "In all the low valleys of the Umpqua there was very little undergrowth, the annual fires set by the Indians preventing young growth of timber". (George Riddle, 1851).

Perhaps there was not a canopy to burn, the area may have always been brush component. Regardless of the previous vegetation, fires have burned here with high enough intensity, leaving no seed source for conifer re-establishment. Brush sprouted from below ground adventitious buds and completely occupied the site. More recently, with increased fire suppression, many of these areas have become reforested either naturally, or by conversion of brush to conifer stands.

D. Additional Fire History and Recent Fire Starts

The analysis area is located in the low elevation hills which drain into Calapooya Creek and the Main Umpqua River. This area’s landscape has been influenced by large fires in the past, and most recently by road-building and logging. The adjacent private “bottom lands” are mostly pastured now. Natural fire and escaped Indian/settler burns have impacted the adjacent BLM timber over time.

Records of recent fire starts in the watershed are available on a database created by the DFPA (**Figure 3-4**). These records indicate that 70 fires occurred in the watershed during the last 15 years. The largest fire was 132 acres in size and was caused by a rancher. Only 5 fires occurred on BLM managed lands over the same period of time. Lightning was the major cause of these burns and none were larger than 1 acre in size. Because of rapid initial attack by the DFPA, 80% of all fires were less than 1 acre in size.

E. Current Vegetation Age Class Distribution

The following write-up on vegetation is based on existing forest inventory records and recent surveys of natural and managed stands on BLM lands. The Organon (Hann, 1995) growth model is used to predict future stand attributes under different management scenarios.

1. Processes: Stand Development

The dominant physical process responsible for changes in forest type, with the exception of timber harvest, is fire. Fire is the major disturbance event that leads to regeneration of the Douglas-fir forest by removing the overstory shade and creating a bare mineral seed bed. If not for naturally occurring stand replacing fires this forest would consist predominantly of shade tolerant conifers. The frequency and intensity of fire is variable and dependant on land form and climate. In general, low intensity surface fires are more prevalent and create small, non-contiguous openings. Large, stand replacing fires are much more infrequent, with intervals estimated at 200 to 500 years. The result is a mosaic of single and multi cohort stands across the landscape.

Following a major fire event the openings created are rapidly reestablished with the plants that existed prior to the disturbance. Roots and seeds that survive the fire in the soil sprout and germinate soon after. Adjacent plants shed seed on these areas, and the process of regeneration begins. The progression is not so much a well-defined succession of new plants as it is a reoccurrence of the previously established plants. The length of time required for Douglas-fir to reestablish and dominate is variable and dependent on seed sources and the degree to which the site is occupied by other plants. The age of trees in natural stands is not even, but rather a range that may span 200 or more years. The term even-aged does not accurately define most natural stands. A better term may be *single cohort* and is defined as all the trees that have resulted after a single disturbance event (Oliver et. al. 1990). A *multi-cohort* stand is one where minor disturbance events have created openings in a patch like nature and younger cohorts exist interspersed with older cohorts.

Recently forest development has replaced fire as the dominant disturbance event. Logging, road building and planting have converted much of the old natural forest into young Douglas-fir plantations. To some extent clear cutting and burning mimics a major disturbance event, but there are differences. Some of the more obvious differences include the removal of large trees, the creation of young stands that are much more uniform and even-aged, and the lack of large snags, large defective trees, and coarse woody debris. In time this practice would likely result in the loss of stand structures associated with old growth forests.

Other disturbance events that add to plant diversity include landslides, storms, disease, insects, and climatic change. There is no evidence to suggest that any of these events are responsible for the creation of large openings, or major change in plant communities in the recent past. However, the potential for large scale disturbance and change in plant communities as a result of any of these events certainly exists.

2. Stand Structure Classification and Seral Stage

Structural and compositional characteristics will be used to define three distinct seral stages: Early, mid and late. Each of these seral stages contains characteristic structure that can be defined. A comparison of the percent of area in each of the seral stages between the current and reference condition is then possible.

Early Seral is the time when the available growing space is occupied and shared by many species of plants. These early plants are sometimes referred to as pioneers, and may be short or long lived. In plantations, these early plants compete with trees and are often removed as part of management. In natural stands, conifers become established and eventually expand to exclude many of the early plants so that eventually competition is primarily between trees.

Mid seral begins when trees and/or other plants have captured all of the available growing space. The area is fully occupied and new plants will normally not invade unless there is further disturbance. The dominant plants are competing with each other for the available growing space, often forming a continuous closed canopy that allows very little light to reach the soil surface. Surface vegetation and plants that can not maintain their position in the canopy die. Compositional and structural diversity is more limited than in the early and late stages. Growing space becomes available slowly as plants die from competition, and growth rates are slow.

Stand differentiation often begins in the mid seral stage of development.

In natural stands difference in the age, size, and genetic potential of trees, and the differences in microsite and the abundance and arrangement of other plants, leads towards stand differentiation.

In managed plantations trees are more uniform in size, age, spacing, and genetic potential. Other plants are often excluded as part of management. It is more likely that the trees in these stands will all grow up together and reach a condition where competition between trees results in substantially reduced growth. It probably takes much more time for stands in this condition to differentiate.

Late seral is defined as having the following characteristics:

! Deep multiple canopy layers: This characteristic may not occur in nature on southerly aspects because of the frequency of fire. Typically two or more canopy layers exist until the younger cohorts reach heights equal to the older residual conifers.

! Diverse tree size, form and condition: Trees are not evenly spaced and may exist in clumps, and tree size and form are affected by this variable distribution and density. Trees that are open grown typically have large diameter stems and full crowns. Tall, cylindrical stems with narrow crowns are found when trees grow close together. Large old conifers are present. Many of the oldest conifers are fire scarred and hollow, have broken tops, and contain heart and butt rots.

! Canopy gaps and natural openings: Late successional forests contain openings. The degree to which a stand is open, and the size and spatial arrangement of openings depends on the processes that create them. Stand age, frequency and intensity of fire, disease, insects, wind, and soil movement all have an effect.

! Large snags in various stages of decay: Competition, fire, insects and disease are primarily responsible for the creation of large snags. This is probably a highly variable characteristic. Some large snags are present in late successional forests even when fires occur frequently. There are probably fewer large snags on aspects prone to frequent, high intensity fires.

! Coarse woody debris: The processes that create snags also create coarse woody debris. The amount that exists may depend on the frequency and intensity of fire.

! Species diversity: Countless species exist in late seral forests, many of which are difficult to inventory and describe. Large conifers including Douglas-fir, grand fir, incense-cedar, western red cedar and western hemlock are present in the oldest stands. Hardwoods and shrubs are common. The late seral stage includes areas of early and mid seral development interspersed.

Based on timber cruise data from 10 timber sales in late seral stands on 1043 acres of the Calapooya watershed, natural stands averaged 76 trees per acre (greater than 10 inches DBH). The breakdown of tree species by percent was as follows: Douglas-fir, 61%; Grand fir, 4%; Incense cedar, 11%; Western red cedar, 7%; Western Hemlock, 6%; Hardwoods, 11%. The cruise data is given in greater detail in **Appendix A** at the end of this WA document.

3. Arrangement of Stand Structures

The arrangement of natural stands is dependent on process, and results in a mosaic of single and multi-cohort stands across the landscape. Private lands are interspersed with federal lands. Most of the private lands are managed for agricultural purposes or as tree farms to produce wood fiber on short rotations. Currently on BLM lands, natural stands are interspersed with younger, managed plantations. **Figure 3-2** and **Table 3-4** shows the 1992 vegetation types based on satellite imagery.

Table 3-7 shows the existing age class distribution on federal land within the watershed and acres within the age class that have been pre-commercially thinned and/or fertilized. Data is from the forest operations inventory.

Table 3-7 Calapooya Creek Watershed Age Classes and LUA (M*S Records)

Ten Year Age Class	Acres	PCT Acres	Fert Acres	Matrix Acres	Reserves Acres
0-5 years	1,875			1,755	120
10	1,450	730	527	1,290	160
20	1,045	526	274	940	105
30	2,260	1,179	455	2,090	170
40	1,295	445	97	1,180	115
50	165			145	20
60	145			145	
70	80			80	
80+	6,735			5,060	1,675
Totals	15,050	2,880	1,353	12,685	2,365

Typically an area is planted with between 450 and 650 seedlings per acre after regeneration harvest. Plantations are maintained to assure survival of at least 150 well spaced conifers per acres. Pre-commercial thinning is usually required at about age 15 years.

A sample of 10 plantations between 5 and 9 years of age and one replication from a 15 year progeny site were used to calibrate the SYSTUM-1 young stand growth model (Ritchie, 1993). The sample plantations and the progeny site were well maintained to assure seeding survival, but hardwoods and shrubs are still present. This data was used with SYSTUM 1 to generate average stand conditions at age 15 years. **Table 3-8** represents an average condition of all stands sampled as output from SYSTUM-1.

Table 3-8 Average Stand Conditions at 15 years with and without PCT

Species	TPA without PCT	TPA with PCT
DF	598	220
Other Conifer	75	27
Hardwood	7	3
TOTAL	680	250

The stand conditions at age 15 are input to the Organon model. The model is used to project stand conditions at age 30, 40, 50 and 60 years with and without pre-commercial thinning.

Table 3-9 Existing Stand Conditions without PCT

Age	TPA[1]	BA[2]	VOL[3]	QMD[4]	RD[5]	HT[6]	CC [7]	CR [8]
30	580	175	8.5	7.4	64	68	100	52
40	456	213	21.0	9.3	70	92	100	44
50	376	243	36.0	10.9	74	113	100	40
60	318	268	51.5	12.4	76	132	100	36

[1] Trees per acre.
[2] Basal area per acre in square feet; the total of the cross sectional area in trees including bark and measured at 4.5' above the ground. Used to explain the area occupied by trees.
[3] Volume per acre in thousand board feet.

[4] Quadratic mean diameter; the diameter of the tree with mean basal area.
[5] Relative density (Curtis); ba/ac divided by the square root of the QMD. Used to define the upper (55) and lower (35) thinning limits. Above 55 and competitive stress causes tree mortality, reduced live crowns, weak stems and roots. Below 35 and the area is not fully occupied with tree species.
[6] Height; total height of the dominant trees in feet.
[7] Crown Closure: the percent of overstory canopy that is closed. Can exceed 100% when limbs are intertwined.
[8] Crown ratio; the ration of live crown to total tree height as a percent.

Table 3-10 Existing Stand Conditions with PCT.

Age	TPA	BA	VOL	QMD	RD	HT	CC	CR
30	248	119	6.5	9.4	39	60	110	80
40	246	203	21.1	12.3	58	84	115	61
50	209	238	36.5	14.4	63	107	100	51
60	185	264	54.0	16.2	65	126	100	45

What is obvious and should come as no surprise is that diameters and crowns are larger with thinning. The difference in the TPA from 30 to 60 years age is mortality due to competition between trees.

The opportunity to commercially thin both stands exists at about age 40. Either stand would probably benefit from thinning at an earlier age, but in order for the thinning to be commercial there needs to be enough volume. Commercial thinnings are usually planned to remove about 40 percent of the basal area per acre, removing the smallest trees first. This was done using the Organon model and stands were projected to age 80 (**Table 3-11**).

Table 3-11 Existing Stand Conditions at age 80.

Without Commercial Thinning				With Commercial Thinning			
TPA	BA	QMD	CR	TPA	BA	QMD	CR
193	330	17.7	30	97	268	22.5	41

The model predicts smaller diameters and live crowns without commercial thinning. Again, there is a reduction in the amount of dead wood due to competition between trees with thinning. However, after age 80, the trees that die are much larger and would be considered higher quality snags and coarse woody debris.

Table 3-12 is based on real stand exam data from managed and natural stands. It is shown here to give some perspective to the differences in stand conditions relative to past management. Of note is the fact that both managed stands would benefit from thinning at this time, but it would not be economically viable in the stand that was not pre-commercially thinned because of the small diameters.

Table 3-12

Type	Age	TPA	BA	QMD	Vol	RD	CC	CR
Un-managed	50	176	184	13.8	34.5	50	76	47
Managed, No PCT	37	713	237	7.8	18.0	85	100	33
Managed, w/ PCT	37	242	215	12.8	26.0	60	87	47

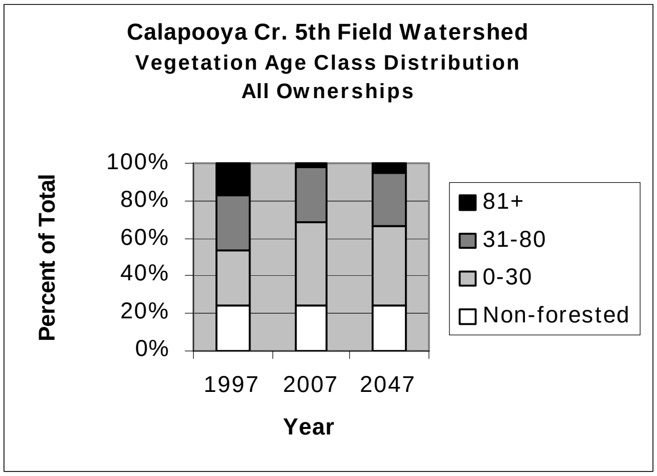
A regression analysis was done using continuous forest inventory plot data to predict diameter by age. The best r squared was obtained when only plots between the 50 and 150 year age classes with < 50%

hardwoods and > 60% BA in trees > 7.0" diameter were used. The resulting curve predicts a 10 inch diameter at age 30 years. R squared is .32 (32% of the variation is explained by the equation). This is not statistically robust, but does come very close to the modeled and the measured diameter at age 30.

The tables and discussions above describe generally the overall vegetation on federal lands across Calapooya Creek Watershed. On federal lands, Riparian Reserves and riparian areas within Late Successional Reserves account for approximately 3,824 acres (33%) of the federal ownership in the watershed (**Table 1-4**). The description of coarse woody debris levels within these areas as well as management options to move these areas toward late seral characteristics is discussed further under the **Aquatic Habitat and Fish** section.

F. Future Vegetative Trends

There are numerous natural and human related factors that influence overall watershed condition and function. In general, timber harvest and agriculture appear to have had the greatest influence in the Calapooya Creek Watershed. One simple measure of watershed condition and trend is the distribution of vegetation age classes. **Chart 3-1** displays the current and projected vegetative age class distribution for all lands within the watershed. The overall watershed trend in vegetative condition is a reflection of potential non-federal activities. It was assumed that any forest stand that is currently >30 years of age will be harvested within the next 50 years on non-federal land. **Chart 3-2** displays the current and projected vegetative age class distribution for federal lands within the watershed. In general the trend of federal vegetative condition reflects the extensive reserve network.



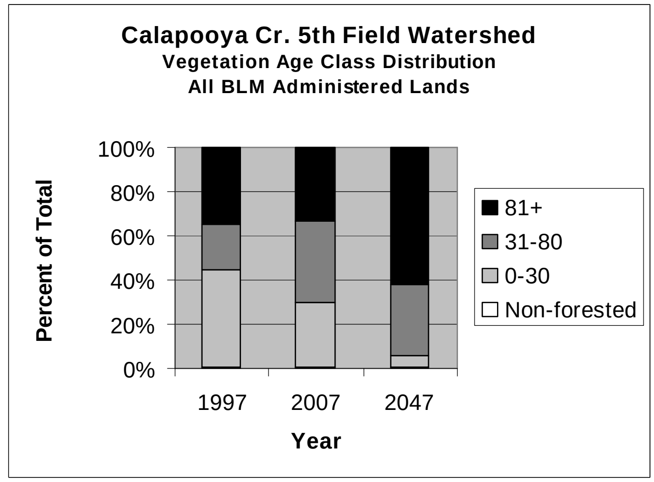


Chart 3-1 **Chart 3-2**

G. Special Status Plants

1. Special Status Plant Key Questions

a. Describe any Special Status Plant Species that have been discovered within the watershed, their habitat, abundance and distribution.
b. Describe any Special Status Plant Species likely to occur within the watershed, and the likely habitat associated with the species.
c. Describe the amount of Sensitive Plant surveys which have occurred in the watershed over the past 10 years.
d. Describe any special habitats within the watershed (meadows, rock outcrop, riparian/aquatic) and their relative abundance.

Nonvascular Survey and Manage Plants

e. Describe any Survey and Manage nonvascular plants discovered within the watershed, their habitat, abundance and distribution.
f. Describe any Survey and Manage nonvascular plants likely to occur within the watershed, and the likely habitat associated with the species.
g. Describe the amount of Sensitive Plant surveys which have occurred in the watershed over the past 10 years.

2. Special Status Plants (SSP)

No comprehensive watershed or subwatershed botanical surveys have been conducted in the Calapooya watershed. Until 1997 all surveys were associated with ground disturbing projects. Since then, Section 33 in T24S-R0W was surveyed for special status plants as part of a District wide survey effort. *Phacelia verna* is the only SSP that has been found within the Calapooya watershed although not during surveys of section 33. Typically many of the SSP that could or do occur in this watershed prefer dry or vernal areas with sparse canopy cover or thin soils and rock out crops which do not support coniferous trees (**Table 3-15**). Potential SSP habitat occurring on BLM land has been identified by aerial photograph interpretation and from the Forest Operations Inventory (**Table 3-13**).

Areas of Possible Special Status Plant Habitat Identified by Forest Operations Inventory and Aerial Photograph Interpretation. Shaded locations are common to both methods of analysis.

Table 3-13 Sections identified by Forest Operations Inventory

T24S-R04W-Sec 25	6.96	Acres	Hardwoods
T24S-R04W-Sec 25	2.85	Acres	Hardwoods
T25S-R06W-Sec 03	28.92	Acres	Hardwoods
T24S-R04W-Sec 01	6.47	Acres	Barren land due to rock outcrops
T24S-R06W-Sec 17	7.99	Acres	Barren land due to rock outcrops
T25S-R04W-Sec 23	1.16	Acres	Barren land due to rock outcrops
T24S-R04W-Sec 01	12.82	Acres	Water and marsh lands
T24S-R04W-Sec 01	3.67	Acres	Water and marsh lands
T25S-R03W-Sec 17	1.87	Acres	Water and marsh lands
T25S-R03W-Sec 29	2.03	Acres	Water and marsh lands
T24S-R04W-Sec 25	0.74	Acres	Water and marsh lands

Sections Identified by Aerial Photograph

T23S-R02W-Sec 33	T24S-R03W-Sec 31	T24S-R05W-Sec 29	T25S-R03W-Sec 29
T23S-R04W-Sec 29	T24S-R04W-Sec 5	T24S-R06W-Sec 11	T25S-R04W-Sec 3
	T24S-R04W-Sec 27	T24S-R06W-Sec 17	T25S-R04W-Sec 13
	T24S-R04W-Sec 33	T24S-R06W-Sec 35	T25S-R04W-Sec 23
			T25S-04W-Sec 29
			T25S-R04W-Sec 32

3. Special Attention Species (SAS)

There are 358 plant species listed under four different Survey and Manage strategies and Protection Buffer category in Appendix H of the Roseburg District ROD. While some of these species are well known and quite common many have not been observed in the Pacific Northwest more than a few times. Because of their assumed rarity little is known about the specific ecological parameters in which they survive therefore only the broadest of ecological screens can be used to determine potential habitat within a given area. The species listed in the ROD are thought to be associated with late seral forests. Due to the lack of specific habitat information for many of these species, Calapooya watershed has potential habitat for a majority of the species listed in Appendix H.

As part of a ongoing District LSR survey T24S-R02W-Section 33 was surveyed in 1998. **Table 3-14** lists SAS that were found during the 1998 LSR survey.

Table 3-14 Survey and Manage Species known to occur in the Calapooya Watershed.

Type	Species	Code	Status
BRYOPHYTE	*Antitrichia curtipendula*	ANCU3	SM 4
	Ptilidium californicum	PTCA50	SM 1,2 & PB
	Ulota megalospora	ULME	PB
FUNGUS	*Cantharellus formosus*	CAFO50	SM 3,4
	Cantharellus subalbidus	CASU50	SM 3,4
	Gomphus floccosus	GOFL50	SM 3
	Hydnum umbilicatum	HYUM50	SM 3
	Sparassis crispa	SPCR50	SM 3
LICHEN	*Lobaria pulmonaria*	LOPU50	SM 4
	Lobaria oregana	LOOR60	SM 4
	Lobaria scrobiculata	LOSC50	SM 4
	Nephroma parile	NEPA60	SM 4
	Peltigera collina	PECO60	SM 4
	Peltigera pacifica	PEPA48	SM 4
	Pseudocyphellaria anthraspis	PSAN61	SM 4
	Pseudocyphellaria anomala	PSAN60	SM 4
	Sticta fuliginosa	STFU60	SM 4
	Sticta limbata	STLI60	SM 4
	***Usnea longissima*	USLO60	SM 4
VASCULAR PLANT	*Allotropa virgata*	ALVI2	SM 1,2

* PB= Protection buffer, SM=Survey and Manage: 1=manage known sites, 2=survey prior to activities and manage sites 3=conduct extensive surveys and manage sites, 4=conduct general regional surveys

** *Usnea longissima* was found in *Quercus garryana* (oregon white oak) bordering a *Pseudotsuga menziesii* (Douglas fir) forest. All other species were found in Western Hemlock/Rhododendron and Western Hemlock/Vine Maple plant associations presently dominated by Douglas fir (TSHE/ACCI-RHMA3, TSHE/ACCI-GASH-SWO, TSHE/RHMA3-GASH-SWO).

Table 3-15 Special Status Species in Calapooya

(Special Status Plants (*1*) and Special Attention Species) **known** or suspected of occurring in the Calapooya watershed. Does not include data from **Table 3-14**. *

TYPE	SPECIES	CODE	STATUS	HABITAT
BRYOPHYTE	*Buxbuamia viridis*	BUVI2	PB	rotten conifer logs
	Crumia latifolia 1	CRLA10	AS	wet rocks and soil
	Douinia ovata	DOOV50	SM 4	underside of conifer and hardwood limbs also on bole
FUNGUS	*Cantharellus tubaeformis*	CATU50	SM 3,4	rotten wood in conifer forest
	Clavaridelphis truncatus	CLTR50	SM 3,4	conifer duff

TYPE	SPECIES	CODE	STATUS	HABITAT
	Gyromitra infula	GYIN50	SM 3,4	hardwood and conifer forest on rotten wood, soil, and humus
	Gryomitra escuelenta	GYES50	SM 3,4	hardwood and conifer forest
	Helvella compressa	HECO50	SM 1,3	hardwood and conifer forest
	Hydnum repandum	HYRE50	SM 3	conifer forest
	Otidea leporina	OTLE50	SM 3 & PB	conifer humus
	Otidea onotica	OTON50	SM 3 & PB	conifer humus
	Otidea smithii	OTSM50	SM 1,3 & PB	conifer hu mus
	Phaeocollybia attenuata	PHAT50	SM 3	conifer forest
	Phaeocollybia californica	PHCA50	SM 1,3	conifer forest
	Phaeocollybia kauffmanii	PHKA50	SM 1,3	conifer forest
	Phaeocollybia olivacea	PHOL50	SM 3	conifer forest
	Sarcodon fusccoindicum	SAFU50	SM 3	conifer forest
	Sarcosoma latahense	SALA50	SM 1,3	conifer duff
	Sarcosoma mexicana	SAME50	SM 3 & PB	conifer duff
	Sarcosphaera exima	SAEX50	SM 3	conifer forest
LICHEN	*Chaenotheca furfuracea*	CHFU3	SM 4	conifer bark
	Hydrothyria venosa	HYVE7	SM 1,3	riparian rocks
	Hypogymnia oceanica 1	HYOC	SM 1,3 & AS	conifer forest
	Nephroma laevigatum	NELA3	SM 4	hardwoods, riparian and understory shrubs
	Nephroma helveticum	NEHE4	SM 4	rocks and trees in moist areas
	Nephroma occultum 1	NEOC3	SM 1,3 & AS	bark and wood of conifers
	Pannaria saubinetii	PASA4	SM 4	bark, wood, rock in moist to wet forests
	Pannaria leucostictoides	PALE15	SM 4	bark, wood of conifers and hardwoods
	Peltigera neckeri	PENE11	SM 4	moist conifer forests
	Pseudocyphellaria crocata	PSCR60	SM 4	bark and wood of hardwoods
	Pseudocyphellaria rainerensis	PSRA3	SM 1,2,3	bark and wood of conifers, moist old growth forests
	Ramalina thrausta	RATH2	SM 4	bark and wood of conifers in moist forests

TYPE	SPECIES	CODE	STATUS	HABITAT
VASCULAR PLANTS	*Aster vials* 1	ASVI4	BS	open woods
	Astragulus umbraticus 1	ASUM3	TR	woods
	Carex barbarae 1	CABA	TS	meadows, riparian
	Cimifuga elata 1	CIEL	BS	woods, thickets
	Cypripidium fasciculatum 1	CYFA	SM 1,2 & BS	woods
	Cypripidium montanum 1	CYMO2	SM 1,2 & TS	woods
	Dichelostemma ida-maia 1	DIID	TR	woods, meadows
	Festuca elmeri 1	FEEL2	TS	dry wooded slopes
	Horkelia congesta ssp.congesta 1	HOCOC	BS	meadows, openwoods
	Lewisia cotyledon ssp.congesta 1	LECOH2	TR	rock outcrops
	Lupinus sulphereus var. kincaidii 1	LUSUK	BS, SLT, FP	woods, meadows
	Mimulus kelloggii 1	MIKE	TR	open slopes
	Montia howellia 1	MOHO	BS	rock outcrops
	Pella andromedaefolia 1	PEAN2	AS	rock outcrops
	Periderida erythrorhiza 1	PEER3	BS	woods, meadows
	Perideridia howellii 1	PEHO5	TR	woods, meadows
	Phacelia verna 1	**PHVE3**	**TR**	**rock outcrops**
	Plagiobothrys hirtus ssp. hirtus 1	**PLHI6**	**FPE**	**wet meadows**
	Polystichum californium 1	POCA13	AS	rock outcrops
	Romanzoffia thompsonii 1	ROTH50	BS	wet rock outcrops
	Sidalcea cusickii 1	SICU	TS	wet meadows
	Sisyrinchium hitchcockii 1	SIHI4	BS	valleys grasslands, oak savannahs

* PB= Protection buffer, SM=Survey and Manage: 1=manage known sites, 2=survey prior to activities and manage sites 3=conduct extensive surveys and manage sites, 4=conduct general regional surveys, AS=assessment species, BS=bureau sensitive, FPE=Federal endangered, TS=tracking species, SLT=state listed endangered

4. Noxious Weed Key Questions

a. Have non-native species and noxious weeds changed the landscape pattern of native vegetation?
b. What is the relative abundance and distribution of non-native plants and noxious weeds?
c. What is the habitat distribution and character of non-native plants and noxious weeds?
d. What are the current habitat conditions and trends for non-native species and noxious weeds?

5. Noxious Weeds

The BLM uses an integrated weed management approach which includes mechanical, chemical and biological methods of reducing weed populations. These operations are covered by the Northwest Area Noxious Weed Control Program Environmental Impact Statement, 1985 (Supplement, 1987) and the

Environmental Assessment, 1995-1999 (Plan Conformance, 1999). Our District noxious weed list is based on the Oregon Department of Agriculture's, Noxious Weed Policy and Classification System, 1998 (**Table 3-16**).

For widespread weeds such as thistles, Saint John's wort and Scotch broom biological controls have been approved and are used to slow and or reduce the spread of established populations. While new invading species are the focus of prevention, early detection, and aggressive eradication. In addition to biological agents some widespread weeds such as Scotch broom are treated more aggressively with mechanical and chemical means to prevent its spread and increase visibility along forest roads. **Figure 3-5** shows which roads in the Calapooya watershed have been treated for Scotch broom in 1999.

Preventing the establishment and spread of new noxious weed populations is the best method of protecting our public lands. Many weeds are mineral soil colonizers hence disturbed areas are most susceptible to invasion. Timber harvest, road building, rock stock piles, landing, quarries provide primary habitat for weeds. Vegetative material and seeds are known to become lodged between tire treads and cracks underneath vehicles often traveling hundreds of miles before dropping off to infect a new area. **Table 3-17** lists areas that are susceptible to noxious weed infestation.

Table 3-16 Weeds that are suspected (S) or known (K) within the watershed.

Complied from the 1999 Oregon Department of Agriculture's Noxious Weed Policy and Classification System.

Species name	Common name	ODA Rank	Status	Relative Abundance
Centaurea pratensis	meadow knapweed	B	K	widespread
Centaurea solstitialis *	yellow star thistle	B, T	S	adjacent watersheds
Cirsium arvense *	canada thistle	B	K	widespread
Cirsium vulgare *	bull thistle	B	K	widespread
Convolvulus arvensis	field bindweed	B	S	widespread
Crupina vulgaris	common crupina	A	S	suspected district wide
Cystisus scoparius *	scotch broom	B	K	widespread
*Hypericum perforatum**	St. John's wort	B	K	widespread
Lythrum salicaria *	purple loosestrife	B	S	adjacent watersheds
Polygonum cuspidatum	Japanese knot weed	B	S	
Pycnocephalis cardus *	italian thistle	B	K	widespread
Senecio jacobaea	tansy ragwort	B, T	K	widespread
Taeniatherum caput- medua	medusahead	B	S	widespread
Ulex europaeus *	gorse	B, T	S	adjacent watersheds

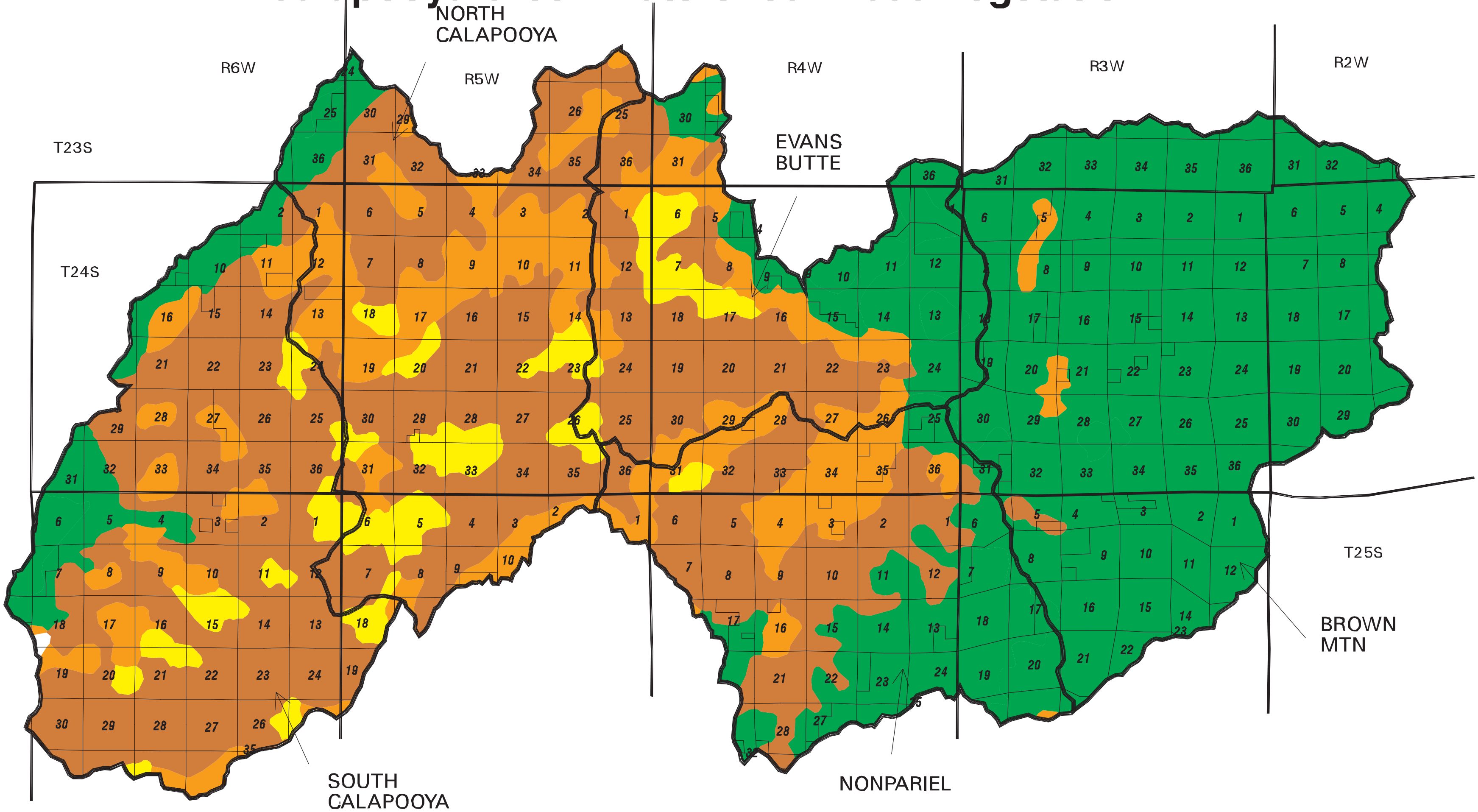
A - species populations not yet found in Oregon or are very restricted
B - species that are known to occur throughout the state or in large regions of the state
T - Target list; priority for control
* biological controls have been approved

Table 3-17 Areas susceptible to weed invasion.

T24S-R04W-Sec 11	1.83	Acres	Roads and supporting facilities (stock piles, maintenance sheds)
T24S-R04W-Sec 25	1.23	Acres	Roads and supporting facilities (stock piles, maintenance sheds)
T24S-R04W-Sec 35	1.62	Acres	Roads and supporting facilities (stock piles, maintenance sheds)
T25S-R04W-Sec 23	0.84	Acres	Roads and supporting facilities (stock piles, maintenance sheds)
T25S-R04W-Sec 23	0.87	Acres	Roads and supporting facilities (stock piles, maintenance sheds)
T25S-R04W-Sec 23	0.90	Acres	Roads and supporting facilities (stock piles, maintenance sheds)
T25S-R03W-Sec 13	5.74	Acres	Roads and supporting facilities (stock piles, maintenance sheds)
T25S-R03W-Sec 29	0.46	Acres	Roads and supporting facilities (stock piles, maintenance sheds)
T25S-R04W-Sec 29	8.16	Acres	Barren or nonreforestable land due to utility corridors
T25S-R03W-Sec 29	1.23	Acres	Roads and supporting facilities (stock piles, maintenance sheds)
T25S-R04W-Sec 17	9.11	Acres	Barren or nonreforestable land due to utility corridors
T25S-R04W-Sec 17	3.58	Acres	Barren or nonreforestable land due to utility corridors
T25S-R04W-Sec 29	1.31	Acres	Barren or nonreforestable land due to utility corridors

Figure 3-1

Calapooya Creek Watershed - 1936 Vegetation



Scale 1:200000

0 1 2 3 4 5 6 Miles

Early Seral Stage
Mid Seral Stage
Late Seral Stage
Agricultural Lands
Hardwoods

N

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data was compiled from various sources. Spatial information may not meet National Map Accuracy Standards. This information may be updated without notification.

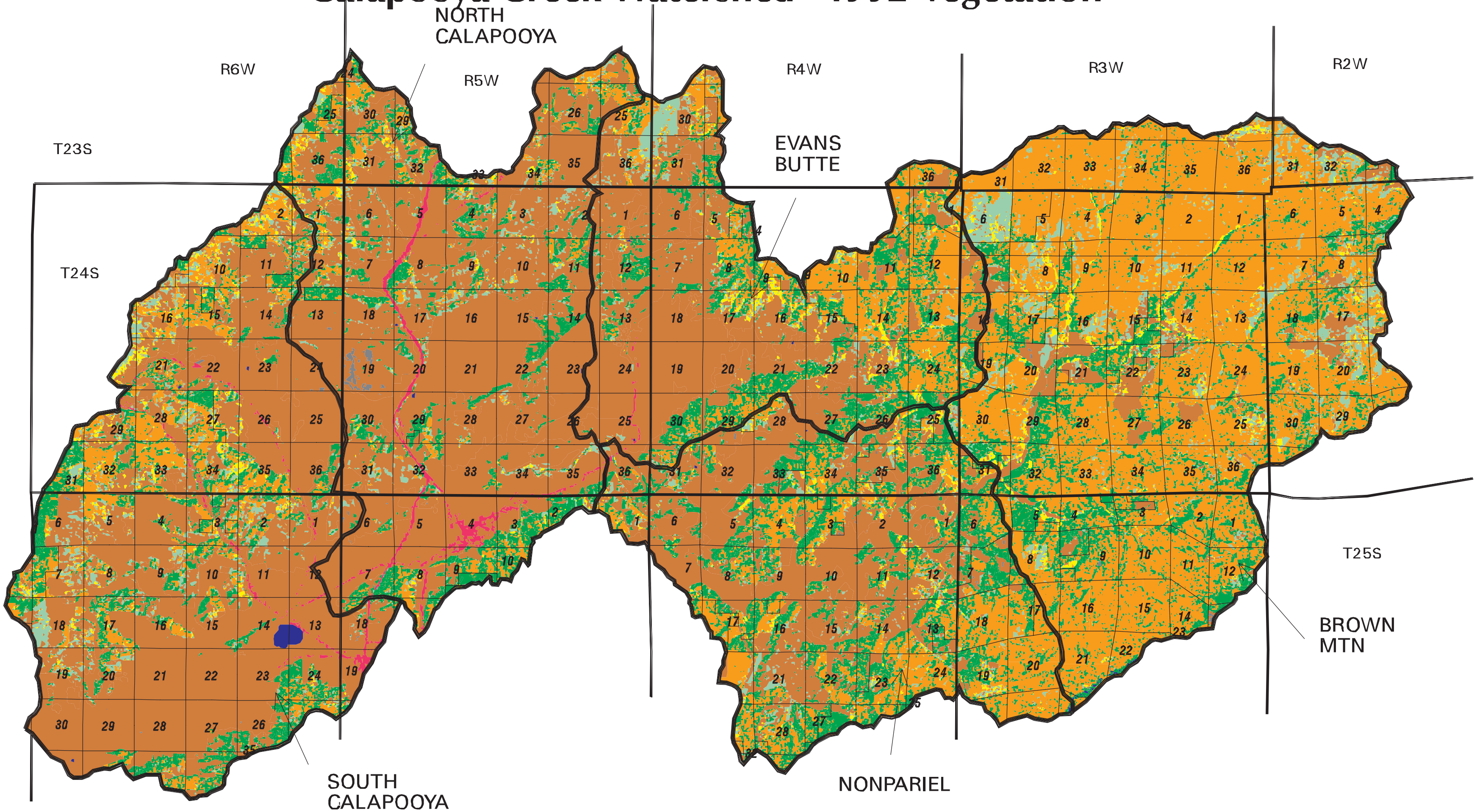
Table 3-1	CALAPOOYA CREEK WATERSHED - 1936 VEGETATION (acres)											
	BROWN MTN		EVANS BUTTE		NONPARIEL		NORTH CALAPOOYA		SOUTH CALAPOOYA		TOTAL	
	BLM	Private	BLM	Private	BLM	Private	BLM	Private	BLM	Private	BLM	Private
Vegetation Type	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres
Early Seral Stage	52	212		9418	256	10002	79	17730	437	21293	824	58656
Mid Seral Stage	109	618	40	4422	551	4372	165	8340	197	4605	1062	22357
Late Seral Stage	2218	39699	3120	4332	3206	6934	501	1018	1006	3744	10051	55727
Hardwoods		0		1879		239	18	3637		2723	18	8477
TOTAL	**2380**	**40529**	**3159**	**20051**	**4013**	**21547**	**763**	**30725**	**1641**	**32364**	**11955**	**145216**

Table 3-2	CALAPOOYA CREEK WATERSHED - 1936 VEGETATION (% by ownership & subwatershed)											
	BROWN MTN		EVANS BUTTE		NONPARIEL		NORTH CALAPOOYA		SOUTH CALAPOOYA		TOTAL	
Vegetation Type	BLM %	Private %	BLM %	Private %	BLM %	Private %	BLM %	Private %	BLM %	Private %	BLM %	Private %
Early Seral Stage	2.2%	0.5%	0.0%	47.0%	6.4%	46.4%	10.3%	57.7%	26.7%	65.8%	6.9%	40.4%
Mid Seral Stage	4.6%	1.5%	1.3%	22.1%	13.7%	20.3%	21.7%	27.1%	12.0%	14.2%	8.9%	15.4%
Late Seral Stage	93.2%	98.0%	98.7%	21.6%	79.9%	32.2%	65.6%	3.3%	61.3%	11.6%	84.1%	38.4%
Hardwoods	0.0%	0.0%	0.0%	9.4%	0.0%	1.1%	2.4%	11.8%	0.0%	8.4%	0.2%	5.8%

Table 3-3	CALAPOOYA CREEK WATERSHED - 1936 VEGETATION (data)											
	BROWN MTN		EVANS BUTTE		NONPARIEL		NORTH CALAPOOYA		SOUTH CALAPOOYA		TOTAL	
Diameter Class	BLM	Private	BLM	Private	BLM	Private	BLM	Private	BLM	Private	BLM	Private
Forest Type	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres
Non-Forest	52	212		9418	256	10002	79	17730	437	21225	824	58587
Burned										69		69
6-20" Conifer	109	618	40	4422	551	4372	165	8340	197	4605	1062	22357
20-40" Conifer	250	506	1913	1548	2715	5625	330	965	863	3125	6070	11768
Old Growth Conifer	1968	39193	1207	2784	491	1309	171	53	144	619	3981	43959
Hardwoods		0		1879		239	18	3637		2723	18	8477
TOTAL	**2380**	**40529**	**3159**	**20051**	**4013**	**21547**	**763**	**30725**	**1641**	**32364**	**11955**	**145216**

Figure 3-2

Calapooya Creek Watershed - 1992 Vegetation



Scale 1:200000

0 1 2 3 4 5 6 Miles

- *Early Seral Stage (0-10" DBH)*
- *Mid Seral Stage (11-20" DBH)*
- *Late Seral Stage (20"+ DBH)*
- *Hardwoods*
- *Agricultural Lands/Recent Harvest Areas*
- *Water*
- *Urban Areas*
- *Barrens*

N

Table 3-4

CALAPOOYA CREEK WATERSHED - 1992 VEGETATION (acres)

	BROWN MTN		EVANS BUTTE		NONPARIEL		NORTH CALAPOOYA		SOUTH CALAPOOYA		TOTAL	
	BLM	Private	BLM	Private	BLM	Private	BLM	Private	BLM	Private	BLM	Private
Vegetation Class	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres
Early Seral Stage	524	6010	809	7382	1039	6282	199	12173	344	9833	2915	41680
Mid Seral Stage	927	25799	1283	3484	1379	4829	155	2053	520	3640	4265	39806
Late Seral Stage	860	7387	973	3412	1462	5305	381	3737	720	3553	4395	23394
Hardwoods	60	1102	80	437	117	370	23	366	50	718	330	2993
Agricultural Lands		196	1	5281	2	4731	1	11613	0	14125	3	35946
Water		18		3		6		8		133	0	168
Urban Areas		0		34		5		653		321	0	1014
Barren/Other	9	24	9	9	11	12		107	0	28	30	180
TOTAL	**2380**	**40536**	**3154**	**20042**	**4010**	**21541**	**759**	**30711**	**1635**	**32351**	**11938**	**145181**

Table 3-5

CALAPOOYA CREEK WATERSHED - 1992 VEGETATION (% by ownership & subwatershed)

	BROWN MTN		EVANS BUTTE		NONPARIEL		NORTH CALAPOOYA		SOUTH CALAPOOYA		TOTAL	
Vegetation Class	BLM %	Private %	BLM %	Private %	BLM %	Private %	BLM %	Private %	BLM %	Private %	BLM %	Private %
Early Seral Stage	22.0%	14.8%	25.7%	36.8%	25.9%	29.2%	26.3%	39.6%	21.0%	30.4%	24.4%	28.7%
Mid Seral Stage	39.0%	63.6%	40.7%	17.4%	34.4%	22.4%	20.4%	6.7%	31.8%	11.3%	35.7%	27.4%
Late Seral Stage	36.1%	18.2%	30.8%	17.0%	36.5%	24.6%	50.2%	12.2%	44.1%	11.0%	36.8%	16.1%
Hardwoods	2.5%	2.7%	2.5%	2.2%	2.9%	1.7%	3.0%	1.2%	3.1%	2.2%	2.8%	2.1%
Agricultural Lands		0.5%	0.0%	26.3%	0.1%	22.0%	0.1%	37.8%	0.0%	43.7%	0.0%	24.8%
Water		0.0%		0.0%		0.0%		0.0%		0.4%	0.0%	0.1%
Urban Areas		0.0%		0.2%		0.0%		2.1%		1.0%	0.0%	0.7%
Barren/Other	0.4%	0.1%	0.3%	0.0%	0.3%	0.1%		0.3%	0.0%	0.1%	0.2%	0.1%

Table 3-6

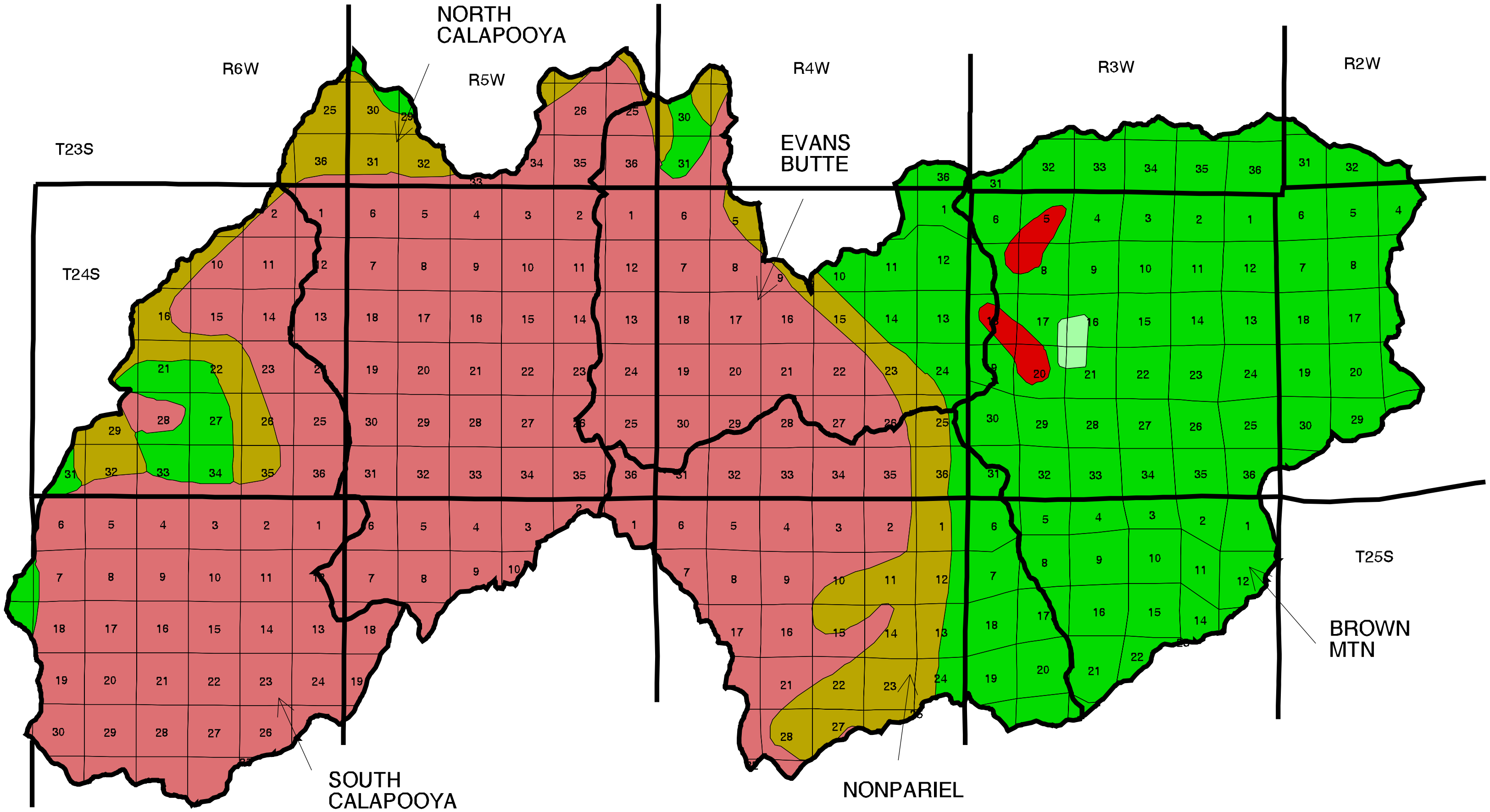
CALAPOOYA CREEK WATERSHED - 1992 VEGETATION DATA (Western OR Digital Image Project)

	BROWN MTN		EVANS BUTTE		NONPARIEL		NORTH CALAPOOYA		SOUTH CALAPOOYA		TOTAL	
VEGETATION	BLM	Private	BLM	Private	BLM	Private	BLM	Private	BLM	Private	BLM	Private
Diameter or Type Class	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres
Recent Harvest Areas	310	2264	565	5937	725	4950	109	10366	140	7284	1849	30800
Conifer - 0 to 10"	214	3746	244	1445	313	1332	91	1807	203	2549	1065	10880
Conifer - 11 to 19"	927	25799	1283	3484	1379	4829	155	2053	520	3640	4265	39806
Conifer - 20 to 29"	640	6232	689	2738	927	3948	242	2914	535	2876	3032	18708
Conifer - 30 + "	219	1155	284	674	535	1358	139	822	186	677	1363	4686
Hardwoods	60	1102	80	437	117	370	23	366	50	718	330	2993
Agricultural Lands		196	1	5281	2	4731	1	11613	0	14125	3	35946
Urban Areas		0		34		5		653		321	0	1014
Water		18		3		6		8		133	0	168
Barren/Other	9	24	9	9	11	12		107	0	28	30	180
TOTAL	**2380**	**40536**	**3154**	**20042**	**4010**	**21541**	**759**	**30711**	**1635**	**32351**	**11938**	**145181**

Figure 3-3

Calapooya Creek Watershed

1914 Fire



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Scale 1:200000

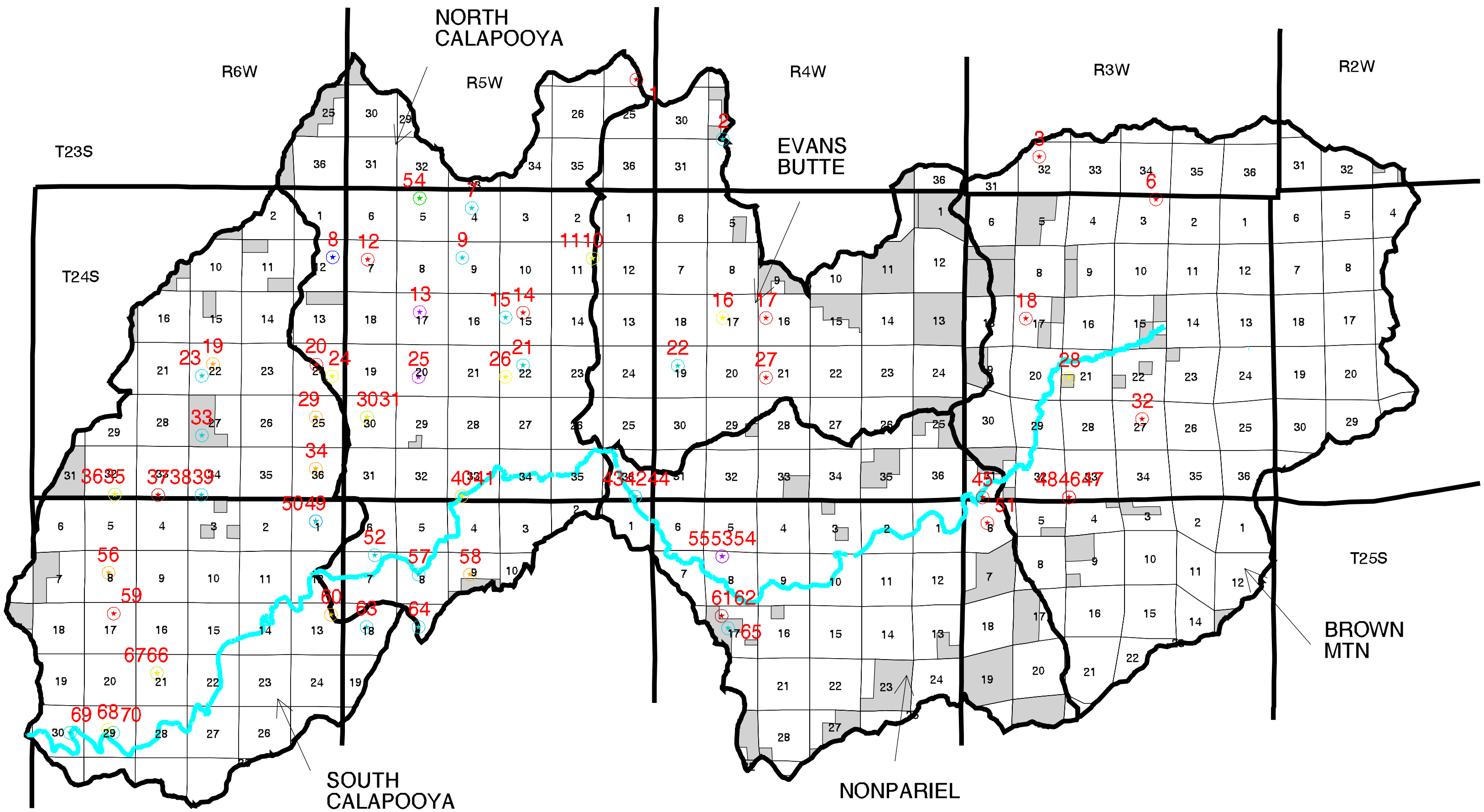
1 0 1 2 3 4 5 6 Miles

- Merchantable Timber - 56,454 acres
- Cutover Areas Re-Stocking - 351 acres
- Burned Areas Not Re-Stocking - 1,121 acres
- Brush - 15,084 acres
- Non-Timber Areas - 84,185 acres

N

Figure 3-4

Calapooya Creek Watershed
Recent Fire Occurrences



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Scale 1:200000

1 0 1 2 3 4 5 6 Miles

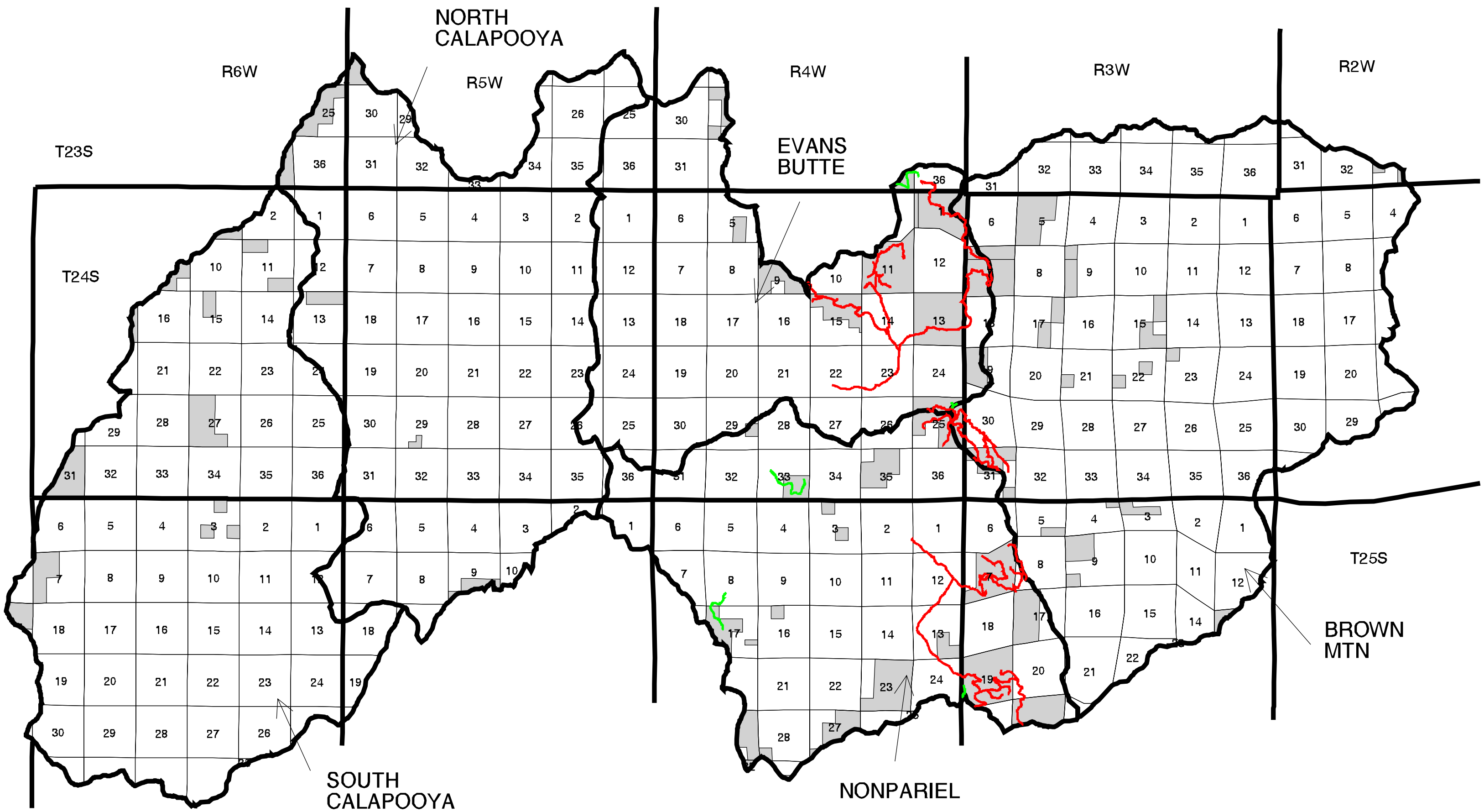
1 2 3 4 5 7 8 9

BLM

N

Figure 3-5

Calapooya Creek Watershed
Scotch Broom Control



No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data was compiled from various sources. Spatial information may not meet National Map Accuracy Standards. This information may be updated without notification.

Scale 1:200000

1 0 1 2 3 4 5 6 Miles

Scotch Broom Sprayed
Scotch Broom Pulled
BLM

N

WILDLIFE HABITAT AND SPECIES

A. Introduction

The Northwest Forest Plan (NFP) currently provides an adequate strategy for conservation and viability for species that are dependent on Late Successional Habitat (LSH) but are not on the list of species in Table C-3 of the ROD. 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. Although many sensitive species listed as threatened or endangered occur in this watershed (**Table 4-1**), 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.

B. Key Questions

<u>LS/OG Habitat</u>

1. *What is the distribution and amount of LS/OG habitat across the landscape ?*
2. *What is the condition of LS/OG habitat ?*
3. *How much interior LS/OG habitat is there ?*

<u>Special Status Species -- Northern Spotted Owl</u>

1. *How many owl sites are there ?*
1. *How many acres of suitable habitat are there ?*
2. *How many acres of dispersal habitat are there ?*
3. *What changes have occurred in habitat in the past 5-10 years ?*
5. *How many acres of critical habitat are there ?*
4. *What changes have occurred in critical habitat in the past 5-10 years ?*

<u>Special Status Species -- Marbled Murrelet</u>

1. *How many acres of suitable habitat are there ?*
2. *What changes have occurred in habitat in the past 5-10 years ?*
3. *How many acres of critical habitat are there ?*
4. *What changes have occurred in critical habitat in the past 5-10 years ?*

<u>Special Status Species -- Bald Eagle</u>

1. *What is the status within the watershed ?*

<u>Special Status Species -- Columbian White-tailed Deer</u>

1. *How many acres of suitable habitat are there ?*

<u>Special Status Species -- Survey and Manage</u>

1. *How many acres of red tree vole habitat are there ?*

<u>Connectivity - Critical Habitats and Late Successional Reserves</u>

1. *What is the condition of connectivity between LS/OG stands both within and outside of CHUs and LSRs ?*
2. *What is the condition of connectivity between CHUs and between LSRs ?*

C. LS/OG Habitat

Late-successional/old-growth (LS/OG) habitat has many different definitions, in many different documents. In these analyses LS/OG habitat was defined as: 1) (when using WODIP data) conifer stands with a size class 4 (30+

inches dbh) and 2) (when using the BLM's operational inventory (FOI)) birth date (DK) less than or equal to 1879 and not equal to 0.

WODIP data was developed from LANDSAT imagery taken in 1992. The data was classified, for each 25 meter pixels, into 247 different classifications based upon cover type, species, structure, size, and crown closure. For these analyses WODIP data was reclassified and filtered into 11 categories: water, urban, agricultural, barren/non-forested, hardwood, conifer-sapling, conifer-pole, conifer-small saw, conifer-large saw, conifer-old growth, and no data. The WODIP data is probably the more conservative of the two data sets and will be used when describing all ownerships. The analyses will use FOI data when describing BLM lands, alone, because it describes individual stands, not arbitrary 25 meter pixels, and is more reflective of management–past and future.

There are 81,024 acres of forest land (conifer sapling and larger) in the Calapooya watershed. Four thousand, nine hundred and sixty-six (4966) acres (6 percent) are considered to be LS/OG, based upon WODIP classifications (**Table 4-1, Figure 4-1**). One thousand, two hundred and fifty-eight (1258) acres (1.5 percent) of the LS/OG occur on federal lands (**Table 4-1**).

There are 10,376 acres of federal land at greater than 10 years of age [BLM FOI]. Three thousand, six hundred and thirty (3630) acres (35 percent) are consider to be LS/OG (**Table 4-1, Figure 4-2**).

Table 4-1 LS/OG habitat in the Calapooya Watershed Analysis Unit

	WODIP Data		FOI Data
	Watershed	BLM	BLM
LS/OG Area (ac)	4966	1258	3630
LS/OG Area in LSR (ac)	53	52	570
-- % of total LS/OG	1.1	4.1	15.7

Figure 4-1 illustrates the distribution of LS/OG patches across the Calapooya landscape. Eighty-two percent of the LS/OG patches are less than one acre in size (**Table 4-2**). Interior habitat is that portion of a LS/OG patch more than 150 meters from the edge. There are no patches of interior habitat identifiable using the WODIP data. **Figure 4-2** illustrates the distribution of LS/OG patches on federal lands within the Calapooya Creek Watershed.

BLM stand data (FOI) indicates 14 patches of interior habitat; totaling 98 acres. The largest patch of interior habitat on BLM is 29.6 acres, the average patch size is 7 acres.

LS/OG habitat is on the decline in the watershed, There are 788 acres of federal lands reserved for the maintenance and development of LS/OG (LSRs); 44 acres in the Cascades and the remainder in the Coast Range. Management assessments have been completed for all LSRs in this watershed (*South Coast-North Klamath Late-Successional Reserve Assessment* and *South Cascades Late Successional Assessment*). In each document they have descriptions of the existing LS/OG stand conditions that would be the best sources for existing condition data.

Table 4-2 Patch size distribution of LS/OG habitat in the Calapooya Watershed Analysis Unit (expressed as number of patches).					
	WODIP Data			FOI Data	
Patch Size (ac)	Watershed	BLM	BLM LSR	BLM	BLM LSR
<1	3915	629	55	8	1
1-4	678	107	12	23	3
5-9	111	35	1	17	0
10-19	48	14	0	14	1
20-29	15	7	0	10	1
30+	14	7	0	38	3
Total Number of Patches	4781	799	68	110	9
Maximum Patch Size (ac)	87	81	9.6	256	256
Average Patch Size (ac)	2.0	1.6	0.8	33	63

D. Special Status Species

Table 4-3 Special status species [1] that may occur in the Calapooya Watershed

Species	**Historic Occurrence in Watershed**	**Current Occurrence in Watershed**	**Habitat Requirements**	**Micro-Habitat**
Southern torrent salamander *Rhyacotriton variegatus*	YES	YES	Springs and streams	riparian/wetland, coarse woody debris (CWD)
Clouded salamander *Aneides ferreus*	YES	YES	Forested habitats	CWD/talus
Tailed frog *Ascaphus truei*	YES	YES	High gradient, perennial streams	Cobbles/boulders, riparian
Northern red-legged frog *Rana aurora aurora*	YES	YES	Low gradient streams/ponds	Aquatic vegetation
Foothill yellow-legged frog *R. boylii*	YES	YES	Low gradient streams/rivers	Gravel/cobbles, riparian
Northwestern pond turtle *Clemmys marmorata marmorata*	YES	YES	Ponds, low gradient rivers	CWD, rocks, riparian (basking sites)
Sharptailed snake *Contia tenius*	YES	YES	Forested habitats	CWD, talus, riparian
Common kingsnake *Lampropeltis getulus*	YES	YES	Grassland, mixed oak woodlands	riparian

Species	Historic Occurrence in Watershed	Current Occurrence in Watershed	Habitat Requirements	Micro-Habitat
Common kingsnake *Lampropeltis getulus*	YES	YES	Grassland, mixed oak woodlands	riparian
Bald eagle *Haliaeetus leucocephalus*	YES	YES	Late-successional conifer forests	Lg. diameter trees/snags
Northern goshawk *Accipter gentilis*	UNKNOWN PROBABLE	UNKNOWN PROBABLE	Mature and older conifer forests	
American peregrine falcon *Falco peregrinus anatum*	UNKNOWN	UNKNOWN	Cliffs	
Mountain quail *Oreotyx pictus*	YES	YES	Forested habitat	Shrub component
Marbled murrelet *Brachyramphus marmoratus*	UNKNOWN PROBABLE	UNKNOWN	Late-successional conifer forests	Lg. diameter trees/limbs, platforms
Northern pygmy owl *Glaucidium gnoma*	YES	YES	Mature and older conifer forests	Snags, cavities, edge habitat
Northern spotted owl *Strix occidentalis caurina*	YES	YES	Late-successional conifer forests	Lg. diameter trees, snags, cavities
Northern saw-whet owl *Aegulius acadicus*	YES	YES	Mature and older woodlands	Cavities, snags
Pileated woodpecker *Dryocopus pileatus*	YES	YES	Forests 40 years and older	Snags
Purple martin *Progne subis*	YES	UNKNOWN PROBABLE	Grasslands, brush lands, open woodlands	Cavities
Western bluebird *Sialia mexicana*	YES	YES	Grasslands, brush lands, open woodlands	Cavities
Hoary bat *Lasiurus cinereus*	YES	YES	Late-successional conifer forests, associated with water	Caves and mines, snags
Yuma myotis *Myotis yumenensis*	YES	YES	Late-successional conifer forests, associated with water	Caves/mines, bridges, buildings, snags
Long-eared myotis *M. evotis*	YES	YES	Late-successional conifer forests, associated with water	Caves/mines, bridges, snags
Fringed myotis *M. thysanodes*	YES	YES	Late-successional conifer forests, associated with water	Caves/mines, bridges, rock crevices
Long-legged myotis *M. volans*	YES	YES	Late-successional conifer forests, associated with water	Caves/mines, bridges, loose bark, rock crevices
Silver haired bat *Lasionycteris noctivagans*	YES	YES	Late-successional conifer forests, associated with water	Caves/mines, bridges, loose bark, rock crevices, snags
Pacific Townsend's big-eared bat *Corynorhinus townsendii townsendii*	YES	YES	Late-successional conifer forests	Caves/mines, buildings, bridges
Pacific pallid bat *Antorozous pallicus pacificus*	YES	UNKNOWN PROBABLE	Ponderosa pine, oak woodlands	Buildings, bridges, snags
Columbian white-tailed deer *Odocoileus virginianus leucurus*	YES	YES	Bottom lands, oak/hardwood forests	
White-footed vole *Phenacomys (=Arborimus) albipes*	YES	UNKNOWN PROBABLE	Riparian alder/hardwood forests	

Species	Historic Occurrence in Watershed	Current Occurrence in Watershed	Habitat Requirements	Micro-Habitat
Red tree vole *P. longicaudus*	YES	YES	Douglas-fir forests	Platforms, large dia. limbs, cavities, high canopy closure
Oregon shoulderband *Helminthoglypta hertleini*	UNKNOWN	UNKNOWN	Forest and Talus	Talus/rocks
Oregon megomphix *Megomphix hemphilli*	YES	YES	Conifer	Big leaf maples
Blue-grey tail-dropper *Prophysaon coeruleum*	YES	YES	Conifer	Hardwoods
Papilose tail-dropper *P. dubium*	YES	YES	Conifer	Hardwoods
Pristoloma arcticum crateris	UNKNOWN	UNKNOWN	Conifer	Above 2000 feet elevation

[1] This table contains a list of species that meet the Special Status Species definition in the BLM's 6830 manual, and those species of concern identified in the NFP as Survey and Manage and Protection Buffer, and Species identified in Appendix J2 of the NFP.

1. Northern Spotted Owl

There are 14 activity centers for the northern spotted owl, representing 10 pairs, within the Calapooya watershed. Six of these activity centers are protected under the NFP with Residual Habitat Areas. Yearly monitoring is being conducted on the 2 activity centers located in the western portion of the watershed, within the Tyee Density Study Area. Activity centers outside of the density study area are monitored as required under existing biological opinions.

There are 4,224 acres of forested habitat capable of providing nesting roosting, and foraging (NRF) habitat on federal lands (**Figure 4-3**). There are 1325 acres of additional forested habitat capable of providing for the dispersal of the northern spotted owl (**Figure 4-3**). Private forest lands are currently providing some NRF but primarily they are providing dispersal habitat. In the future, very little if any NRF should be anticipated on private lands.

Since 1990, 1,443 acres of suitable and dispersal habitat have be harvested on federal lands. In the long term, approximately 4152 acres of federal land will be available on which to maintain existing and develop future NRF habitat. Two thousand, four hundred and thirty-one (2,431) acres of NRF are available for harvest activities under the NFP.

Federal lands in this watershed will serve primarily as a bridge between the LSRs, within the physiographic provinces. Monitoring of dispersing juvenile spotted owls indicates that dispersing birds are primarily moving in a north-south direction on either side of the valley (Personal Communications, with J. Reid, PNW). There is not enough reserved habitat now, or in the future, to sustain population centers-as is the assumption for LSRs.

There are 4,930 acres of designated critical habitat for the northern spotted owl in the Calapooya watershed (**Figure 4-4**). The most critical habitat area is contained in Critical Habitat Unit (CHU) OR-24, 4,000 acres. OR-24 provides a "stepping stone", helping to link the Coast Range population with the Cascade population. None of OR-24, in the Calapooya watershed, is designated as LSR by the NFP. Approximately 89 percent of the CHUs are Matrix; 3,548 acres are available for harvest under the NFP. Currently, there are 1,741 acres of NRF in the CHUs. Since 1990, 487 acres of NRF have been harvested from within the CHUs. There are an additional 996 acres of NRF available for harvest.

2. Marbled Murrelet

The Calapooya watershed is located at the limit of the inland range of the marbled murrelet, approximately 50 miles (**Figure 4-5**). There are 2,166 acres of forest land with the potential to provide suitable marbled murrelet habitat (MMH). Seventy (70) acres of MMH have been harvested since 1990. There are 1,101 acres of MMH remaining in the Calapooya watershed (**Figure 4-5**). Four hundred and forty-seven (447) acres are protected in LSRs. Six hundred and twenty-six (626) acres of MMH are available for harvest.

There is no designated critical habitat for the marbled murrelet in the Calapooya watershed.

3. Bald Eagle

There is one known bald eagle nest site in the watershed. It has been occupied since 1984. Eighty-five (85) acres have been withdrawn from timber harvest for its protection.

4. Columbian White-tailed Deer

There are very few acres of federal lands suitable for white-tailed deer habitat. These deer predominantly use the pasture/grassland, oak woodlands, and shrub riparian habitat of the valley bottom; predominantly found on private lands.

Seven hundred and fifty-four (754) acres have been withdrawn from timber harvest for management of the Columbian white-tailed deer.

5. Red Tree Vole

There are 7,708 acres of suitable red tree vole habitat within the Calapooya watershed (**Figure 4-6**). The BLM administers less than 10 percent of the watershed. There is no need to survey for red tree voles prior to ground disturbing activities under existing survey and manage recommendations.

E. Connectivity - Critical Habitats and Late Successional Reserves

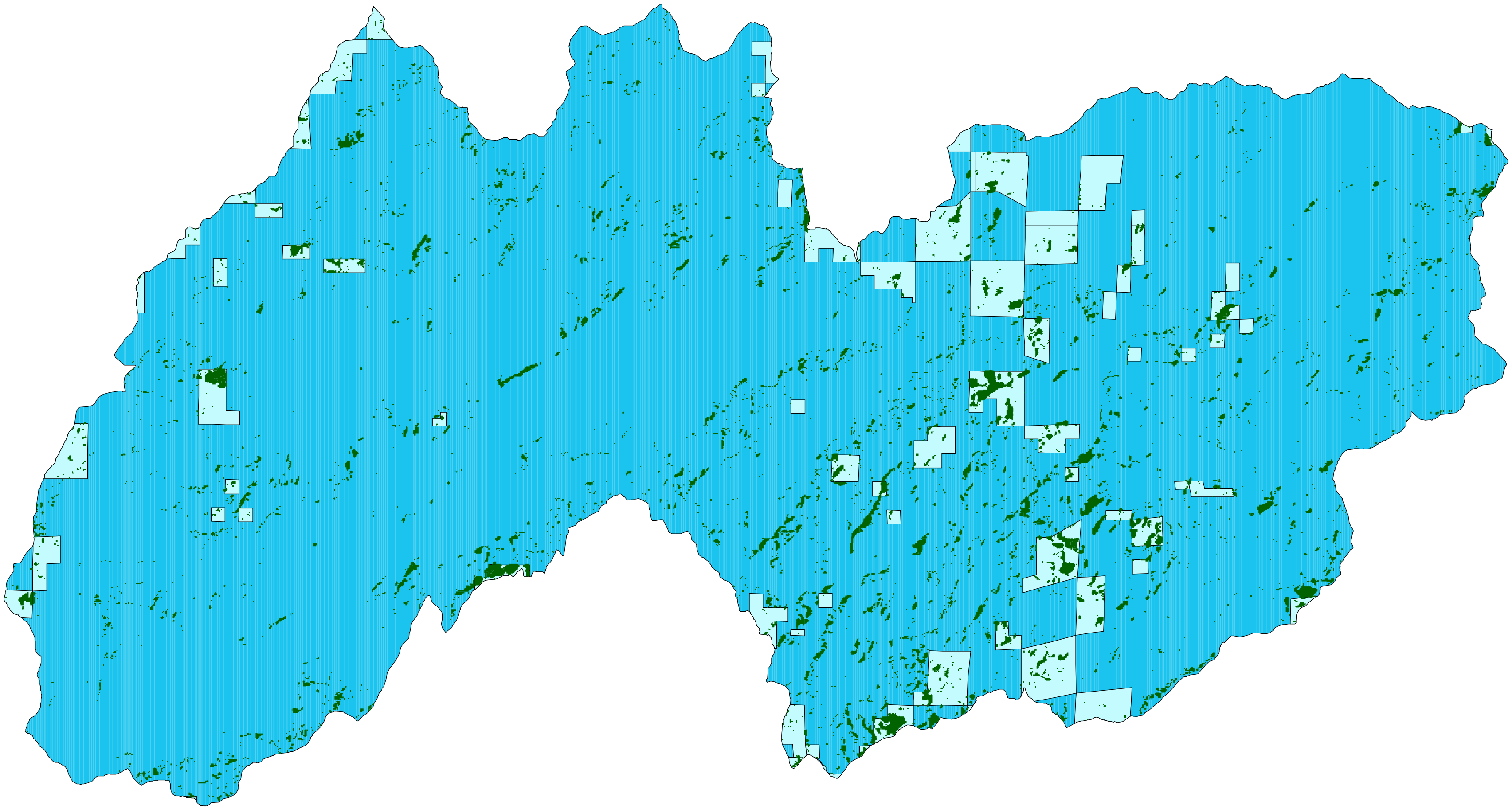
Calapooya watershed has the potential to play an important role in linking the Cascades to the Coast Range, however there are several drawbacks. First, there is a large patch of agricultural/non-forested habitat that sits squarely in the middle of the watershed. Second, Interstate 5 bisects the watershed, into east and west. Third, the BLM administers less than 10 percent of the watershed. Movement across the watershed in an east-west direction would be almost impossible, except for the strongest flyers, or the more habitat generalists.

BLM ownership is scattered in 59 parcel, very few greater than 640 acres, almost one-half less than 100 acres. Movement of any species across the landscape is highly dependent upon the conditions of the adjacent private lands. The most important role that this watershed could play in facilitating movement in a north-south direction would be to provide islands of suitable LS/OG habitat. These islands are too small to provide suitable habitat by themselves, for the larger species. But in conjunction with private land, as it becomes suitable, intermittent breeding sites may become available . These islands could serve as refuge for those species moving across an otherwise inhospitable landscape. For small species, those with small home ranges, they may serve as refugia. Into which populations recede as the adjacent habitats lose their suitability.

Connectivity between LSRs and CHUs is not very good. Again, the lack of federal lands is a key factor.

Late successional habitat in the Calapooya Creek AWS.

Figure 4-1



No warranty is made by the BLM as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Spatial information may not meet National Map Accuracy Standards. This information may be updated without notification.

Determined from 1992 Landsat imagery (WODIP 1997).
Conifer stands with size class 4 (30+ inches DBH).

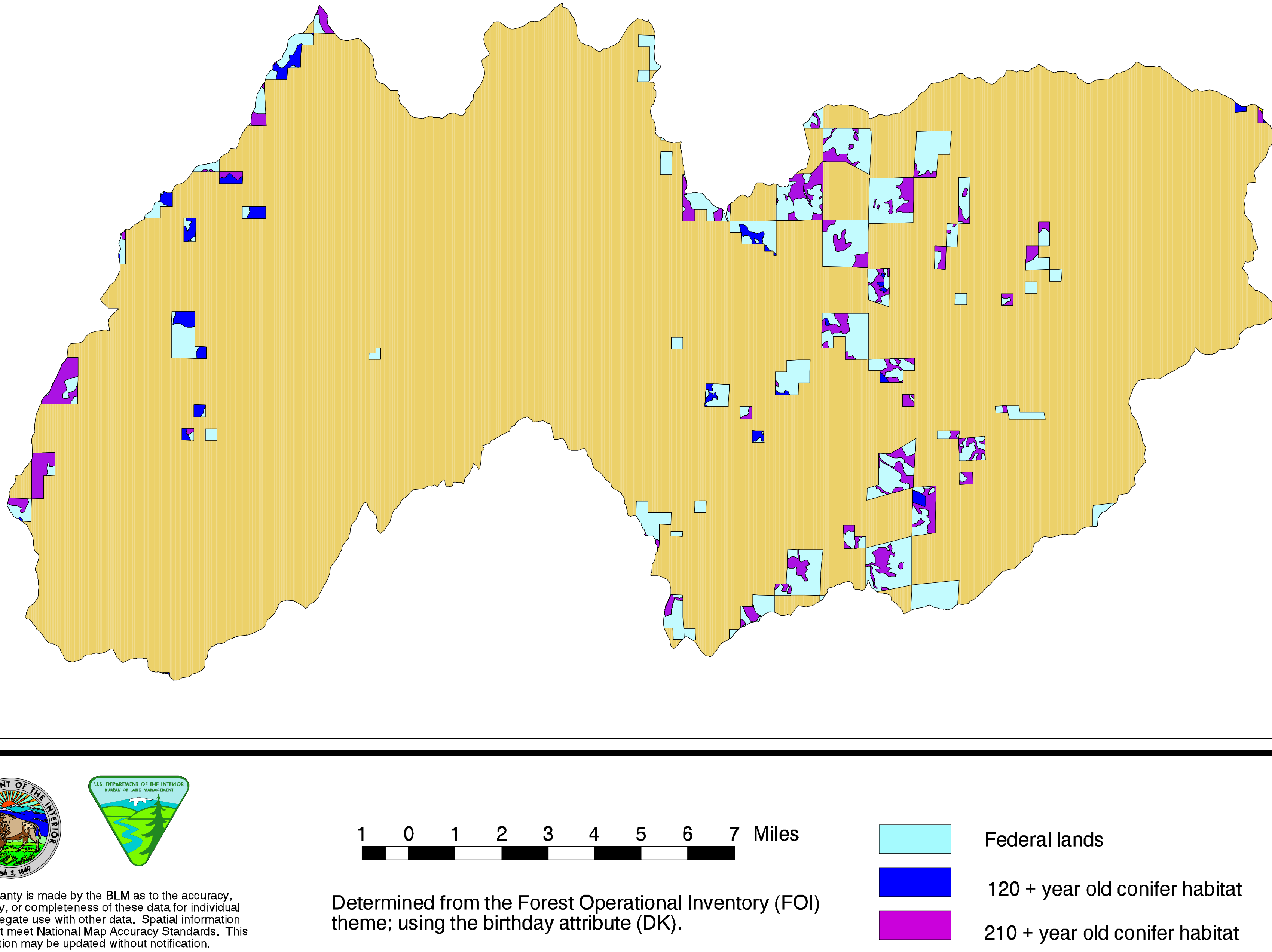
Federal lands

Old growth habitat

N

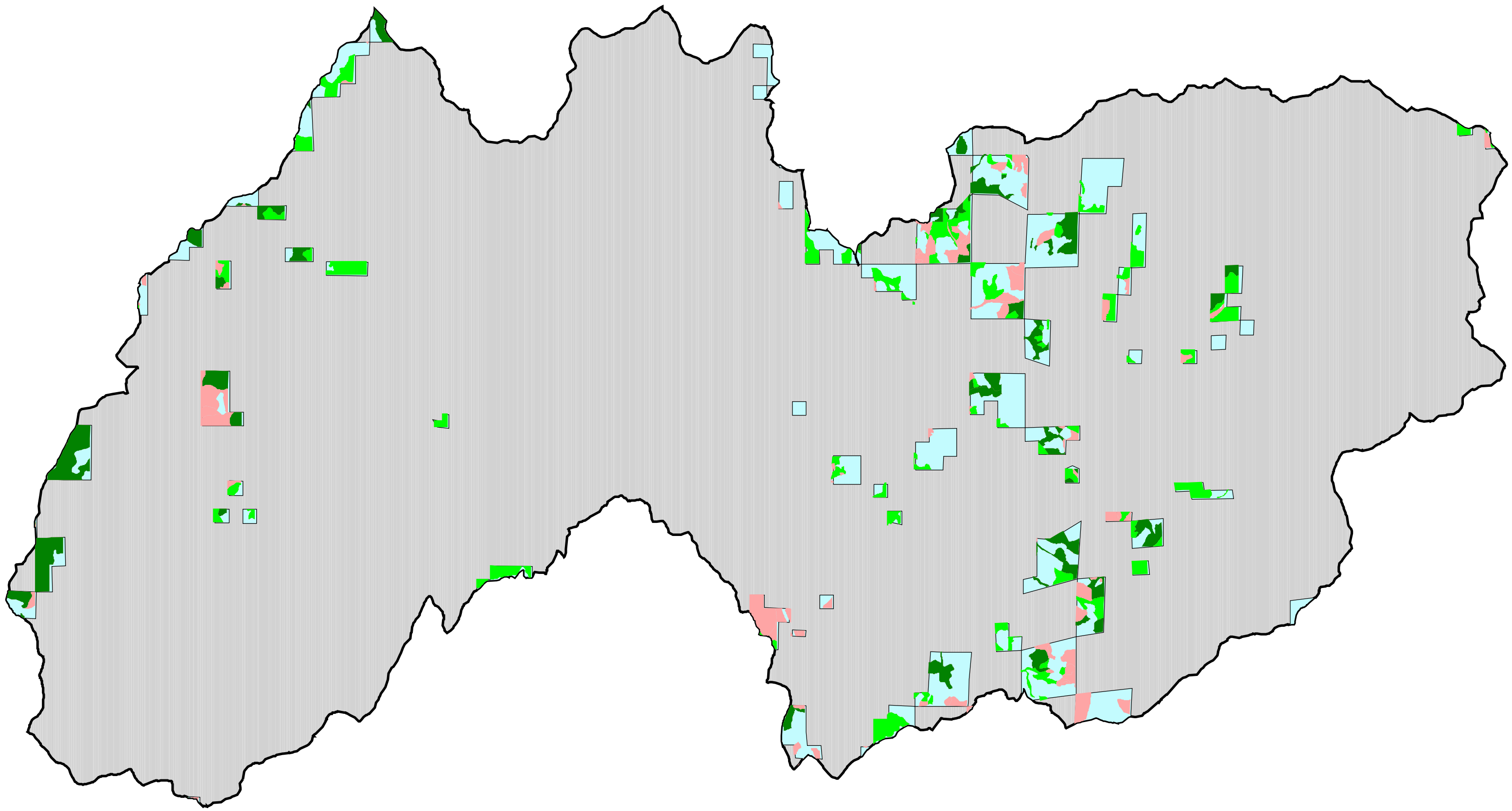
Late successional habitat in the Calapooya Creek AWS.

Figure 4-2



Determined from the Forest Operational Inventory (FOI) theme; using the birthday attribute (DK).

Northern spotted owl habitat in the Calapooya Creek AWS. Figure 4-3



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1 0 1 2 3 4 5 6 7 8 Miles

Federal lands

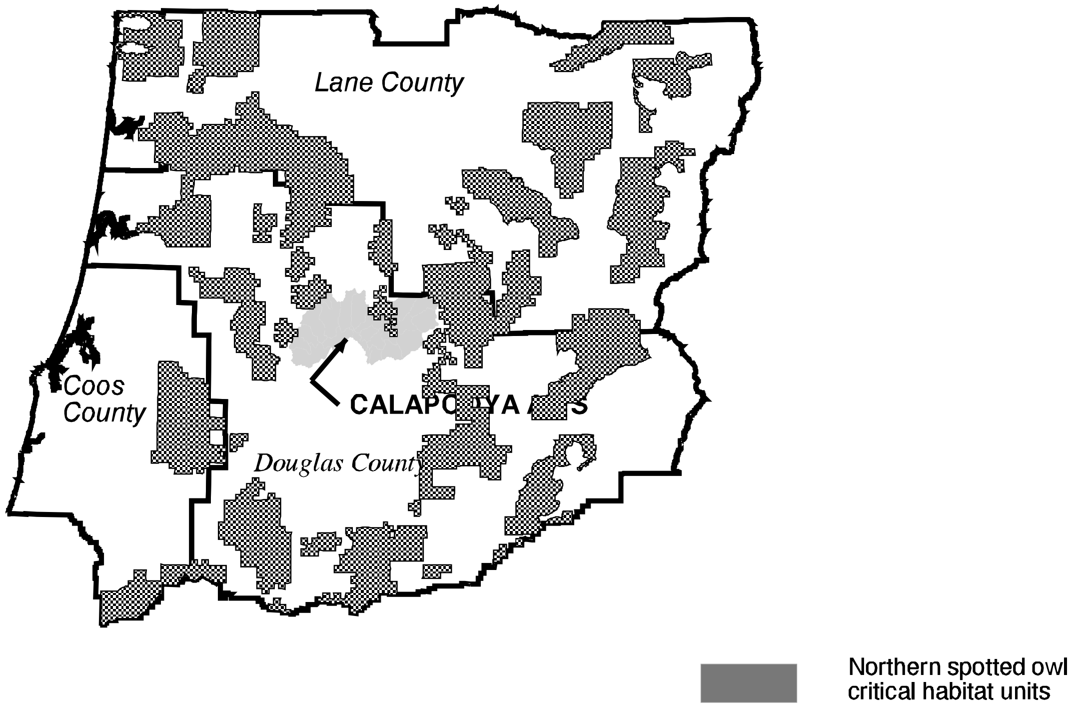
Dispersal habitat

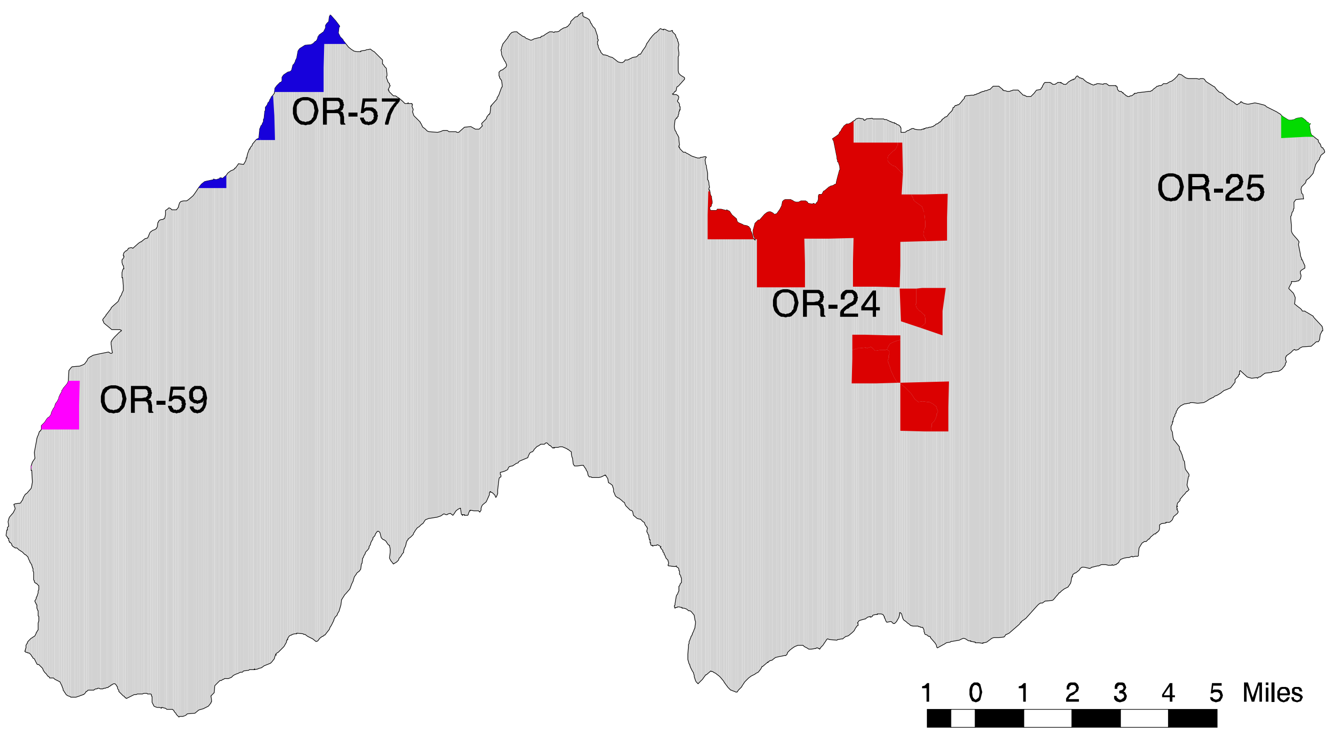
Nesting, roosting, and foraging habitat

N

Designated critical habitat for the northern spotted owl in the Calapooya Creek AWS and the region.

Figure 4-4





N

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Marbled murrelet habitat in the Calapooya Creek AWS.

Figure 4-5

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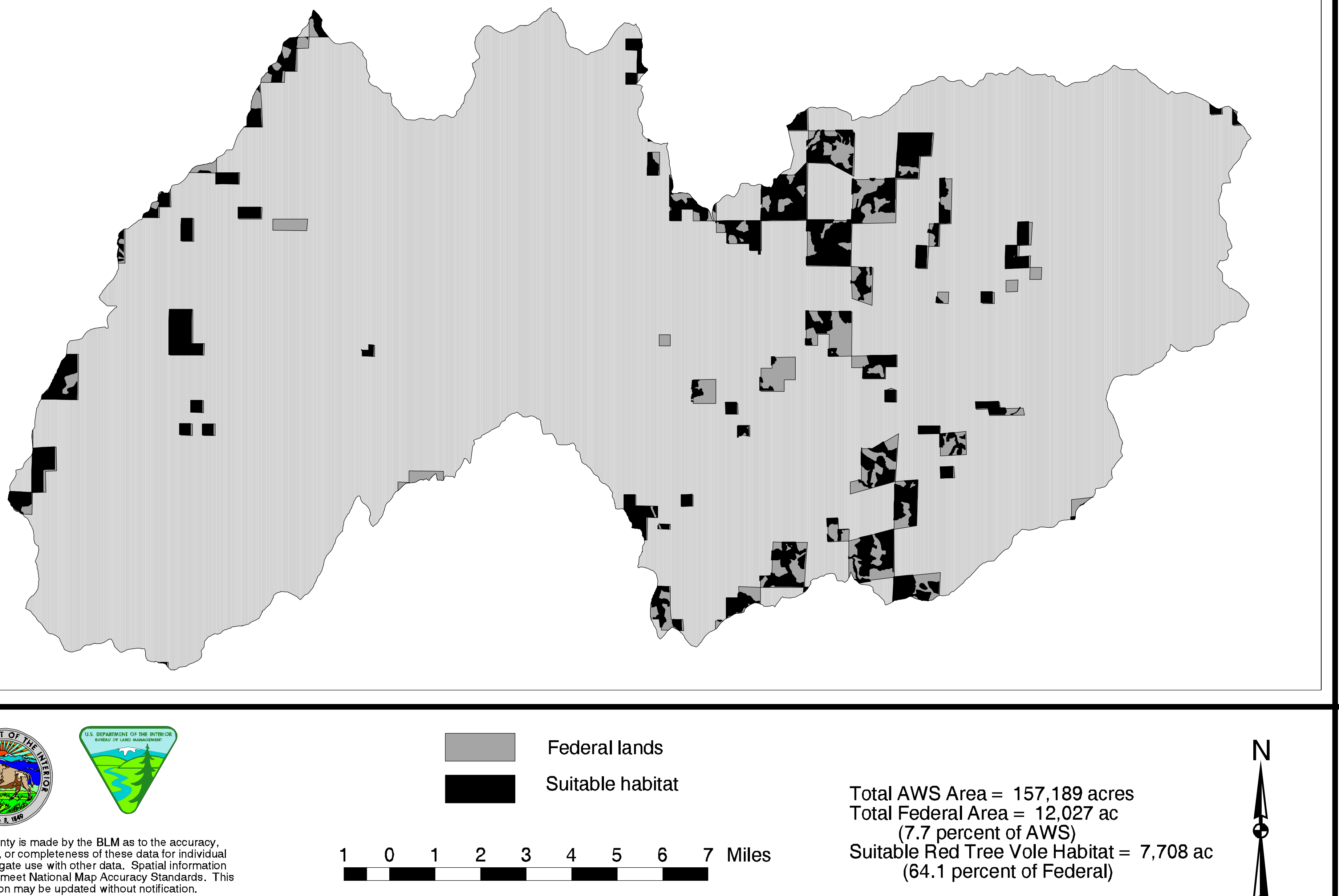
Red tree vole habitat in the Calapooya Creek AWS.

Figure 4-6



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HYDROLOGY

A. Introduction

Calapooya Creek is a tributary draining 246 square miles of the Umpqua River and intersects the Umpqua at river mile 103. Calapooya Creek drains roughly 5% of the 4,560 square mile Umpqua basin. Major streams draining the Calapooya are shown in **Figure 1-4**. The Calapooya Fifth-field watershed is composed of five sixth-field watersheds and twenty-two seventh-field drainages (**Figure 1-5, Table 1-1**). Numerous seventh-field drainage's, such as Ford's Pond, Fair Oaks, and Driver Valley contain other frontal tributaries, and by definition are not distinct watersheds.

Forest management, agricultural practices, water withdrawals are anthropogenic activities that have contributed to changes in hydrologic processes, water quality, and ultimately may have reduced aquatic habitat. Changes in peak flows, low flows, and annual water yield due to forest management are difficult to quantify, and are generally not very pronounced or persistent above current conditions. Characteristics of climate, geography, and fluvial geomorphology all contribute to the way catchment stores and routes water downstream. The following discussion begins to answer the *key questions* regarding hydrology.

B. Climate

Calapooya Creek Watershed has a Mediterranean type of climate typical of lower elevation western Cascade watersheds. The majority of precipitation occurs as rain at lower elevations (less than 2000') and snow at higher elevations during the winter months. During unusually cool and wet winters snow may fall at less than 2000 feet, but will only last 1-3 days. Weather stations in Roseburg, Winchester, Sutherlin, and Oakland were used to characterize both air temperature and precipitation (**Chart 5-1, 5-2**).

The Roseburg weather station is the most accurate due to a longer period of record, but the other stations are shown to illustrate variability in precipitation (**Chart 5-1**). The lower elevations of the watershed receive between 40-50 inches of precipitation annually while higher elevation areas receive 80-90 inches due to topographic variation. Precipitation is affected by elevation due to orographic effects and Pacific frontal storms.

Chart 5-2 shows the departure from normal (of water year precipitation) for both Roseburg and Winchester weather stations. The cumulative departure for precipitation indicates that from the early 1900's to around 1940, precipitation was below normal. From 1942 to approximately 1967 precipitation was above normal. From 1967 to the present, a pattern could not be discerned and precipitation seemed to vary from year to year. Annual peak flows show a similar pattern as precipitation; lower than average annual flows were evident during periods of lower precipitation. The reverse was also evident with higher than normal average annual peak flows during periods of higher than normal rainfall. The Pacific Northwest has experienced several large flood events (e.g. Dec. 1996 and Jan. 1997) suggesting a climate influence on peak flows. Large frontal storms off the Pacific Ocean combined with warm air can cause rain-on-snow events and possible downstream flooding.

Four distinct climate periods from 1870 to 1995 have been identified as a result of oceanic circulation patterns known as the "Conveyor belt" theory (Gray and Landsea, 1993). The theory involves transport of warm ocean water from the Pacific through the Indian Ocean and into the Atlantic. Warm water from the northern Atlantic mixes with cool water from the north; it cools very quickly and sinks. This sets up a sub-surface countercurrent which transports the cool water back to the Indian and Pacific oceans. Over the past 100 years, Gray and Landsea identified four distinct periods associated with the conveyor belt theory.

C. Streamflow and Flood History

Streamflow has been monitored in the Calapooya watershed at four locations: Calapooya Creek near Oakland, OR, Calapooya Creek at Nonpareil, OR, Gassy Creek, and Sutherlin Creek at Sutherlin, OR. The station at Oakland, OR has a longer period of record than the other three stations and can be used to characterize annual peak flows for the watershed (**Chart 5-3**). The largest floods occurred in 1961 and 1997 and were between a 10 and 25 year event (**Chart 5-4**). In 1964, Calapooya Creek experienced a larger than 5-year flood event compared to the North and South Umpqua, which experienced 100 year flood events due to rain-on-melting snow runoff. Headwater streams such as Gassy Creek probably experienced greater than a 5-year flood event due to its proximity to the transient snow zone.

Bank full floods shape streams by building bars, forming flood plain, and generally doing work that makes up the morphologic characteristics of streams. Bank full discharge generally occurs about every other year. Calapooya Creek near the Oakland gage experienced approximately 13 bank full or greater events over the 20-year period of record (**Chart 5-4**).

A comparison of monthly runoff for the Nonpareil and Oakland gaging stations is shown in Chart H-4. As we might expect, most of the runoff (approximately 85%) occurs between November and May with the maximum occurring in January. A comparison of flow per square mile between the two stations indicates that 89, 75, 64, and 58 percent of the flow occurs at the Nonpareil station for the 1.25, 2, 5, and ten-year flood events. This is probably due to a number of reasons; small flow contributions from tributaries downstream of Nonpareil, water diversions for municipal and private use, differences in water storage or greater snow accumulation and melt.

Flood frequencies developed by the USGS for the Calapooya watershed are in **Appendix 5-A** at the end of this chapter.

1. Low Flows

Some streams may have no flow for periods during the summer months, especially drainage areas less than one square mile. Some streams in the watershed have interrupted flow; that is, they flow subsurface and parallel to the stream and then re-surface downstream. This may be due to past forest management activities, earthflow processes, or changes in soil properties.

Summer low flows are probably affected by water withdrawals in the watershed. Domestic, irrigation, agriculture, and livestock watering have all contributed to reduced streamflow during the summer months. The volumes of water withdrawn are not known, but water removal during the summer months may reduce available habitat for aquatic species.

2. Hydrologic Recovery

The US Forest Service (USFS) developed a hydrologic recovery procedure to evaluate the cumulative effects of timber harvesting in the transient snow zone (elevations between 2,000 and 5,000 feet elevation). The premise is that forested vegetation within this elevation band is hydrologically recovered when 75% of the vegetation is greater than 32 years old (for site class IV). At this age, tree crowns are large enough to intercept snow and reduce the risk of rain-on-snow flooding. Weyerhaeuser manages a large area of the rain-on-snow zone and has completed an assessment of peak flows using the Washington Forest Practices Board manual (Upper Calapooya Creek watershed analysis, 1997). Conducting an assessment of peak flows using the "Water Available for Runoff" method would be useful in the watershed.

Most of the watershed above 2,000 feet elevation is under private ownership **(Figure 5-1)**. Only 3% of the watershed administered by BLM are within the transient snow zone (TSZ, **Table 5-1**). The subwatersheds with the most area in the TSZ are Evans Butte and Nonpareil at 6% and 8%, respectively. BLM administers very little land within the TSZ, and the risk of federal lands causing channel change or bed scour due to rain-on-snow peak flows is probably low.

Wemple (1994) estimated roads in her study area extended the stream network 60% over winter base flow stream lengths and 40% over storm event stream lengths. Road densities in her study were 1.6 miles per square mile. Evans Butte and Nonpareil subwatersheds have road densities of 5.0 and 5.3 miles per square mile (**Table 5-2**). Road densities and actual effects to water quality and routing need to be examined further, because not all roads are mapped in GIS.

Stream crossings per mile (**Table 5-2**) as well as road densities may indicate potential for increases in peak flows. Higher stream crossing densities may indicate channel extension due to roads and associated potential for peak flow increases. Increased peak flows may also cause bed scour and mass wasting during storm events.

D. Stream Channel Characteristics

Stream channels integrate watershed processes and changes in processes can alter fluvial processes. Predicting stream channel response to land use and disturbance is a weak link in watershed assessments. However, a process based classification of valley type and channel pattern, dimension, and profile provides a foundation for assessing channel condition and potential stream restoration opportunities.

Streams within the watershed can be separated into sediment source areas, transport areas, and depositional areas depending on location within the drainage net and gradient of the channel. High gradient streams are *source* areas for debris torrents and are generally located in the furthest upstream areas of a watershed. *Transport* areas are generally located downstream of *source* areas and are medium gradient streams that transport sediment to depositional areas. These areas may not change much through time unless significant changes in sediment, discharge, land use, or debris flows occur. Low gradient alluvial streams are the most likely to change due to erosion processes.
Depositional streams that are stable may move back and forth within its valley but the dimension, pattern and profile of streams remains relatively the same through time depending on climate and land use. Downstream transitions from transport to depositional reaches define locations in the drainage net where impacts from increased sediment supply are likely to occur. Depositional stream reaches provide the best quality fish habitat because of the aquatic diversity of in-stream and riparian areas and interactions between the two areas.

Stream Classification: Streams were delineated in Rosgen channel types based solely on stream gradient. Stream gradients were determined from 30-meter digital elevation models and are color-coded based on stream type (**Appendix B**, at the end of the WA document). Rosgen C or F are stream gradients less than 2%, B or G between 2% - 4%, A channels between 4% - 10%, and Aa channels greater than 10%. Aa stream types are most likely source areas; A, B, and G stream types are most likely transport areas, and C and F stream types are probably depositional areas.

Based on the information in GIS, Aa source stream types represent 57%; A, B, and G stream types represent 26%, and C and F stream types comprise 17% of the watershed. The majority of C and F stream types are probably located along main stem Calapooya Creek and near the mouths of tributaries to Calapooya Creek. Aa stream types comprise the most stream miles, but this is expected since most of the drainage density is in the upper reaches of the watershed. Level II and III assessments are necessary to better understand channel responses to land use, sediment, discharge relations, and fluvial processes in the watershed.

E. Water Quality

1. Clean Water Act

The objective of the Clean Water Act (CWA) is to maintain and restore the physical, chemical, and biological integrity of the Nation's waters. EPA directs the State of Oregon to implement the CWA by establishing water quality standards and disclose the health of the State's water on a biennial basis. EPA regulations indicate that "water quality standards" are made up of three primary components. They include numeric water quality criteria, designation of beneficial uses, and provisions for antidegradation of water quality. The Oregon Administrative Rules (OAR 340-41-026) outline specific guidelines to meet the objectives of the CWA. Water quality is to be managed to protect beneficial uses.

The identified beneficial uses in the watershed include: public and private domestic water use, irrigation, livestock watering, resident fish and aquatic life, and salmonid spawning and rearing. DEQ has identified many stream reaches in the watershed not meeting water quality standards for due to bacteria, habitat modification, stream temperature, flow modification, pH, and dissolved oxygen.

2. Stream Temperature

Water temperature is to be managed to protect recognized beneficial uses. The Umpqua Basin temperature standard set by DEQ is 64 degrees Fahrenheit and no measurable increase in water temperature is allowed in accordance with Oregon administrative rules. Stream temperature monitoring was conducted in Calapooya Creek (below south fork) and compared to air temperature at the Winchester, OR weather station (**Chart5-5**).

Calapooya Creek exceeded the 64-degree Fahrenheit standard during July 1998. Other stream temperature sites with similar drainage areas and flow conditions were compared to Calapooya Creek and are displayed in **Chart 5-5.** Regression analysis indicates that the 7-day average daily maximum stream temperature correlates with the 7-day average maximum air temperature at Winchester, OR. Only one season of data has been collected to date on Calapooya Creek and a trend in stream temperature cannot be determined from the data.

Taylor, 1999 determined that climate in Oregon seems to alternate between wet and dry cycles and they tend to last approximately thirty years. Moreover, Holaday, 1992 found that stream temperature condition in the Steamboat Creek, OR improved over a 21-year period (1969-1990) due to the improvement of riparian shade. Data over several decades would be preferable to capture the variability in climate and flow conditions from year to year. Continued monitoring of stream temperature appears to be necessary to establish long term trends.

3. Dissolved Oxygen

Dissolved oxygen is essential for respiration in aquatic life as well as being important in the cycling of organic material within a stream. Since gas solubility generally decreases as temperature rises, this can lead to lower DO levels during the summer. In the Umpqua basin, diurnal variations in DO can occur due to photosynthetic activity during the day and respiration and decomposition demands during the evening and morning hours. Low dissolved oxygen (DO) has been identified by DEQ as a problem in Calapooya Creek. Several factors have probably contributed to DO problems, including water withdrawals, degraded riparian conditions, and increases in width/depth ratio. DO criteria are discussed in the Oregon Administrative Rules.

4. pH

The pH standard set by DEQ for fish and aquatic life in the Umpqua basin is 6.5 to 8.5. Studies of pH have concluded that levels outside this range can have an adverse effect on fish and aquatic insects. The accumulation of algae in streams may affect pH. Aquatic organisms take up dissolved CO_2 and release oxygen during the process of photosynthesis during the day, especially in the late afternoon, which increases pH. A night, CO_2 is released during respiration and pH decreases. When photosynthesis is moderated, such as well-shaded stream reaches with turbulent flow, pH levels are lower.

Generally on federal lands, the implementation of large riparian reserve widths, proper road location and management, and implementation of best management practices should maintain or improve pH, dissolved oxygen, and stream temperature over time.

F. Riparian Function and Coarse Woody Debris

Riparian function is the interaction of various hydrologic, geomorphic, and biotic processes across a range of spatial and temporal scale within the riparian environment. In the context of watershed analysis, riparian function is defined here by two specific processes: 1) the recruitment of large woody debris to aquatic systems, and 2) the provision of shade to aquatic systems. The role of large woody debris as a critical factor affecting aquatic habitat for fish and other aquatic organisms has been heightened by recent research studies. Scientists originally viewed large debris jams as barriers to fish passage and wood was systematically removed across the landscape during the 1940s and 1950s. Several studies have shown that the loss or removal of woody debris from stream channels can result in significant changes in channel morphology, a loss of sediment storage capacity, and an increase in the rate of sediment transport (Beschta 1979; Bilby 1984; Heede 1985). The buffering capacity of wood is reduced leading to degradation of spawning gravels, filling in of rearing pools, and reducing invertebrate populations. The quality and quantity of wood reaching the stream will influence the morphological and biological functioning within the stream; such as creating and maintaining pools, forming eddies where food organisms are concentrated, reducing stream velocities and shear stress along banks, shelter during high flows, and trapping organic inputs from adjacent riparian areas.

The natural recruitment of coarse wood to streams can result from landsliding, fires, wind, and debris torrents. The delivery of coarse wood to downstream fisheries and aquatic life is affected by valley form, soil stability, tree species and age class, and the frequency of large flows over time. Low gradient streams tend to store large wood from upstream sources and headwater streams tend to be Rosgen A channels that transport coarse wood (see **Appendix B**).

The size of wood necessary to interact with headwater streams is less due to valley type, channel morphology, and flow conditions. Larger wood is necessary to interact with larger stream systems. For conifers, significant recruitment from a second-growth stand generally begins approximately 100 years after harvesting, with increasing rates of recruitment after this period. A process for developing, enhancing, as well as recruiting larger wood in the riparian areas of second-growth stands is given in the **Restoration Opportunities and Management Recommendations** section.

Two recent studies of riparian areas in Oregon have been conducted; one in the central Oregon coast range and the other in the McKenzie River drainage. Both studies concluded that riparian forest contained lower abundances of conifers in stream side forests than in adjacent upslope forests. In four stands (central coastal Oregon) that were older than 90 years, the total conifer basal area was 65% of that estimated for upslope forests (Andrus and Froehlich, 1988). Several factors probably contribute to the lower percentage of conifers in riparian areas. These include natural wind throw damage and natural landslides. Of the 15 stands older than 20 years, all had greater basal area (ft2/ac) and volume on upslope forests than that observed in riparian areas. However, the abundance of trees along riparian areas differs from reach to reach, and depends on the land form or valley type associated with a particular stream reach. In the McKenzie River drainage, the total conifer basal area for an old growth stand and a 125-year-old stand were 75% and 71%, respectively of that noted in upslope forests. Conifers in riparian areas need to reach 150-200 years of age in order for streams to reach maximum production potential regarding biomass, biodiversity, and species richness (Gordon Reeves personal communication). **Figure 7-3, Table 7-7** and **Charts 7-3, 7-4** show the general distribution of riparian vegetation in Calapooya.

Chart 5-1. Mean Annual Precipitation

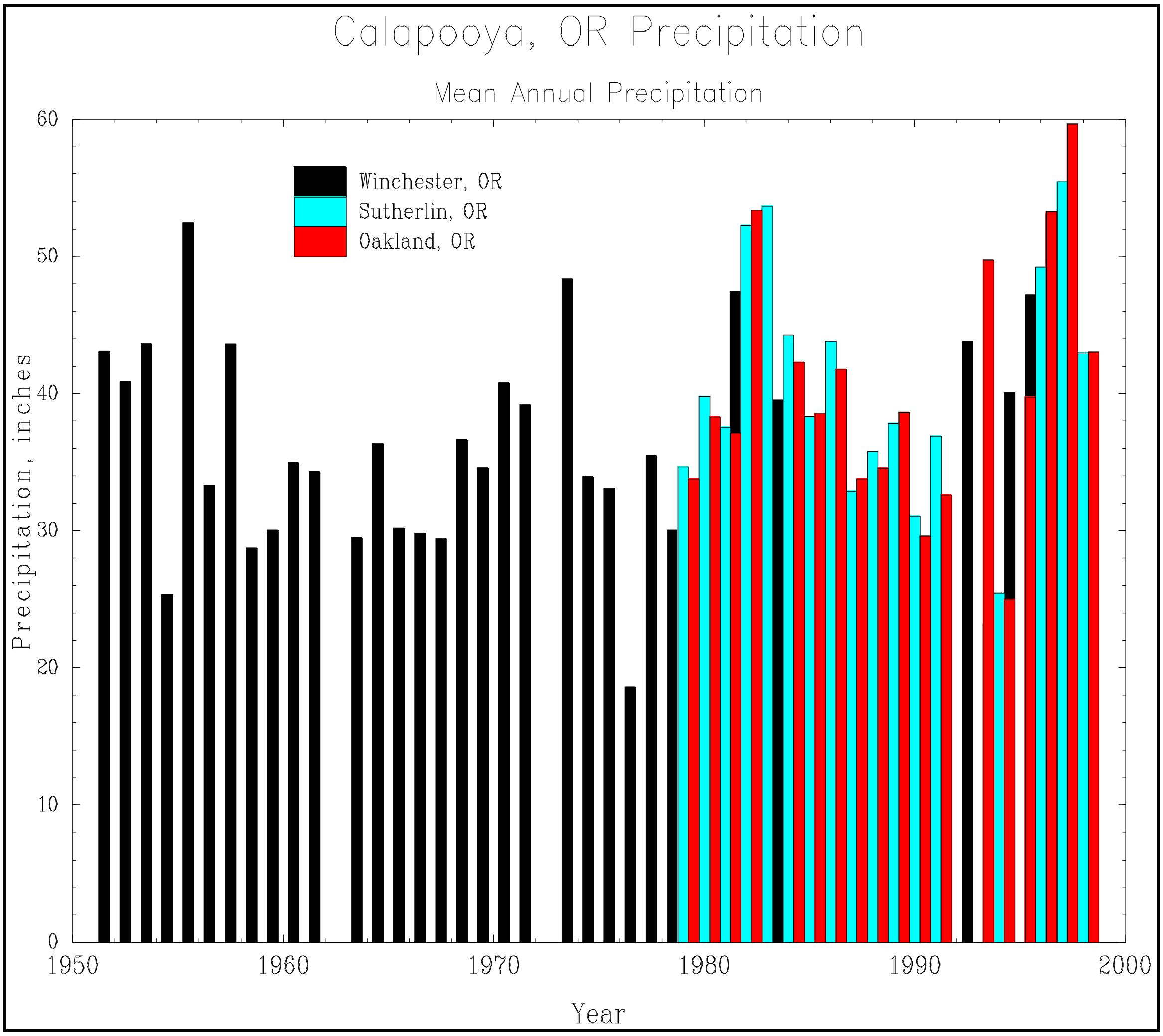
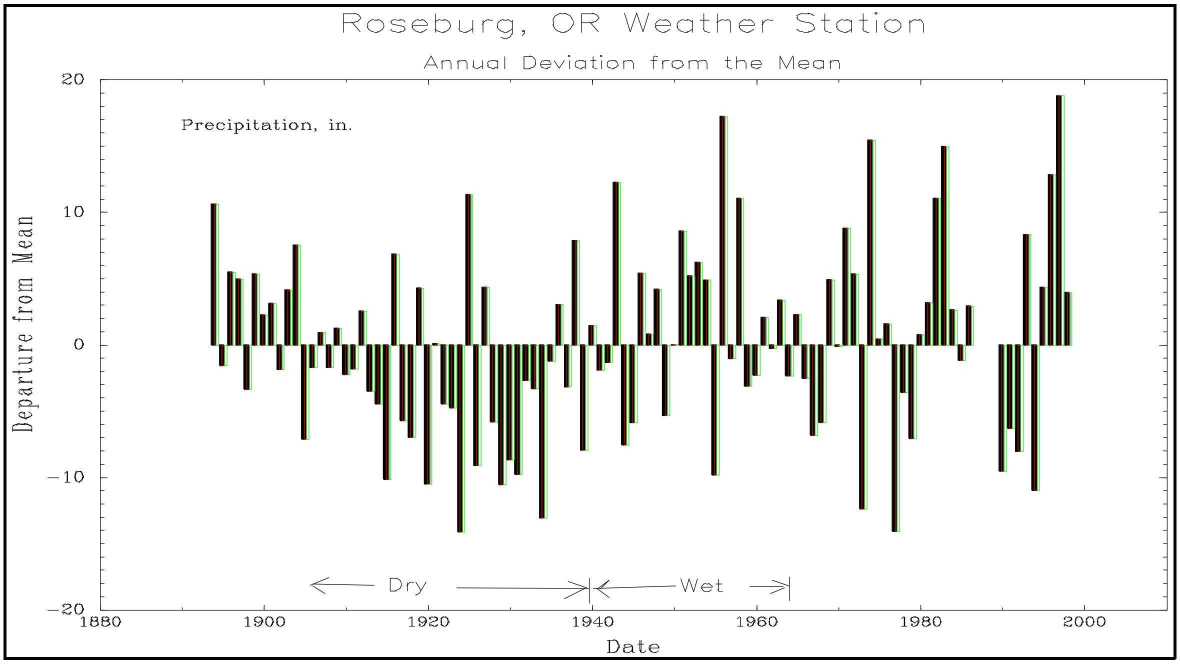


Chart 5-2. Comparison of Roseburg and Winchester NOAA Weather Stations.



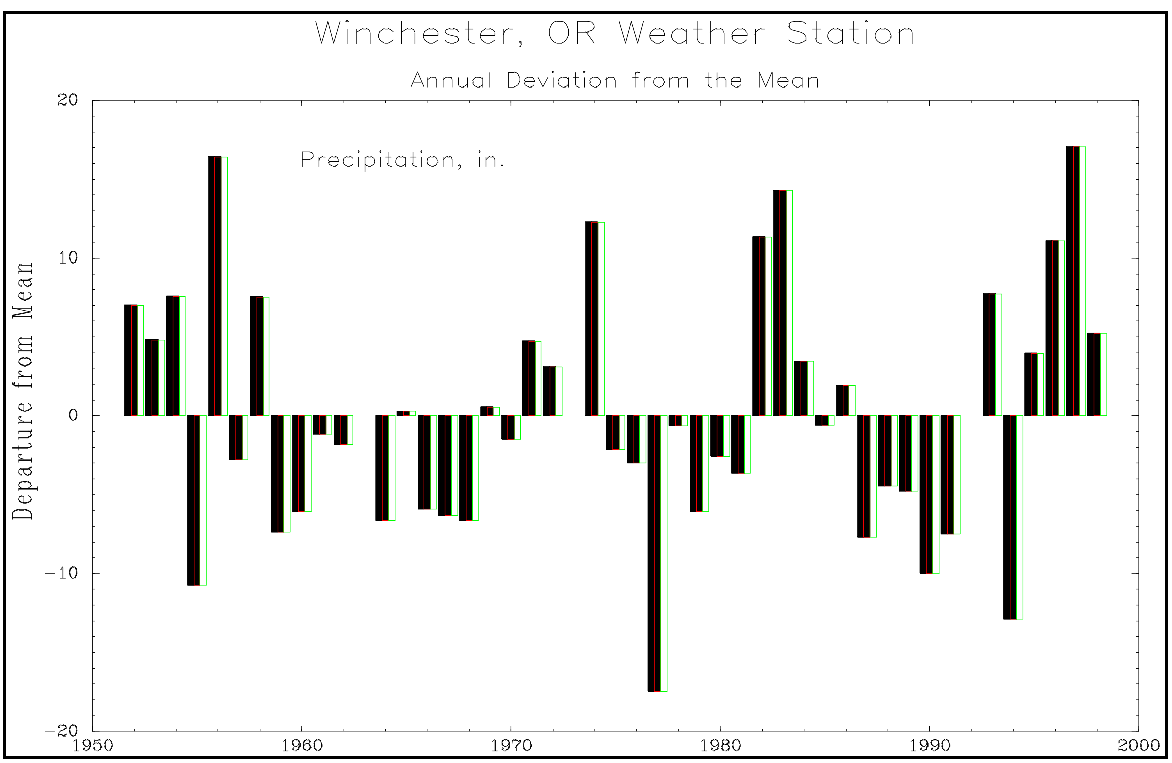
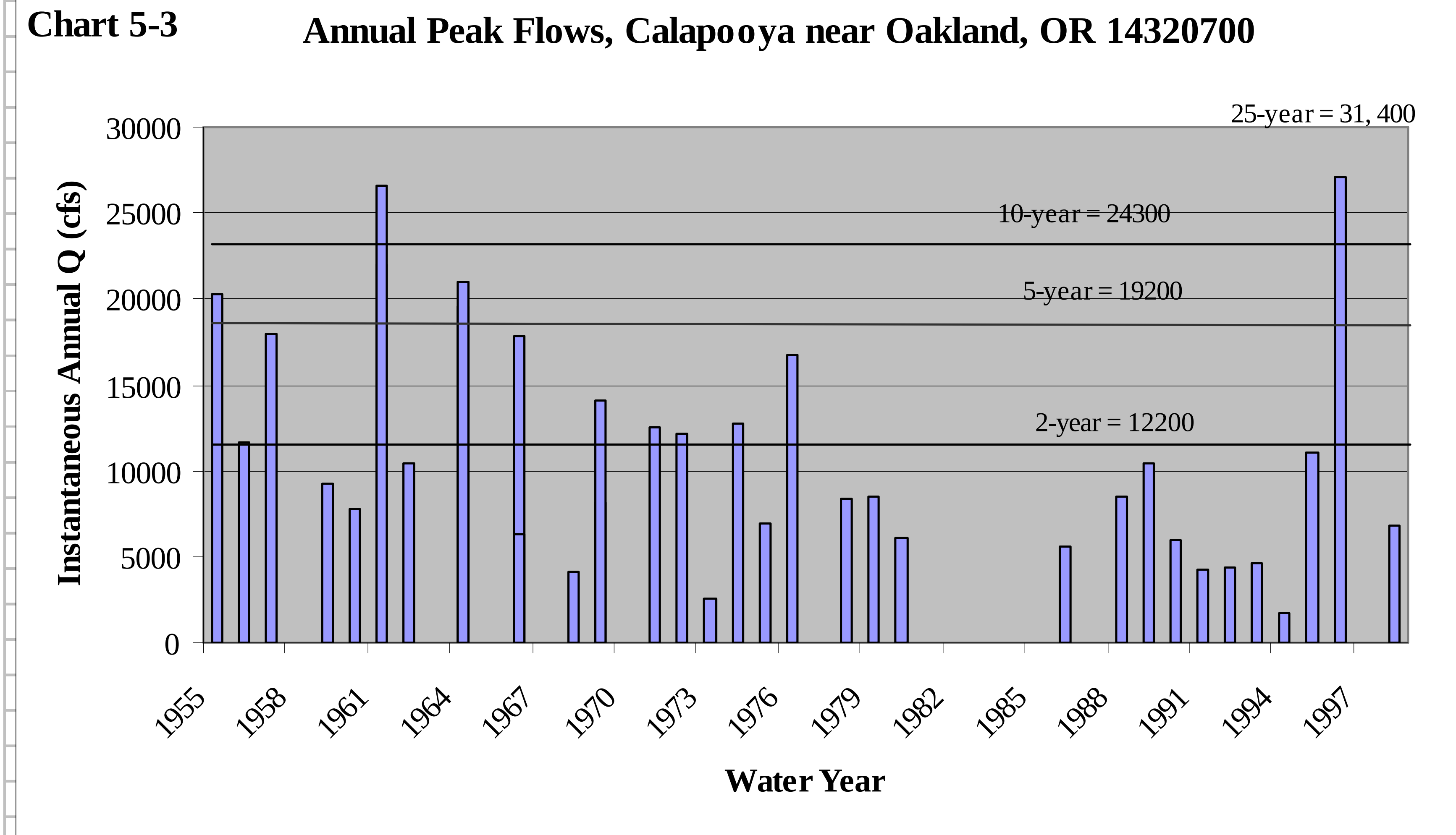


Chart 5-3


Annual Peak Flows, Calapooya near Oakland, OR 14320700
Instantaneous Annual Q (cfs)
Water Year
25-year = 31, 400
10-year = 24300
5-year = 19200
2-year = 12200
30000
25000
20000
15000
10000
5000
0
1955
1958
1961
1964
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997

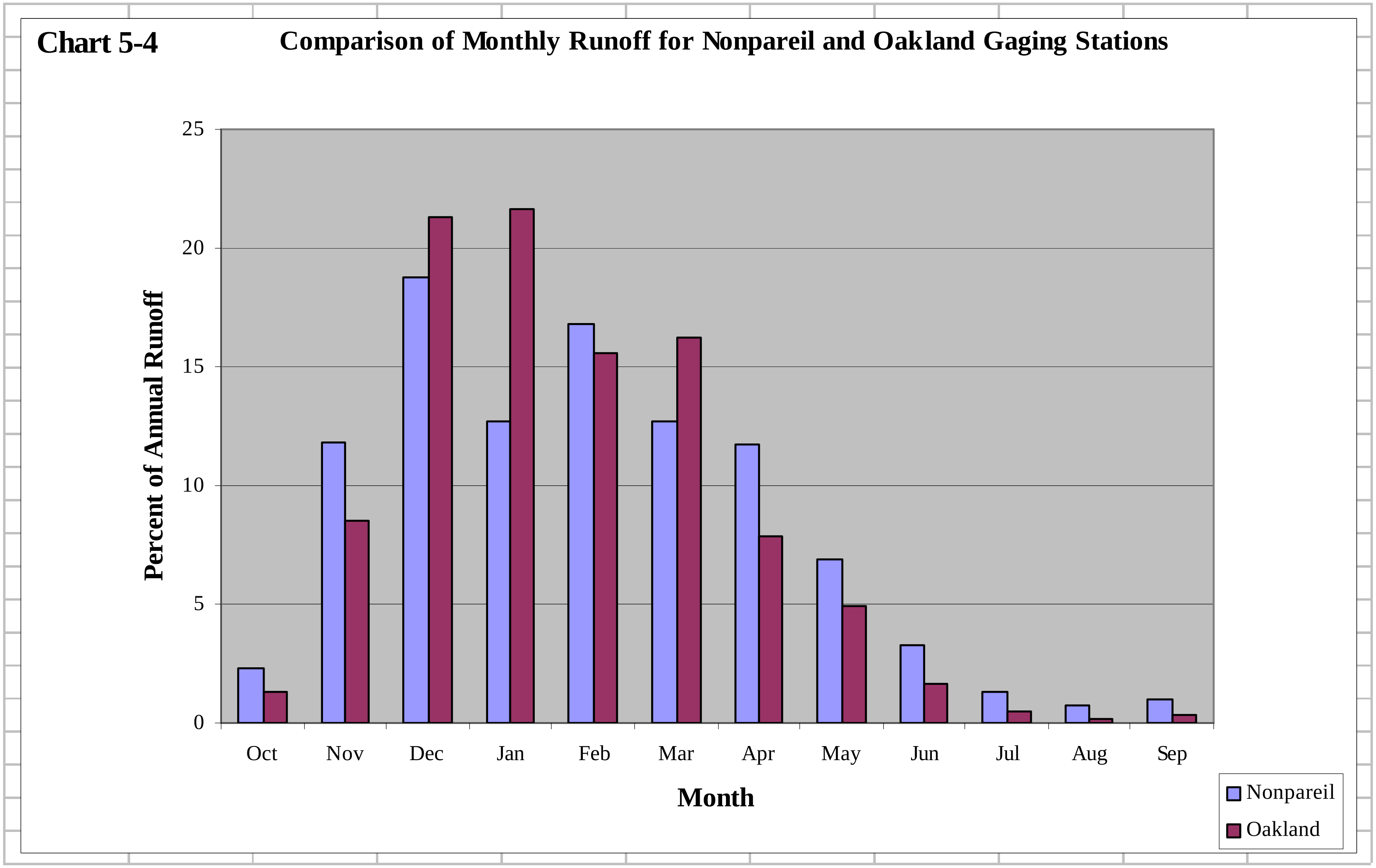
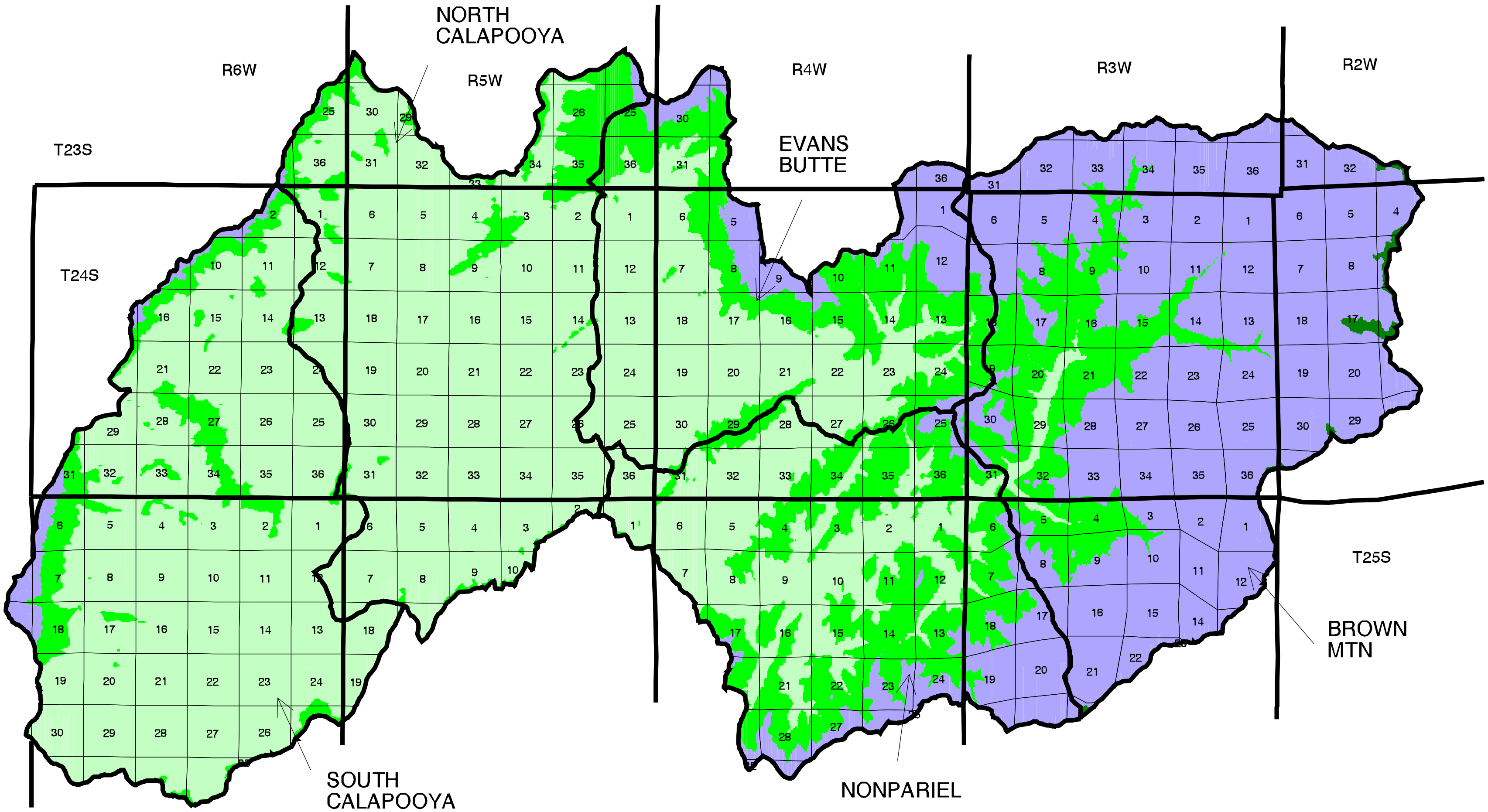


Chart 5-4
Comparison of Monthly Runoff for Nonpareil and Oakland Gaging Stations
Percent of Annual Runoff
25
20
15
10
5
0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Month
Nonpareil
Oakland

Figure 5-1

Calapooya Creek Watershed - Transient Snow Zone



Scale 1:200000

1 0 1 2 3 4 5 6 Miles

- 500 - 1000
- 1000 - 1500
- 1500 - 4000 (Transient Snow Zone)
- 4500

N

Table 5-1	Calapooya Watershed Hydrologic Recovery **(1)**				
Subwatershed	**Drainage**	**% BLM hydrologic recovery**	**% Private hydrologic recovery**	**Total BLM Acres in TSZ**	**% BLM TSZ Acres in Subwatershed**
	Buzzard Roost	14%	0.6%	370	0.9%
	Calapooya Divide	27%	0.8%	630	1.5%
	Hinkle Creek	12%	0.3%	212	0.5%
	NF Calapooya	N/A	1.0%	0	0.0%
	SF Calapooya	21%	1.0%	43	0.1%
Brown Mountain	**42,929 ac**	**19%**	**0.7%**	**1255**	**2.9%**
	English Settlement	15%	0.2%	118	0.5%
	Oldham Creek	14%	0.9%	1394	6.0%
Evans Butte	**23,212 ac**	**14%**	**0.5%**	**1512**	**6.5%**
	Cantell Creek	13%	0.9%	437	1.7%
	Driver Valley	13%	0.6%	107	0.4%
	Fair Oaks	N/A	0.2%	0	0.0%
	Foster Creek	12%	0.0%	142	0.6%
	Gassy Creek	13%	0.7%	1146	4.5%
	Long Valley	19%	0.3%	175	0.7%
	Nonpariel	7%	0.0%	116	0.5%
Nonpareil	**25,560 ac**	**13%**	**0.4%**	**2123**	**8.3%**
	Blackberry Canyon	11%	N/A	218	0.7%
	Cabin Creek	10%	N/A	39	0.1%
	Oakland	N/A	N/A	0	0.0%
	Polloc Creek	N/A	N/A	0	0.0%
North Calapooya	**31,487 ac**	**10%**	**N/A**	**257**	**0.8%**
	Coon Creek	6%	0.6%	50	0.1%
	Dodge Canyon	17%	N/A	50	0.1%
	Fords Pond	1%	0.3%	3	0.0%
	Green Valley	6%	N/A	146	0.4%
South Calapooya	**34,005 ac**	**8%**	**0.2%**	**249**	**0.7%**
Total Calapooya Watershed Hydrologic Recovery	**157193 ac**	**13%**	**0.6%**	**5396**	**3.4%**

(1) Based on Umpqua National Forest Standard and Guideline Procedures for Watershed Cumulative Effects and Water Quality 1990

Table 5-2	Calapooya Creek Watershed - Road Lengths, Drainage, and Stream Crossings						
Subwatersheds							
Characteristics		Brown Mtn	Evans Butte	Nonpareil	North Calapooya	South Calapooya	**Total Watershed**
Area Acres	BLM	2,355	3,159	4,013	763	1,641	**11,931**
	Non-BLM	38,152	19,793	21,547	30,724	32,364	**142,580**
Area Sq Miles	BLM	3.7	4.9	6.3	1.2	2.6	**18.6**
	Non-BLM	59.6	30.9	33.7	48.0	50.6	**222.8**
Stream Length	BLM mi	14.9	17.1	26.4	6.7	7.8	**72.9**
	Non-BLM mi	212.6	111.6	184.6	55.8	84.4	**649**
Stream Density (mi/sq mi)	BLM	4.0	3.5	4.2	5.6	3.0	**3.9**
	Non-BLM	3.6	3.6	5.5	1.2	1.7	**2.9**
Road Length	BLM mi	17.4	24.5	33.4	2	7.1	**84.4**
	Non-BLM mi	187.3	72.4	94.9	82.1	81.6	**518.3**
Stream Crossings	BLM #	28	25	40	1	9	**103**
	Non-BLM #	269	123	231	62	81	**766**
Crossings/ Stream Mile	BLM #	1.88	1.46	1.52	0.15	1.15	**1.41**
	Non-BLM #	1.27	1.10	1.25	1.11	0.96	**1.18**

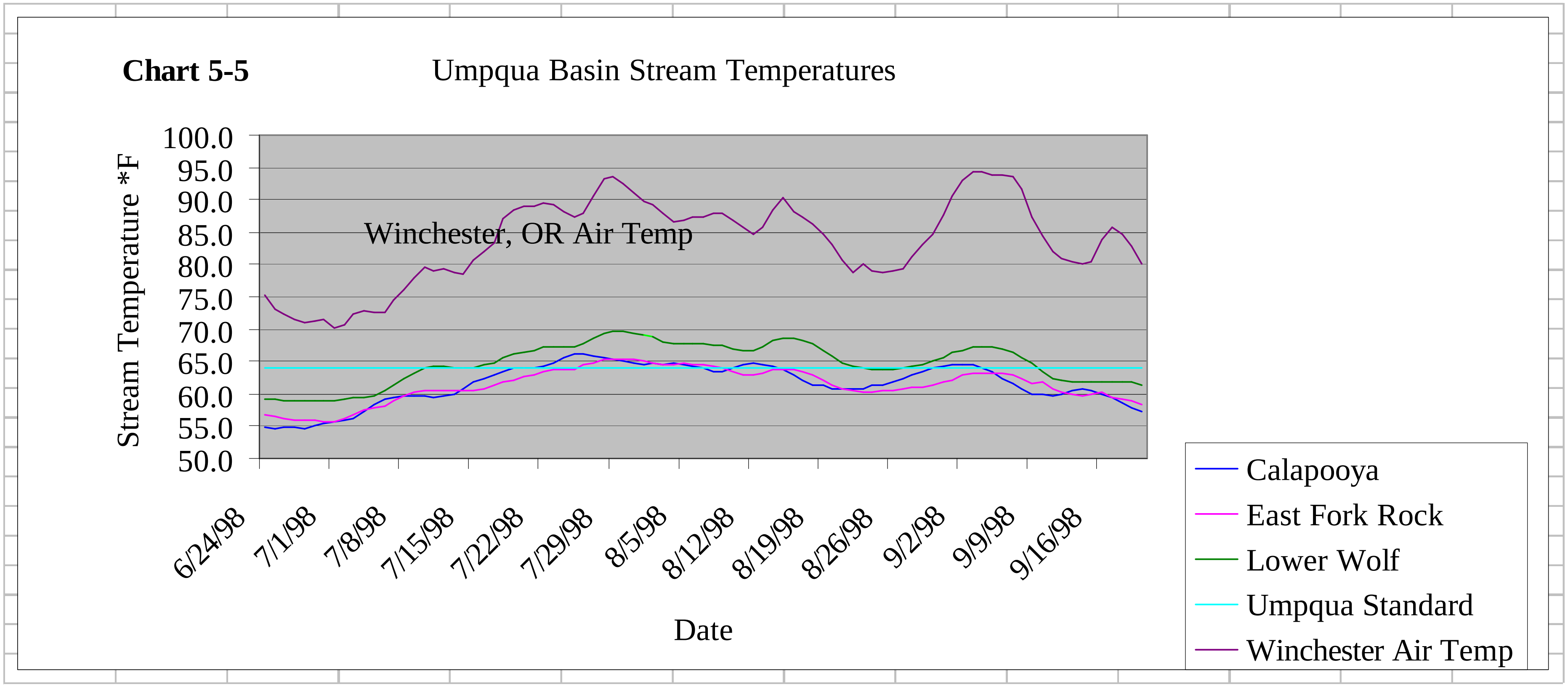


Chart 5-5
Umpqua Basin Stream Temperatures
Stream Temperature *F
100.0
95.0
90.0
85.0
80.0
75.0
70.0
65.0
60.0
55.0
50.0
Winchester, OR Air Temp
6/24/98
7/1/98
7/8/98
7/15/98
7/22/98
7/29/98
8/5/98
8/12/98
8/19/98
8/26/98
9/2/98
9/9/98
9/16/98
Date
Calapooya
East Fork Rock
Lower Wolf
Umpqua Standard
Winchester Air Temp

UMPQUA RIVER BASIN

14319900 CALAPOOYA CREEK AT NONPAREIL, OR

LOCATION.--Lat 43°25'04", long 123°09'13", in SW 1/4 SE 1/4 sec.3, T.25 S., R.4 W., Douglas County, Hydrologic Unit 17100303, on left bank 0.3 mi upstream from county road bridge, 0.9 mi northeast of Nonpareil, and at mile 26.7.

DRAINAGE AREA.--88.6 mi^2.

PERIOD OF RECORD.--July 1976 to September 1987.

GAGE.--Water-stage recorder and crest-stage gage. Datum of gage is 699.22 ft above National Geodetic Vertical Datum of 1929 (Douglas County Survey bench mark).

REMARKS.--Only minor diversions by pumping for irrigation upstream from station.

AVERAGE DISCHARGE.--11 years, 205 ft^3/s, 31.42 in/yr, 148,500 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 7,640 ft^3/s Dec. 6, 1981, gage height, 11.16 ft; minimum discharge, 3.7 ft^3/s Sept. 23-25, 1987.

STATISTICAL SUMMARIES

[n = number of values used to compute statistics]

MAGNITUDE AND PROBABILITY OF ANNUAL LOW FLOW
BASED ON PERIOD OF RECORD 1978-1987

PERIOD (CON-SECU-TIVE DAYS)	n	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND ANNUAL NON-EXCEEDANCE PROBABILITY, IN PERCENT					
		2 50%	5 20%	10 10%	20 5%	50 2%	100 1%
1	10	8.3	6.1	5.3	--	--	--
3	10	8.5	6.3	5.5	--	--	--
7	10	9.4	6.9	5.9	--	--	--
14	10	10	7.7	6.7	--	--	--
30	10	11	8.9	8.0	--	--	--
60	10	14	11	10	--	--	--
90	10	17	15	14	--	--	--
120	10	24	20	18	--	--	--
183	10	52	43	40	--	--	--

MAGNITUDE AND PROBABILITY OF ANNUAL HIGH FLOW
BASED ON PERIOD OF RECORD 1977-1987

PERIOD (CON-SECU-TIVE DAYS)	n	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND ANNUAL EXCEEDANCE PROBABILITY, IN PERCENT					
		2 50%	5 20%	10 10%	25 4%	50 2%	100 1%
1	11	2830	3650	3890	--	--	--
3	11	2060	2430	2500	--	--	--
7	11	1320	1680	1800	--	--	--
15	11	918	1140	1230	--	--	--
30	11	701	906	996	--	--	--
60	11	537	701	777	--	--	--
90	11	462	596	664	--	--	--

MAGNITUDE AND PROBABILITY OF INSTANTANEOUS PEAK FLOW
BASED ON PERIOD OF RECORD 1977-1987

DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND ANNUAL EXCEEDANCE PROBABILITY, IN PERCENT

1.25 80%	2 50%	5 20%	10 10%	25 4%	50 2%	100 1%
2930	3860	5110	5940	--	--	--

Systematic n = 11 historical n = 0
Generalized 17b skew = 0.108

14320700 CALAPOOYA CREEK NEAR OAKLAND, OR

LOCATION.--Lat 43°24'10", long 123°21'45", in NW 1/4 sec.13, T.25 S., R.6 W., Douglas County, Hydrologic Unit 17100303, near center of span on downstream side of highway bridge, 0.9 mi downstream from Williams Creek, 2.5 mi northwest of Sutherlin, 3.5 mi southwest of Oakland, and at mile 10.1

DRAINAGE AREA.--210 mi^2.

PERIOD OF RECORD.--October 1955 to September 1973, October 1986 to September 1987. Records for the years 1974-86 are available at the Douglas County Water Resources Dept. in Roseburg.

GAGE.--Water-stage recorder. Datum of gage is 371.26 ft above National Geodetic Vertical Datum of 1929. Prior to June 22, 1968, nonrecording gage at same site and datum.

REMARKS.--Diversion upstream from station for municipal supply of cities of Sutherlin and Oakland. Small diversions by pumping for irrigation upstream from station.

AVERAGE DISCHARGE.--19 years (water years 1956-73, 1987), 486 ft^3/s, 31.43 in/yr, 352,100 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 26,600 ft^3/s Nov. 23, 1961, gage height, 21.55 ft; no flow Sept. 9-11, 1966.

STATISTICAL SUMMARIES

[n = number of values used to compute statistics]

MAGNITUDE AND PROBABILITY OF ANNUAL LOW FLOW
BASED ON PERIOD OF RECORD 1957-1973

PERIOD (CONSECUTIVE DAYS)	n	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND ANNUAL NON-EXCEEDANCE PROBABILITY, IN PERCENT					
		2 50%	5 20%	10 10%	20 5%	50 2%	100 1%
1	17	5.2	2.6	1.5	0.0	--	--
3	17	5.8	2.9	1.7	0.0	--	--
7	17	6.4	3.3	2.1	1.4	--	--
14	17	7.2	4.3	3.1	2.3	--	--
30	17	8.4	5.2	3.9	2.9	--	--
60	17	12	7.2	5.3	4.0	--	--
90	17	14	9.8	7.8	6.3	--	--
120	17	22	15	12	10	--	--
183	17	58	38	31	26	--	--

MAGNITUDE AND PROBABILITY OF ANNUAL HIGH FLOW
BASED ON PERIOD OF RECORD 1956-1973

PERIOD (CONSECUTIVE DAYS)	n	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND ANNUAL EXCEEDANCE PROBABILITY, IN PERCENT					
		2 50%	5 20%	10 10%	25 4%	50 2%	100 1%
1	18	8540	12300	14400	16400	--	--
3	18	6170	8550	9720	10800	--	--
7	18	4070	5770	6790	7960	--	--
15	18	2730	3800	4440	5200	--	--
30	18	2010	2680	3090	3580	--	--
60	18	1570	2080	2400	2800	--	--
90	18	1330	1710	1930	2190	--	--

MAGNITUDE AND PROBABILITY OF INSTANTANEOUS PEAK FLOW
BASED ON PERIOD OF RECORD 1956-1973

DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND ANNUAL EXCEEDANCE PROBABILITY, IN PERCENT						
1.25 80%	2 50%	5 20%	10 10%	25 4%	50 2%	100 1%
7730	12200	19200	24300	31400	--	--

Systematic n = 18 historical n = 0
Generalized 17b skew = 0.018

GEOLOGY and SOILS

A. Characterization

1. Topography and Geology

The Calapooya watershed is situated in the Coast Range Geographic Province (western three quarters) and the Western Cascade Province (eastern one quarter). The topography is highly variable ranging from rugged, highly dissected mountain slopes along the western margins of the watershed and on the east side to typically low lying hills and broad flood plains and terraces in between. **Figure 6-1** and **Table 6-1** give a good overview of slope distribution. Gentle to moderate slopes (5 to 70 percent) dominate the overall landscape. About 1.4 percent of the watershed is shown on the slope map to have slopes steeper than 70 percent. These slopes are concentrated along the Tyee Mountain-Yellow Creek Mountain scarp forming the western margin, on the Cascade mountain flanks and on the canyon slopes of streams which dissect these mountain flanks. The actual area of the steep and very steep slopes is somewhat higher than 1.4 percent (perhaps three percent) since the contour lines in GIS used in generating the slope map do not reveal all of these steeper slopes . They are hidden as small inclusions, primarily in the 35 to 70 percent delineations.

Elevations range from 320 feet at the confluence of Calapooya Creek with the Umpqua River to 4,443 feet at Middle Mountain on the eastern border in the Cascades. Local relief varies from 200 to 2000 feet going from third and fourth order streams to the overlooking high points. In the mountainous terrain the relief is typically 800 to 2000 feet. In the low laying hill in between it is typically 200 to 700 feet. **Figure 5-1** gives a good overview within Calapooya of broad elevation bands and areas within the transient snow zone.

Thirteen geologic units occur within the watershed as mapped in Compilation Geologic Map of the Southern Tyee Basin, Southern Coast Range, Oregon by Alan and Wendy Niem, 1990. The Roseburg Formation has the greatest coverage, more than half of the watershed. The Calapooya portion of the map is reproduced in **Figure 6-2**. A brief description of each unit is given below.

Qal = Quaternary Alluvium (Holocene and Pleistocene): Flood plain and stream channel sediments composed of clay, silt, sand and gravel; includes fluvial terrace deposits.

Flournoy Formation of Baldwin (lower to middle Eocene)

> Tef_1 = White Tail Ridge Member: Thick-bedded, medium- to coarse-grained, mica-bearing, lithic-feldspathic sandstone with minor interbedded mudstone; some coal and carbonaceous siltstone layers; Some sandstone beds display hummocky cross bedding.

> Tef_3 = Siuslaw member of the Flournoy Formation (lower to middle Eocene): Very thick-bedded, massive to graded fine-grained micaceous amalgamated lithic-feldspathic sandstone with minor sequence of thin-bedded siltstone and fine- to very fine-grained graded sandstone beds and some very thick-bedded channelized sandstone. A few beds are slump folded.

Tyee Formation of Baldwin (middle Eocene)

Tet_1 = Tyee Mountain member of the Tyee Formation (Baldwin 1974) (middle Eocene): Thick-bedded fine- to coarse-grained locally graded to massive micaceous lithic-arkosic sandstone and thin layers of siltstone; cliff former; grades upward into the Hubbard Creek member.

Roseburg Formation of Baldwin (Paleocene to lower Eocene)

Ter_2 = Middle Fan Facies; thick-bedded, fine- to coarse-grained graded amalgamated lithic sandstone, with thin gray interbeds containing bathyal foraminifers.

Ter_3 = Outer Fan and Fan Fringe Facies in the Roseburg Formation of Baldwin (1974) (Paleocene to lower Eocene): thin, even-bedded very fine-grained to medium grained graded lithic sandstone and siltstone.

Ter_4 = Slope Mudstones: massive to laminated mudstone, channelized mudstone, and minor rhythmically interbedded siltstone and claystone; some slumped strata.

Tbs = Basaltic Sandstone: Tongue of basaltic sandstone in Roseburg outer fan strata (Ter_3) and derived from unit Tev.

Tev = Roseburg Volcanics: Tholeiitic pillow basalts, breccia, and some massive aerial flows interbedded with minor conglomerate and basaltic sandstone.

Tert = Tuffs: thick sequence of palagonite tuff and deep-marine tuffaceous siltstone interbedded with pillow basalts in the upper part of unit Tev.

Ti = Tertiary Intrusive rocks (Paleocene to Oligocene): Sills and dikes, predominantly basalt in composition.

Tcf = Undifferentiated Colestin and Fisher Formation (upper Eocene): Nonmarine volcanic strata including massive to poorly bedded tuffs, tuffaceous sandstone and siltstone, and some conglomerate and debris flows. Unit contains some intercalated subaerial flows and breccia of andesite to basaltic andesite.

Tlb = Little Butte Volcanic Series (Oligocene): Nonmarine volcanic rocks, including flows of olivine basalt to pyroxene andesite near the base of the unit and massive andesitic to dacitic pyroclastic rocks in the upper part of the unit.

A series of anticlines, synclines and thrust faults occur across the Roseburg Formation portion. The axis of the anticlines and syncline and the fault lines are oriented from the southwest to the northeast. The dip of the strata in the watershed varies from gentle (less than 10 degrees) to quite steep (as high as 80 degrees). On the anticlines the strata dips away from the axis and on the synclines the strata dip towards the axis. The orientation and steepness of the dips can have slope stability implications. **Figure 6-3** maps these geologic structures and the strike and dips.

2. Soils

The soils maps in this report were compiled from various combinations of soil mapping units from the Natural Resources Conservation Service Soil Survey of Douglas County.

Soil depth, mapped in **Figure 6-4** and statistics given in **Table 6-2,** is an important characteristic for vegetation, hydrology and slope stability. On BLM managed surface the average soil depths fall heavily into the moderately deep and deeper range. The following statements in general apply to soil depth for a given soil.

-The deeper soils have higher water storage capacities and higher site indexes for conifer growth. Very shallow soils over non fractured bedrock will not support trees.
-Very deep, clayey soils may be subject to slump movements under certain conditions on slopes below 60 percent.
-The deeper soils are generally at greater risk for shallow translational landslides than the shallower soils on the same slopes. A depth of five feet is an important break for slope stability analysis.
-Shallow soils are highly sensitive to hot, prescribed burns.
-Soil depth influences water infiltration and runoff. The shallower a soil, the higher the runoff potential.
-Very shallow soils and rock outcrop areas may support rare plants not found elsewhere. These sites can be very sensitive to disturbances. **Figure 6-5** maps areas with rock outcrop as a major component (15 percent or more of a soil mapping unit). The statistics for rock outcrop are given in **Table 6-3**.

Soil drainage, mapped in **Figure 6-6** and statistics given in **Table 6-4**, is another important soil characteristic. Poorly drained soils have water at the surface or at shallow depths for long periods of the year. Somewhat poorly drained soils have water tables at shallow depths for significant periods during the growing season. These two drainage classes are associated with wetland environments. Hydrophytic vegetation is normally found on them. They occur on level ground to slopes of 60 percent and may present slope stability risks. About nine percent of the area on BLM managed surface have soils which are somewhat poorly to poorly drained.

The soil hydrologic group, mapped in **Figure 6-7** and statistics given in **Table 6-5**, gives runoff potentials of soils under bare conditions. Hydrologic group ratings are based solely on the physical properties of the soil and bedrock and depths to water tables, bedrock or other very slowly permeable layer permeable layer. Slope and climatic factors are not considered in the rating. One very slowly permeable layer of note are clay subsoils with montmorillonitic mineralogy. These clays have high shrink-swell capacities and will seal up when wet. Soils with these clays occur in the Roseburg Formation and cover about 16, 500 acres in the watershed.

On BLM managed surface nearly all of the soils fall into the moderately low to moderately high runoff potentials (Groups B and C). About three percent of the surface is in the high runoff potential category (Group D).

The **TPCC** (Timber Production Capability Classification), in part, maps the BLM managed lands in accordance with the soils ability to sustain timber production and maintain its productivity. Areas with soils whose productivity can be substantially degraded through normal timber management or soils which have important limitations in obtaining successful forest regeneration are given a fragile designation of suitable or nonsuitable. Mitigation can be applied to those areas with a “suitable” designation to adequately protect the soil’s productivity and to get successful conifer regeneration. Mitigation can not get acceptable results in those areas with the unsuitable designation and are withdrawn from the timber base. **Table 6-6** gives the acreage breakdown of the different fragile groupings. A brief explanation of each is also given.

Table 6-6	TPCC Acres for Calapooya Creek										
	FSR	FSNW	FGR	FGNW	FPNW	FWNW	FGR/ RSR	FSR/ RSR	RSR	RSW	NR
Brown Mountain	0	40	260	0	7	29	68	9	27	1	1
Evans Butte	0	25	91	0	8	5	0	0	74	2	0
Nonpariel	35	41	221	0	40	9	30	0	11	0	6
North Calapooya	0	0	441	0	0	0	0	0	0	0	0
South Calapooya	0	64	518	1	0	0	0	0	0	0	0
TOTAL	**35**	**170**	**1531**	**1**	**55**	**43**	**98**	**9**	**112**	**3**	**7**

-FSR = Sites where soils are typically moisture deficient due only to soil physical characteristics such as shallow depths and high rock fragment contents. They generally have between 0.5 and 1.5 inches of water holding capacity in the top 12 inches. These sites are suitable for timber harvest when appropriate mitigation is applied.

-FSNW = Sites similar to FSR sites but have soils with water holding capacities of less than one inch. These sites are can not be mitigated to obtain satisfactory regeneration and are considered unsuitable for timber harvest.

-FGR = Sites on steep to very steep slopes that generally have moderate potentials for shallow, rapid landslides. Mitigation can be successfully applied to these sites to prevent unacceptable losses to soil productivity under forest management.

-FGNW = Sites on steep to very steep slopes that generally have high potentials for shallow, rapid landslides. Mitigation can not be satisfactorily applied to these sites to prevent unacceptable losses to soil productivity and are considered unsuitable for forest management.

-FPNW = Sites which have active, deep-seated slump-earth flow types of mass movements. They include areas where soil has been removed and are presently non-producing, or where the rate of movement has resulted in jack-strawed trees. Because of the rate of movement, forest management is not feasible on these sites.

-FWNW = These sites contain mostly water tolerant species. Conifer production is usually limited due to excessive groundwater. When disturbed, groundwater is altered resulting in unacceptable productivity losses and/or loss of water tolerant species. These sites are considered unsuited for timber management.

-RSR = These sites have gravel- sized or larger rock fragments capping the soil. These caps limit planting spot access and/or reduce conifer seedling survival. They can, however, be managed to meet minimum stocking levels of commercial species.

-RSW = These sites have gravel- sized or larger rock fragments capping the soil. These sites can not be managed to obtain acceptable planting spots and will not meet or exceed minimum stocking levels of commercial species.

-NR = Rockland where little soil exist.

The most common designation is FGR (about fourteen percent of the BLM managed lands). The heaviest concentration is along the Tyee Mountain-Yellow Creek Mountain scarp in the Tyee and Flournoy Formations.

B. ISSUE: SLOPE STABILITY

1. Key Questions:

-What is the relative landslide potential (hazard) based on slope class, geology, soils and land form features?

-What was the historic landslide distribution and what is the current landslide distribution? How is the distribution expected to change over time?

-What was the historic landslide magnitude and what is the current magnitude and expected trend of landslide events in the watershed?

-What Anthropogenic activities (i.e. roads, timber harvest methods and rangeland/pasture practices) and natural processes affect/affected landslide initiation, rate, magnitude and delivery?

-What is the relationship(s), adverse and beneficial, between landslide events and surrounding ecosystems (e.g. aquatic ecosystem)?

2. Discussion

During the course of this discussion some information and conclusions will be drawn from Weyerhaeuser's thorough treatment of the subject in their Upper Calapooya Creek Watershed Analysis, September 97. The landslide terminology used in their report will largely be used here to avoid confusion.

-shallow, rapid landslides (called debris avalanches in our earlier watershed analysis reports); These involve only the soil mantle or the soil mantle and a thin layer of bedrock underneath.

-debris flows may develop from shallow, rapid landslides when their mass becomes sufficiently saturated to become a viscous flow of water , soil, rock and organic debris. Debris flows commonly form when shallow landslides move into stream channels.

-small, sporadic deep-seated landslides and large, persistent deep-seated landslides; Deep-seated landslides are generally slow or sporadic mass movements, usually larger and deeper than shallow slides, potentially covering acres of the landscape. The depth of these slides can be in excess of 10 feet, depending on unconsolidated or weathered material depth. The slides are generally inactive, but can be mobilized by undercutting of mid slopes and toe slopes. Some of these features have been called slump/earth flows in our earlier watershed analysis.

Other sources used are The Elkton-Umpqua WAU watershed analysis and Storm Impacts and landslides of 1996, Progress report on Oregon Department of Forestry Studies.

a. Key Question Related to Landslide Potential:

-What is the relative landslide potential (hazard) based on slope class, geology, soils and land form features?

Potential or Risk of landslides as used in this report is defined below. It is based on regeneration harvest prescriptions.

Low Potential = 0 to 10 percent chance of failure
Moderate Potential = 10 to 30 percent chance of failure
High Potential = greater than 30 percent chance of failure

Slope steepness is one of the most important factors influencing slope stability. It is used in this report as the first division in risk categories. The slope map (**Figure 6-1**) can be used as a general overview of risk. Note that due to contour line inaccuracies and other reasons a small percentage of the areas shaded dark green (35 to 70 percent slope) contain slopes greater than 70 percent.

0 to 35 percent slope = Low potentials

35 to 70 percent = Low to moderate potentials; Moderate potentials may exist where other factors favoring slope instability are present. High potentials, if present, are widely spaced across the landscape.

Greater than 70 percent = Moderate to high potentials; These potentials commonly exist where other factors favoring slope instability are present.

Other factors which influence slope stability are:

-Soil Pore Pressure

-Topographic Position: Positions which favor convergence and concentration of moisture such as head walls, hollows, swales and inner gorges of streams generally pose higher risks than planar and convex upland slopes. Where slopes are greater than 70 percent high potentials of landslides can occur in head walls, hollows, swales and inner gorge positions.   Where slopes are greater than 80 percent high potentials of landslides can occur on upland planar and convex sites.

-Soil Depth: The potential of failure increases with increasing soil depth. Five feet seems to be a critical soil depth threshold.

-Soil Shear Strength

-Soil Cohesion: Low cohesion soils are at greater risk for shallow, rapid landslides. Very deep cohesive soils high in clay can be at risk for deep-seated slump/earth flows.

-Rock Fragment content: High rock fragment content generally helps slope stability.

-Competency of the bedrock.

-Strike/Dip of rock strata. There may be slightly higher landslide potentials associated with harvesting where slopes are closely oriented with the direction of the dip. The potential increases with increasing angle of dip. The contact between strata can be a slip plane or can be an impermeable contact over which subsurface flow travels to daylight downslope. Road cuts into dipping strata can result in failures.

-Vegetation

The period of greatest period of vulnerability to landslides after a regeneration timber harvest or other stand replacement event appears to be the first ten years as determined in the ODF 1996 storms study. This vulnerability declines in the 10 to 30 year period and is lowest in 30 to 100 year period. The vulnerability may increase somewhat from the 30 to 100 year period in the older, more mature stands. Weyerhaeuser's landslide inventory showed similar results.

The Tyee Mountain-Yellow Creek Mountain scarp on the western fringe of the Calapooya Watershed (The Tyee Formation and the similar Flournoy Formation) and the scarps and stream canyons of the Western Cascades (Fisher-Colestin and Little Butte Formations) have high densities of very steep , highly dissected slopes.   These locations .probably have the highest concentration of moderate to high landslide potentials, mainly of the shallow, rapid variety and debris flow variety.   The highest acreage of FGR TPCC occur along the Tyee Mountain-Yellow Creek Mountain scarp. In the Oregon Department of Forestry study of the 1996 storms, the three study sites with the highest landslide frequency were all located in the Tyee Sandstone.   A high density of shallow, rapid landslides and debris flows were identified in the Weyerhaeuser Upper Calapooya watershed analysis in parts of the northern Brown Mountain subwatershed.

The Roseburg, Fisher-Colestin, and Little Butte Formations probably have the highest potentials for sporadic, deep-seated slump/earth flow movements because of large concentrations of very deep, clayey soils and subsurface flow characteristics.   The Upper Calapooya watershed analysis identified a number of small sporadic and large, persistent deep-seated landslides, the largest being greater than 400 acres in size.

b. Key Questions, Historic Landslide Distribution, Frequency, Magnitude, and Cause:

-What was the historic landslide distribution and what is the current landslide distribution?

-How far is the distribution expected to change over time?

-What was the historic landslide magnitude and what is the current magnitude and expected trend of landslide events in the watershed?

-What Anthropogenic activities (i.e. roads, timber harvest methods and rangeland/pasture practices) and natural processes affect/affected landslide initiation, rate, magnitude and delivery?

An aerial photograph landslide inventory for the Calapooya watershed was done to only cover the period of mid 1989 to mid 1994. Time constraints did not allow an inventory to be conducted which covered the full time period of our aerial photo coverage. To date the historical distribution of landslides on forested land has been quite similar for all watersheds in which a watershed analysis has been completed. There is no reason to suspect that Calapooya watershed would be any different. The Elkton-Umpqua WAU watershed analysis is to the immediate west of the Calapooya watershed and is in the Tyee, Flournoy and Elkton Formations. An aerial landslide inventory was done for it covering the period of 1959 to 1994. It exhibits the typical landslide distribution through time. Ninety four percent of the cumulative landslide area occurred from mid 1959 to mid 1983. The biggest spike covered the period of the 1964 storm (mid 1964 to mid 1970). The high percentages probably are attributed, in part, to the precipitation patterns including the rain-on-snow 1964 storm, high levels of road construction and harvest and the forest management practices of the time. Practices included side casting of road cut material on steep slopes. Debris flows (torrents) and dam break floods would deliver large volumes of material thousands of feet to streams and radically alter the stream structure. The longest debris flow/dam break flood feature in Elkton-Umpqua survey traveled 7,400 feet.

From mid 1983 to mid 1989 only five percent of the cumulative landslide area occurred. The figure reduced to one percent for the last period (mid 1989 to mid 1994). The trend corresponded with declining levels of road construction and harvest, better forest management practices and the onslaught of protracted drought. Another factor contributing to the decline might have been the large reduction of unstable conditions by the failures induced by earlier storms. Landslide activity has increased in the following years with the return of above normal precipitation and intense storm events.

Sixty six landslides covering the 1989 to 1994 drought period were identified and mapped in the Calapooya landslide inventory. Only 22 of the landslides were greater than 0.1 acres in size. That equates to one landslide larger than 0.1 acre for every 7140 acres of land in the watershed . Apparently the Calapooya watershed followed the same trend of a big decline in landslide activity and volume during this period. The size of the landslides includes both the zones of depletion and accumulation. None were larger than two acres. Only landslides greater than 0.1 acre are tabulated in this report since there are many problems in identifying small landslides. The survey seems to indicate the following for this period:

-Shallow, rapid landslides were the most common, followed by flows and then sporadic, deep-seated landslides.

-The landslides identified were related to roads, timber harvesting and pasture lands. The highest percentage were pasture lands related.

-The landslides were distributed across all of the slope groupings in **Figure 6-1** except 0 to 5 percent. The slope groupings only reflect where the initiation point of the landslides plot on the 7.5 minute USGS contour maps and do not necessarily reflect the true slope. A number of the landslides likely fall in small, steeper inclusions not reflected by the contours.

- The landslides occurred in most of the geologic formations.
  50 percent on Roseburg sedimentary rocks
  23 percent on the Flournoy Formation
  9 percent each on the Roseburg volcanic, Colestin-Fisher Formation and Little Butte Formation

-The most common mix of characteristics is the occurrence of pasture related landslides on the Roseburg sedimentary rocks in the 5 to 35 percent slope zones. The reasons for the large percentage of landslides on this gentle topography may be tied to the nature of pasture land, the high shrink-swell capacities of the clays commonly occurring in this formation and the subsurface drainage.

-Road and harvest related landslides were most common in the 70 to 84 and the 85 to 130 percent slope zones. The Flournoy Formation had the greatest number of landslides in this grouping.

The Calapooya watershed most likely has seen a substantial increase in landslide activity during the wet seasons following 1994. Intense storms such as the November 19, 1996 storm produce high frequencies of the shallow, rapid and debris flow variety. Prolonged precipitation over a wet season encourages deep-seated earth flows to occur. There is speculation in the meteorology profession that the region may be in a protracted wet cycle which could last twenty years. If the scenario of the protracted wet cycle proves correct, landslide activity may continue at relatively high levels. Sediment delivery might not reach levels attained during the fifties through 1983 because much of the unstable ground in the forest and on harvested slopes and also on unstable ground created by roads have already failed. Inadequate road maintenance would likely be an important contributor to failures in the future, however. A protracted wet cycle could encourage some large deep-seated landslides to activate as ground water storage steadily increase.

c. Key Question Related to Consequences to Landslides:
-What is the relationship(s), adverse and beneficial, between landslide events and surrounding ecosystems (e.g. aquatic ecosystem)?

Landslides provide valuable components of large woody debris and rock fragments to the stream structure. Debris flows/torrents are a major delivery mechanism. Replenishment of these components over time in a stream system is necessary. The distribution of this delivery over time and space is important so that fish habitat in a watershed is not overwhelmed by the negative "short-term" impacts such as siltation of spawning beds which can result from landslide activity. Soils in the watershed on slopes with landslide potentials have loamy and clayey textures. Rock fragment content of the soil is highly variable. In many areas landslides would deliver soil material low in rock fragments but high in silt, thus having little long-term benefits for rock fragment structure and high short-term negatives. When considering the impacts to the whole ecosystem the reduced productivity of the land scarred by the landslides would need to be factored in.

C. ISSUE: SOIL CHARACTERISTICS/SOIL PRODUCTIVITY

1. Key Questions:

-What soil types are most at risk to soil productivity losses and to erosion/mass wasting from management activities and why?

-What anthropogenic activities (example, ground-based compaction) affects/affected soil productivity, erosion and sedimentation? What is the extent and distribution of this anthropogenic influence?

2. Discussion:

a. Key Question Related to Soil Types:

-What soil types are most at risk to soil productivity losses and to erosion from management activities and why?

Shallow (10 to 20 inches to bedrock) and very shallow soils (less than 10 inches to bedrock) are very sensitive to soil productivity losses through to compaction, puddling, erosion, mass wasting ,and hot prescribed burns. Because there is relatively little soil material to begin with, losses can translate into significant productivity losses. They are very susceptible to high erosion rates under bare soil conditions because of high runoff potentials (hydrologic Group D). They often occur on steep slopes where the risks are higher for damaging hot prescribed burns. **Figures 6-4** and **6-5** shows where the highest concentration of these soils are located. They tend to be associated with rock outcrops. Many rock outcrops, in fact, actually have a thin veneer of soil and moss over them.

Large concentrations of very shallow soils would fall under the TPCC withdrawal of FSNW where there would be regeneration problems due to very low soil water holding capacities (About 1.5 percent of BLM managed lands. Some of the shallow soils would be included under FSR (About 0.4 percent of the BLM managed land as currently mapped). The actual acreage of FSR is likely higher.). FSR soils have low water holding capacities but satisfactory conifer regeneration is possible with best management practices. About 1.8 percent of the BLM managed lands have soil surfaces covered by gravel and cobble which could make proper planting difficult (RSR and RSW).

All soils are susceptible to damaging compaction with multiple passes of ground-based equipment. Soils with porous, loamy surfaces low in rock fragments are very susceptible to compaction under a wide range of moisture conditions with few passes. Clayey surfaces would be less susceptible under the drier soil moisture conditions with few passes but can be very susceptible under the intermediate moisture ranges. This is especially true of the high shrink-swell clays commonly found in the Roseburg Formation. Loamy surfaces are very common in the watershed. Surfaces with clay textures are usually the result of topsoil displacement through road construction, skidding or other man-made disturbances. Clayey subsoils are quite common throughout the watershed. They are most common in the gentle to moderate slope ranges. Compaction is not as high under the high moisture ranges as is in the intermediate ranges, but under high moisture conditions most soils are very sensitive to puddling which destroys soil structure and seals surfaces.

The low cohesion soil textures with high contents of very fine sands and silts and with low rock fragment content are the common textures most susceptible to erosion and mass wasting . They are loams, silt loams and silty clay loams). They are common on all slope ranges throughout the watershed. A high erosion condition which is common in the Roseburg district is un-surfaced roadbeds and ditch lines on moderate to steep grades and in deeper soils with these textures. These roads when open to vehicle traffic produce large quantities of sediment. Deeper soils with these low cohesion textures present higher potentials for rapid, shallow failures especially in the topographic positions which concentrate moisture on slopes greater than 70 percent. The potentials on BLM managed lands are greatest where mapped FGR (14 percent of the area) .

Very Deep, high cohesion soils have the highest potentials for deep-seated slump-earth flow activity where subsurface moisture conditions are favorable. Typical subsoil textures are clays and silty clays. About 0.5 percent of the BLM managed surface under TPCC FPNW have soils withdrawn due to high potentials for deep-seated movements. Road construction would pose the greatest risks.

Soils which have poorly and somewhat poorly drainage would be sensitive to disturbance. This is about nine percent of the BLM managed surface. The TPCC identifies about 0.4 percent of BLM managed surface as being forest land with severe soil drainage constraints to regeneration and consequently withdrawn (FWNW).

All soil on slopes greater than 70 percent are at greater risk to damaging hot prescribed burns . This is especially so on south facing slopes. The column of fire can destroy high levels of organic matter in and on the soil surface, destroy the surface soil's structure and friable consistency, cause unacceptably high losses of nutrients and put the soil at great risk to erosion and mass wasting.

b. Key Question Related to Soil Productivity, Erosion, and Sedimentation:

-What anthropogenic activities (example, ground-based compaction) affects/affected soil productivity, erosion and sedimentation?

-What is the extent and distribution of this anthropogenic influence?

The following statements have generally applied to the forested land within the Roseburg District. Anthropogenic activities and influence on forest soils have been extensive. Roads have been a major contributor to surface erosion, mass wasting productivity losses and sedimentation to streams. Prior to about 1983 a high density of haul roads were built using practices more impacting than current practices including side casting on steep slopes, widely spaced drainage features, under-sized culverts and not surfacing with rock. Considerable amounts of land was taken out of production by roads. Most of the high impacting valley bottom and mid slope roads were constructed during this period.

Logger's choice tractor yarding and tractor piling occurred on a very high percentage of the near level to gentle ground. High levels of compaction, soil displacement, erosion and sedimentation were common. A fair amount of moderately sloping ground was tractor yarded on slopes up to 70 percent. This usually resulted in a less dense pattern of skid trails but this necessitated a high percentage of them being bladed, many with cuts of 10 feet or more. In many cases, the trails went directly up the slope. Probably little attention was given to drainage. Recovery of the productivity lost will be a slow, ongoing process. Compaction can persist 40 years or more. Surface horizon development is also a slow process.

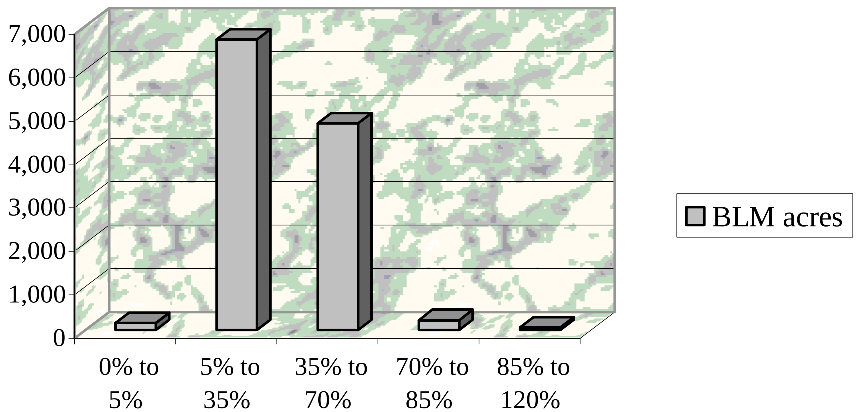
Harvesting and roads have generally resulted in accelerated rates of landslides which leave zones of depletion less productive and often resulted in large inputs of sediment into streams. Other practices such as prescribed fire often had substantial impacts to productivity, erosion and mass wasting . The most impacting periods were prior to 1983.

Currently forest soils are being impacted to a lesser degree than during the fifties through early eighties. On BLM managed surface the greatest impacts may be coming from older roads which still receive traffic and are in need of renovation and improvements or, if no longer needed, reclamation. A road risk assessment was conducted in the Calapooya watershed on BLM controlled roads. The recommendations from that assessment are in the in the **Restoration Opportunities and Management Recommendations** section below.

An important aspect to soil productivity loss is new road construction. Most new roads are short temporary spurs at or near ridgetop positions. Subsoiling would help restore varying degrees of the productivity loss, depending on how much and what kind of soil material remains in the roadbed. In-unit harvesting would also add to the cumulative soil impacts. However, with appropriate soil management prescriptions and best management practices the impacts from both new road and in-harvest impacts to soil productivity should be within acceptable limits according to the SEIS, Volume I on page 3&4-112.

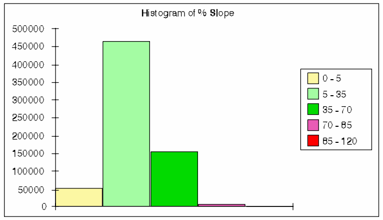
Table 6-1	Calapooya Creek Watershed Slope Classes			
Slope Class		BLM acres	Private acres	Total acres
Nearly Level	0% to 5%	163	14,613	14,776
Gentle	5% to 35%	6,700	98,699	105,399
Moderate	35% to 70%	4,767	29,914	34,681
Steep	70% to 85%	230	1,542	1,772
Very Steep	85% to 120%	63	368	431

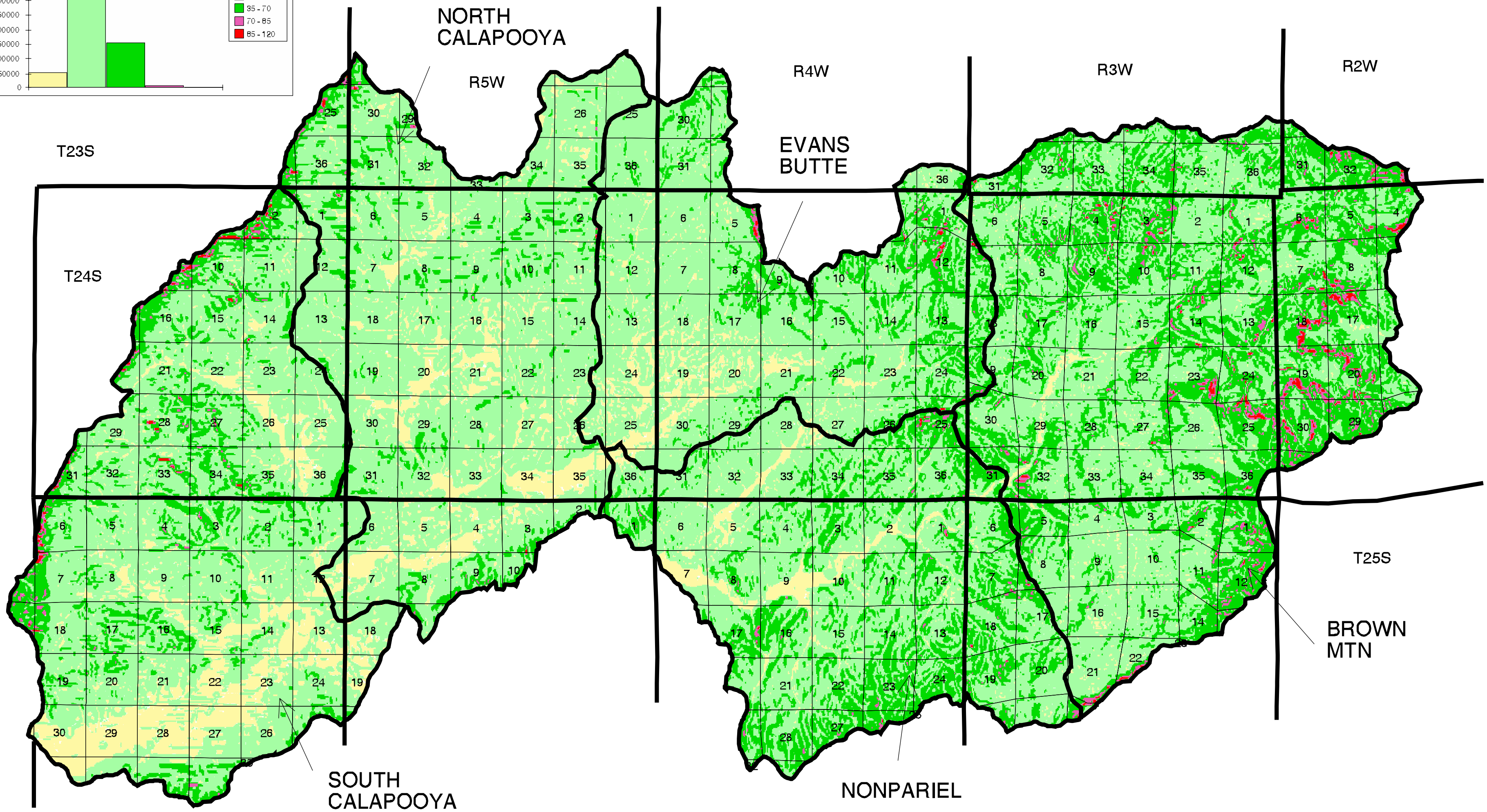
Chart 6-1 Slope Classes BLM Lands



Calapooya Creek Watershed - % Slope Map

Figure 6-1





Scale 1:200000

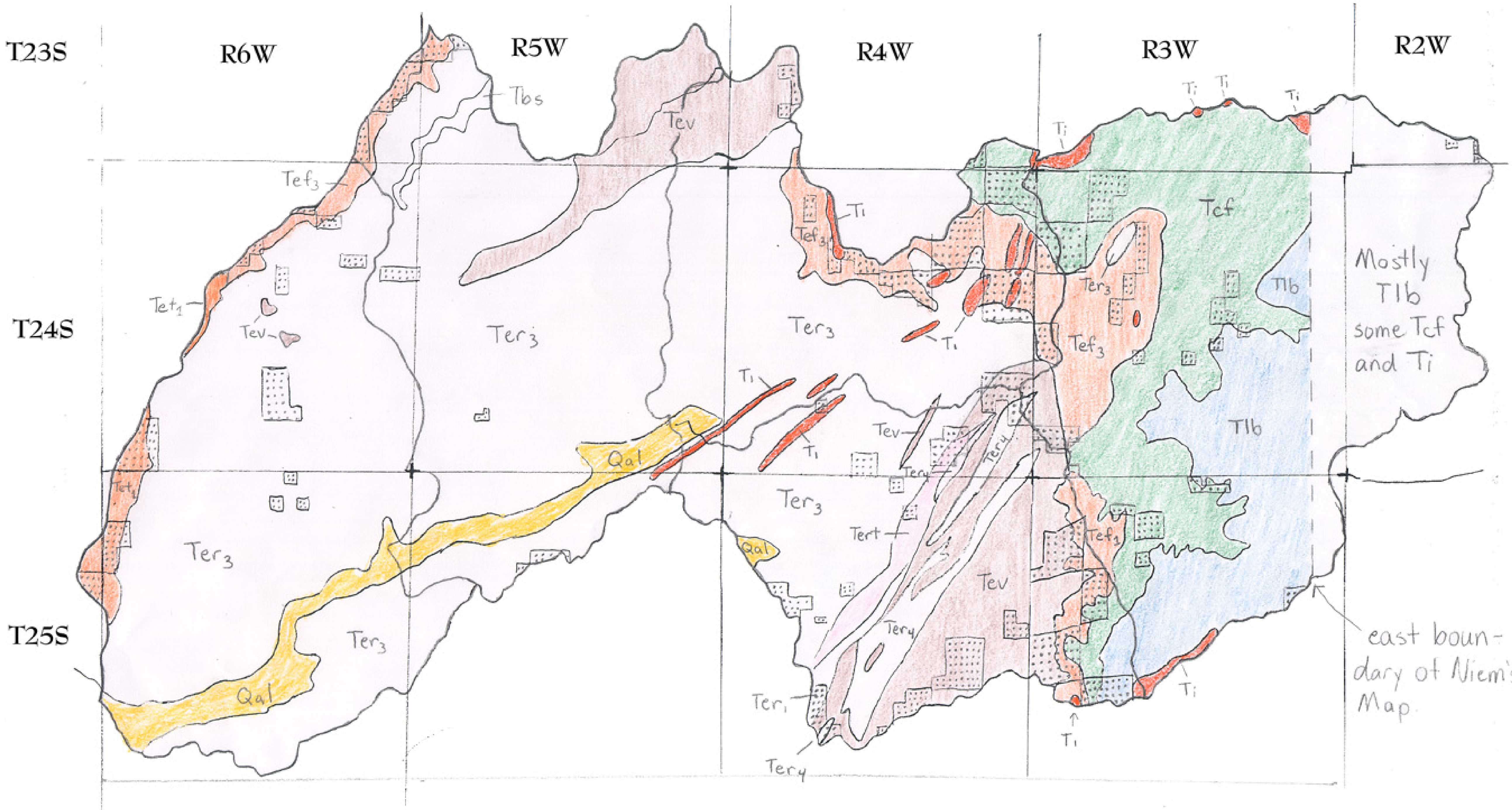
1 0 1 2 3 4 5 6 Miles

% Slope of Calapooya
- 0 - 5
- 5 - 35
- 35 - 70
- 70 - 85
- 85 - 120

N

Calapooya Creek Watershed - Geologic Formations

Figure 6-2



Geologic Formations of Calapooya Creek WAU*

Sedimentary Rock

Qal	Quaternary Alluvium (Holocene & Pleistocene)
	Flournoy Formation of Baldwin (lower to middle Eocene)
Tef1	Whitetail Member
Tef3	Siuslaw Member
	Tyee Formation of Baldwin (middle Eocene)
Tet1	Tyee Member
	Roseburg Formation of Baldwin (Paleocene to lower Eocene)
Ter2	Middle Fan Facies
Ter3	Outer Fan & Fan Fringe Facies
Ter4	Slope Mudstone
Tlb	Basaltic Sandstone

* From Comilation Geologic Map of the Southern Tyee Basin, Southern Coast Range, Oregon by Alan and Wendy Niem,

Igneous Rock

	Roseburg Formation
Tev	Roseburg Volcanics
Tert	Tuffs
Ti	Tertiary Intrusive Rocks
Tcf	Undifferentiated Colestin & Fisher Fmtn (upper Eocene)
Tlb	Little Butte Volcanic Series (Oligocene)

Calapooya Creek Watershed - Geologic Structure/Strike-Dip

Figure 6-3

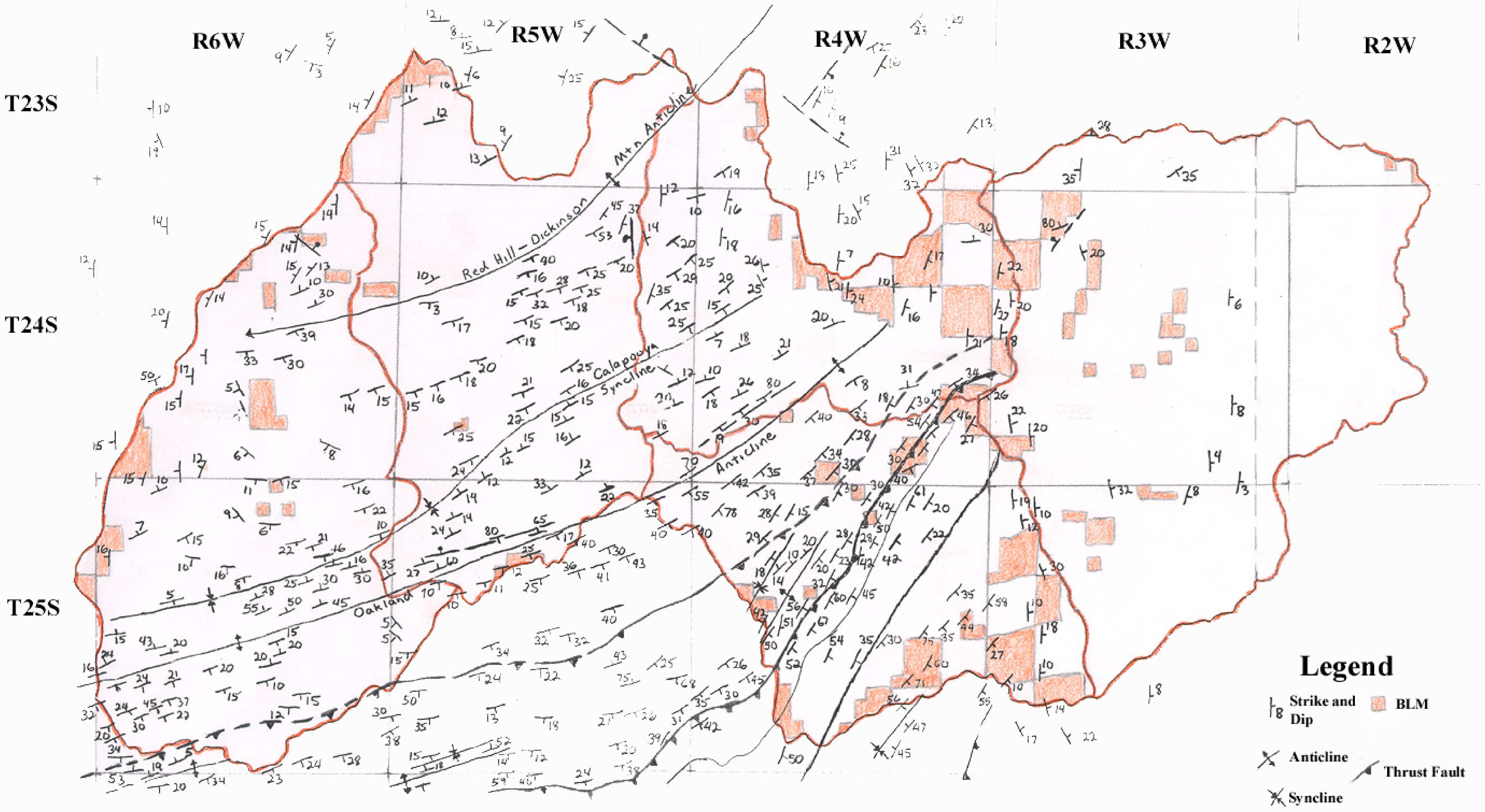


Table 6-2	**Calapooya Creek Watershed Soil Depth Classes**			
Soil Depth Class		BLM acres	Private acres	Total acres
Very Shallow	< 10"	13	2,266	2,279
Shallow	10 to 20"	230	4,783	5,013
Mod. Deep to Deep	20 to 60"	5,969	65,442	71,411
Very Deep	> 60"	5,746	72,751	78,497

Chart 6-2 Soil Depth Classes BLM Lands

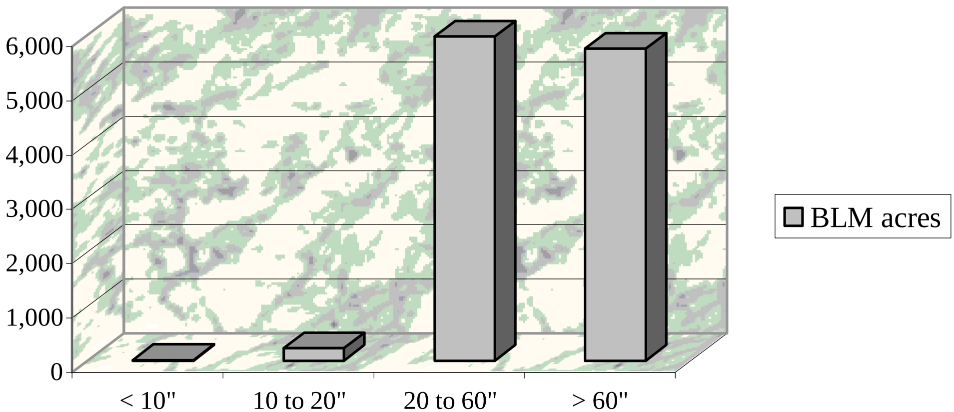
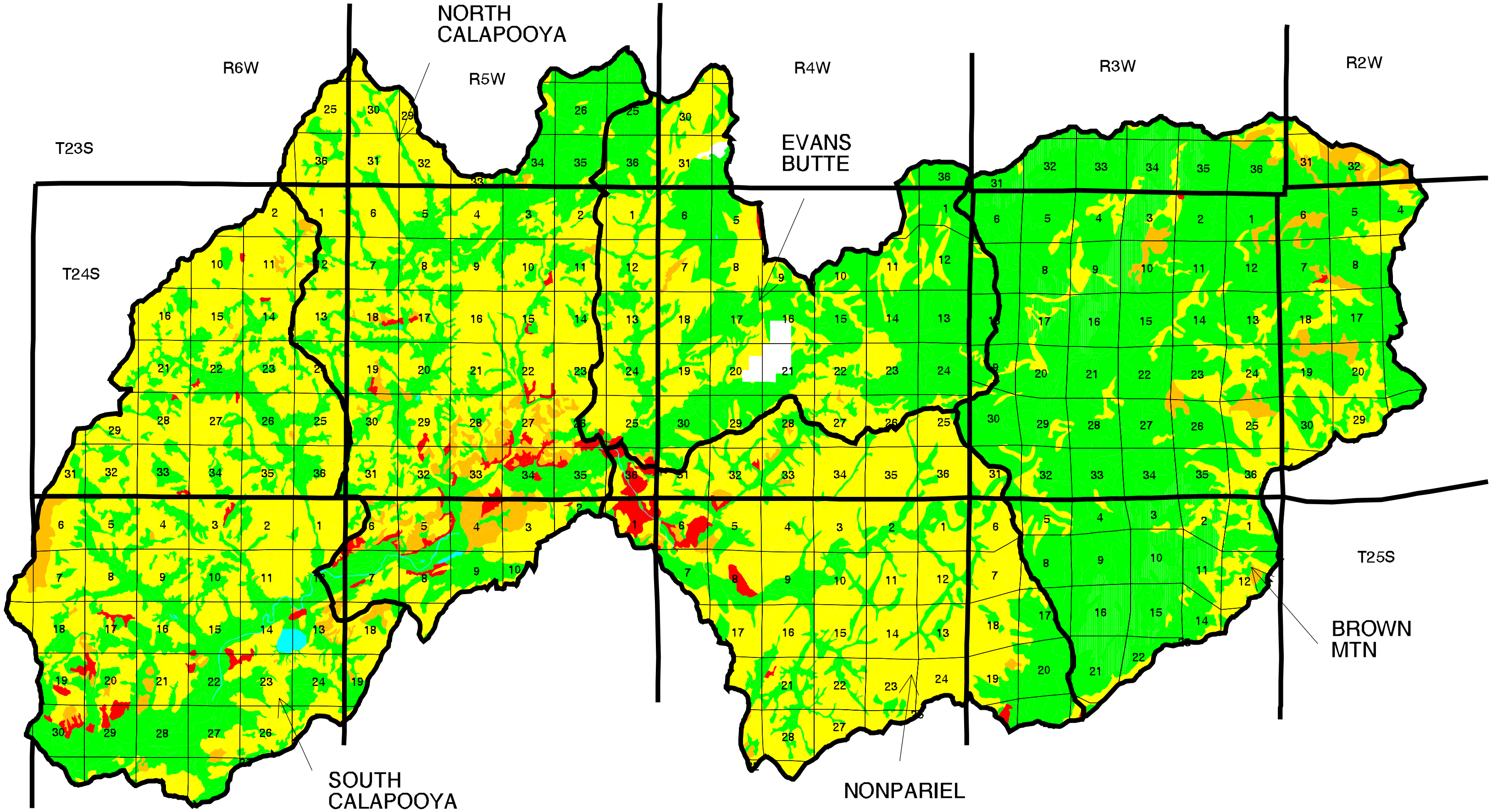


Figure 6-4

Calapooya Creek Watershed - Average Soil Depth



No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data was compiled from various sources. Spatial information may not meet National Map Accuracy Standards. This information may be updated without notification.

Scale 1:200000

1 0 1 2 3 4 5 6 Miles

- Very Shallow
- Shallow
- Mod. Deep/Deep
- Very Deep
- Water

N

Table 6-3 Calapooya Creek Watershed Rock Outcrop as Major Component			
	BLM acres	Private acres	Total acres
Area with Rock Outcrop as a Major Component	13	2,266	2,279
Area with Rock Outcrop NOT as a Major Component	5,746	72,751	78,497

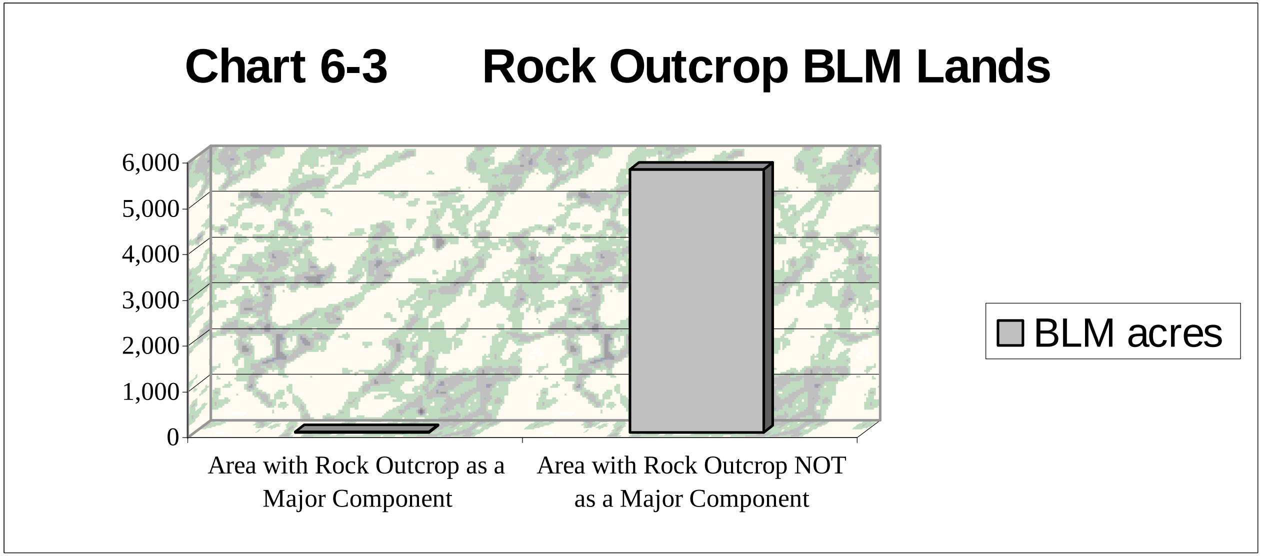
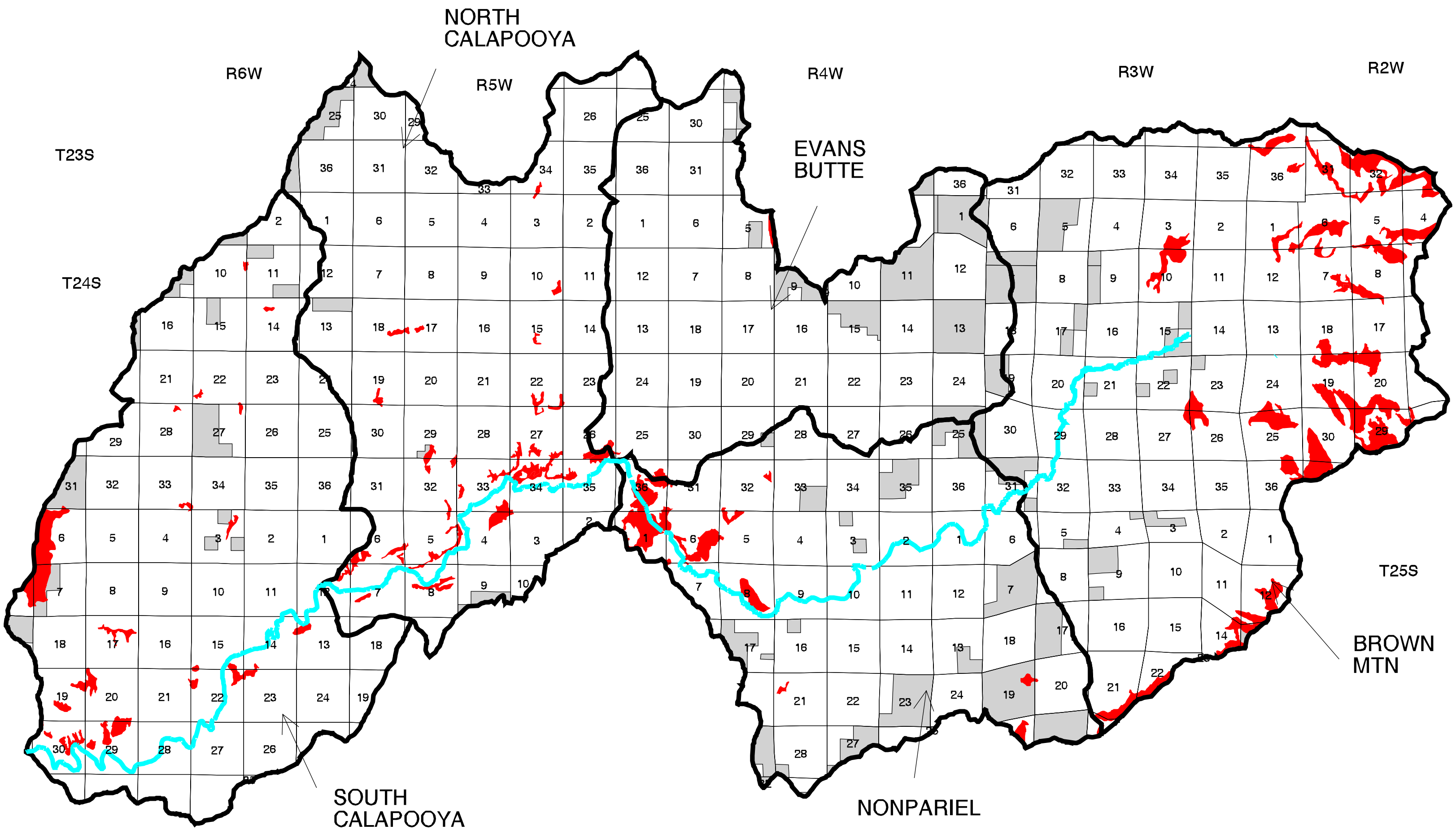


Figure 6-5

Calapooya Creek Watershed

Areas with Rock Outcrop as a Major Component



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Scale 1:200000

1 0 1 2 3 4 5 6 Miles

Rock Outcrops

BLM

N

Table 6-4	**Calapooya Creek Watershed Soil Drainage**		
Soil Drainage Class	BLM acres	Private acres	Total acres
Flood Plain	5	3,063	3,068
Poorly Drained	44	8,614	8,658
Somewhat Poorly Drained	1,042	8,441	9,483
Well-Mod., Well-Excessively Drained	10,866	125,118	135,984

Chart 6-4 Soil Drainage Classes BLM Lands

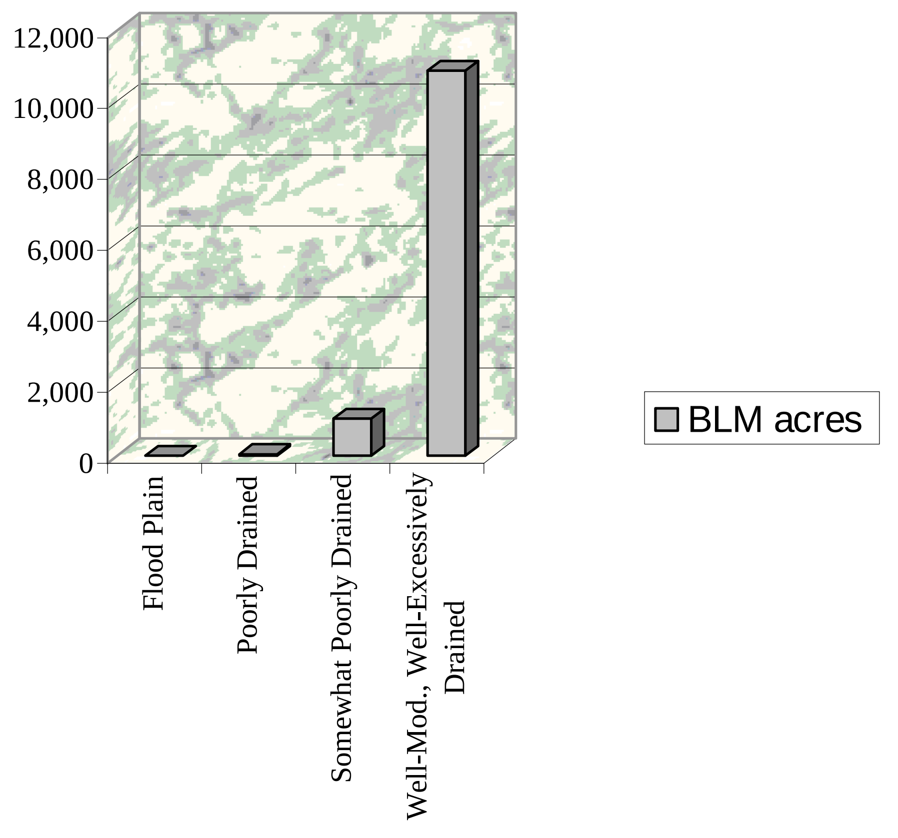
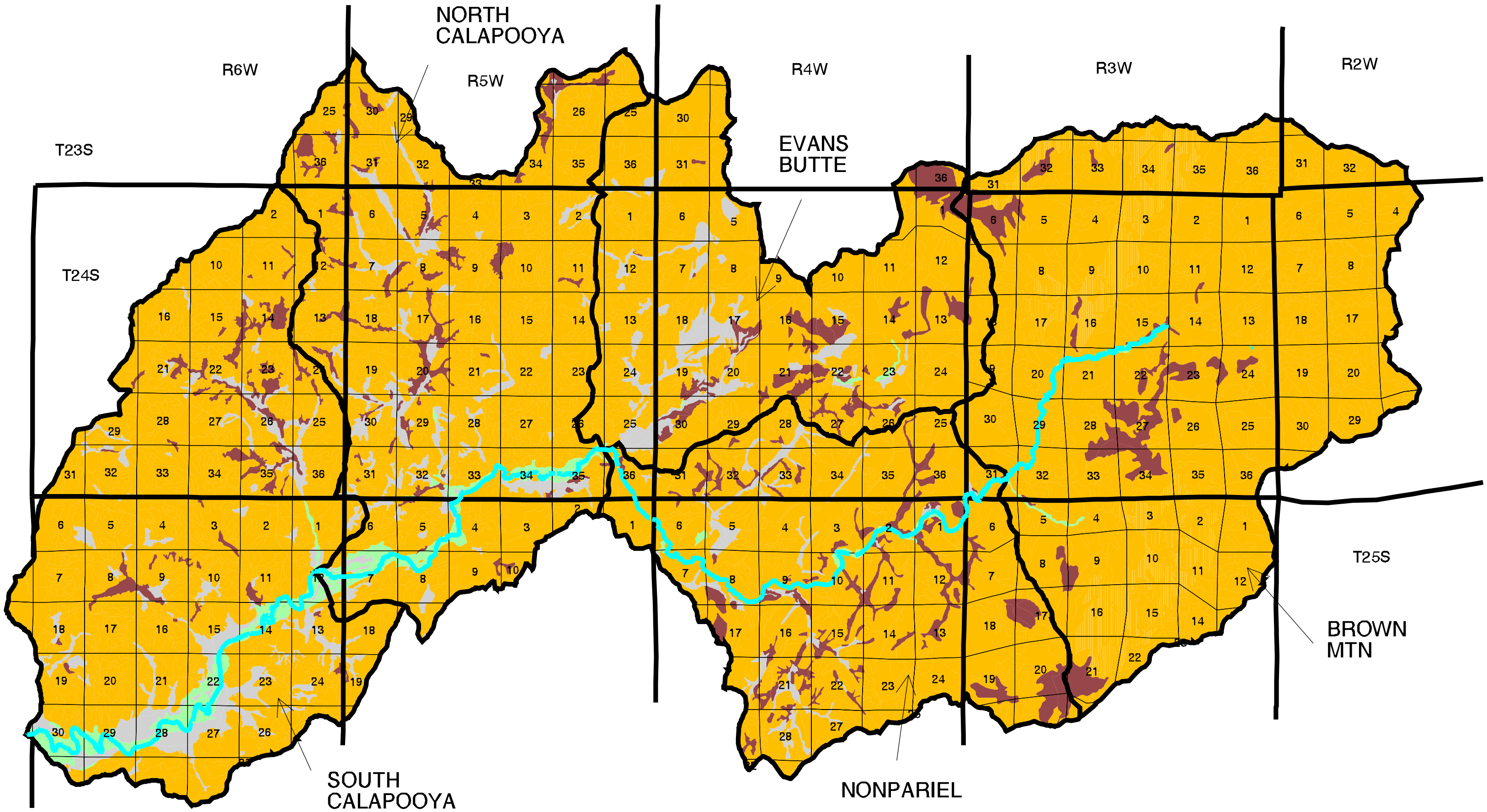


Figure 6-6

Calapooya Creek Watershed - Soil Drainage



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Scale 1:200000

1 0 1 2 3 4 5 6 Miles

- Flood Plain-Soils of Various Drainage
- Poorly Drained
- Somewhat Poorly Drained
- Well Drained, Mod. Well Drained, Excessively Drained
- Water

Table 6-5 Calapooya Creek Watershed Soil Hydrologic Group			
Soil Hydrologic Group	BLM acres	Private acres	Total acres
B. Mod. Infiltration Rate, Mod. Low Runoff Potential	7,733	68,683	76,416
C. Slow Infiltration Rate, Mod. High Runoff Potential	3,901	53,622	57,523
D. Very Slow Infiltration Rate, High Runoff Potential	321	22,935	23,256

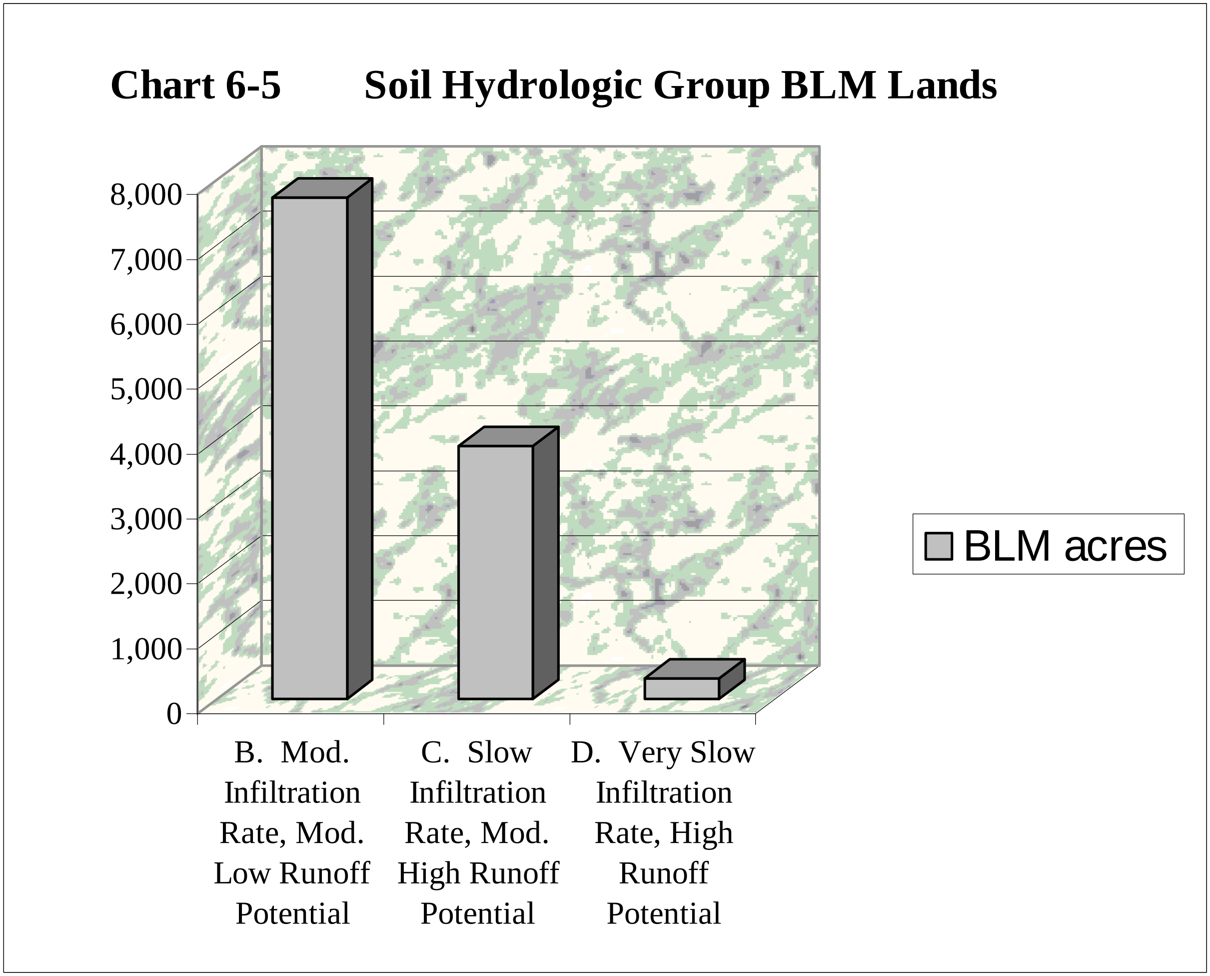
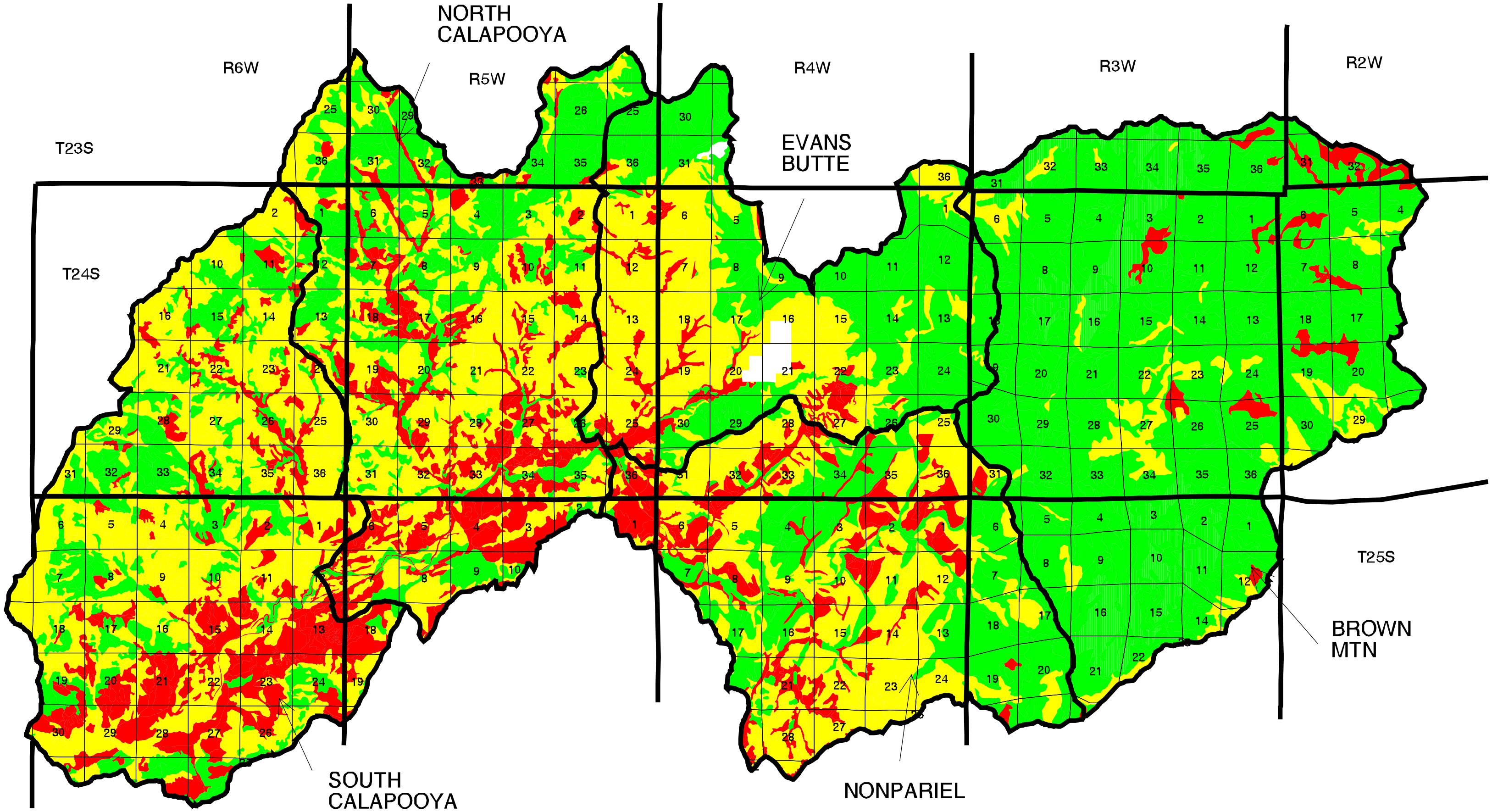


Figure 6-7

Calapooya Creek Watershed - Hydrologic Group



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Scale 1:200000

1 0 1 2 3 4 5 6 Miles

B-Moderate Infiltration Rate
Moderately Low Runoff Potential

C-Slow Infiltration Rate
Moderatley High Runoff Potential

D-Very Slow Infiltration Rate
High Runoff Potential

N

AQUATIC HABITAT AND FISH

A. Key Questions

-What is the distribution of fish species and what species are present?
-How could thinning within the riparian reserves enhance future stand development towards late successional characteristics and also help fish populations?
-Which stream reaches are needing CWD left during riparian reserve treatments?
-What specific road segments could be decommissioned, repaired or modified to reduce risks to aquatics?

B. Fish Distribution and Species Present

Figure 7-1 shows fish distribution for the Calapooya watershed. This map is based on the most current knowledge as compiled by the Oregon Department of Fish and Wildlife. Fish distribution is underestimated on this figure. **Table 7-1** lists the fish species present in the Calapooya watershed. This information is based on fish caught in a rotary screw trap operated near the mouth of Calapooya Creek by BLM personnel.

Table 7-1 Fish species present in the Calapooya watershed.

Native species			
Common name	Scientific name	Common name	Scientific name
steelhead	*Oncorhynchus mykiss*	bluegill	*Lepomis macrochirus*
coho salmon	*O. kisutch*	brown bullhead	*Ameiurus nebulosus*
chinook salmon	*O. tshawytscha*	largemouth bass	*Micropterus salmoides*
cutthroat trout	*O. clarkii*	smallmouth bass	*Micropterus dolomieu*
Umpqua chub	*Oregonichthys kalawatseti*	yellow perch	*Perca flavescens*
Pacific lamprey	*Lampetra tridentata*		
Umpqua dace	*Rhinicthys cataractae*		
sculpin	*Cottus sp.*		
redside shiner	*Richardsonius balteatus*		
speckled dace	*Rhinicthys osculus*		
Umpqua pikeminnow	*Ptychocheilus umpquae*		
largescale sucker	*Catostomus macrocheilus*		

C. Coarse Woody Debris and Riparian Reserve Management

1. Overall Characterization of Riparian Habitat

a. Stream Habitat

Table 7-2 shows Oregon Department of Fish and Wildlife (ODFW) survey data of stream habitat by specific stream reach. The list of streams surveyed by ODFW is not extensive but it does cover a wide range of habitat found in the Calapooya watershed.

b. Riparian Vegetation

A riparian area is a transition between the aquatic and terrestrial environment where micro climate and vegetation are strongly influenced by the aquatic component. Riparian Reserves include the riparian area, the aquatic environment, and the terrestrial component immediately upslope. Riparian Reserve widths are based on the height of a dominant mature tree. Riparian reserves and riparian areas within Late Successional Areas serve several functions in the NFP (USDA, et al. 1994:B-13):

> "...Riparian Reserves are used to maintain and restore riparian structures and functions of intermittent streams, confer benefits to riparian-dependent and associated species other than fish, enhance habitat conservation for organisms that are dependent on the transitions zone between upslope and riparian areas, improve travel and dispersal corridors for many terrestrial animals and plants, and provide for greater connectivity of the watershed... provide a high level of fish and riparian protection..."

Figures 7-2 and 7-3 as well as **Charts 7-1 and 7-2 and Tables 7-3 through 7-10** show the past and present vegetation conditions across the Calapooya watershed in riparian type habitat. Private lands are portrayed according to Oregon Forest Practices rules and federal lands are portrayed according to the Riparian Reserve system within the NFP. This data was compiled using the satellite imagery as explained under the previous **Vegetation** section. The same limitations that applied under the vegetation section also apply to this data. (See pages 3-1 and 3-2 under the **Vegetation** section for a discussion of the strengths and weaknesses of the data.)

2. Characterization of Coarse Woody Debris (CWD) in Riparian Reserves

a. CWD in Streams

Woody debris is critical for properly functioning stream channels. It provides numerous benefits including important habitat forming functions. Coarse woody debris (CWD) is especially important because it has a higher probability to influence the hydrologic processes and remains in the stream system longer. **Tables 7-11** and **7-12** give guidelines for appropriate amounts of CWD in streams. Lack of woody debris in managed forest stands is well documented. To characterize stream CWD in the Calapooya watershed, the ODFW data in **Table 7-2** shows that every reach sampled is lacking large woody debris.

Table 7-11 ODFW and USFS guidelines for CWD pieces per mile of stream.

Agency	Definition	Excellent	Good	Fair	Poor
ODFW	0.6m dia, 10m long (24" dia., 33 ft long)	>29 pieces	20-29 pieces	11-19 pieces	<11 pieces
USFS	24" dia., 50 ft long	>69 pieces	45-69 pieces	31-44 pieces	<31 pieces

Table 7-12 NMFS guidelines for CWD.

Definition	Properly Functioning	At Risk	Not Properly Functioning
24" dia., 50 ft long	>60 pieces	30-60 pieces	<30 pieces

b. CWD Outside Stream Channels but Within Riparian Reserves

Table 7-13 is a general characterization of CWD components for stands that are less than 100 years old on the Roseburg District. These are either un-managed young stands or stands that were harvested and received no other treatments. Many of the stands harvested in the 1950s had large amounts of snags and CWD left on the site because of a lack of commercial value.

Table 7-13 Roseburg District Stand Conditions[1]
(from CFI plots, Stand Age 40-99 Years)

Major Plant Group (% Area in Watershed)	# of Plots	Types of Coarse Woody Debris							
		Sound/acre		Soft/acre		Rotten/acre		Total/acre	
		ft^3	Tons	ft^3	Tons	ft^3	Tons	ft^3	Tons
Mixed Conifer-Interior Valley-Grass (42%)	30	107	1.6	380	5.7	520	7.8	1007	15.1
Douglas fir-Mixed Brush-Salal (56%)	22	26.7	0.4	160	2.4	787	11.8	973	14.6

Cubic feet/ acre converted from tons/ac based on 30 lbs/ft^3 for D-fir @ 12% moisture

The following tables characterize CWD as it may occur in natural old growth stands. There is great variability as shown by the tables in the amount of CWD in natural stands.

Table 7-14 is based on published research to describe CWD in Douglas-fir forest in western Oregon and Washington (Spies *et al* 1988), and a masters thesis on riparian vegetation and abundance of woody debris in streams of southwestern Oregon (Ursitti, 1990).

[1]Down Log and Snag Component Analysis Tables, Roseburg District BLM, August, 1991

Table 7-14 Range of Down Wood in Un-managed Forests, Oregon Coast Range (Stand Age 80 - 150 Years)

Coarse Woody Debris	**Within** 180 Feet of Perennial Stream (Ft.^{3}/ Ac.)	**Beyond** 200 Feet of Perennial Stream (Ft.^{3}/ Ac.)
Range	3,600 - 9,400[a]	1,600 - 2,300[b]

[a]Ursitti, 1990
[b]Spies, 1988/1991

Table 7-15 describes levels of CWD as a volume reported by Spies and Franklin (Spies 1995), and as percent cover Carey (Carey, 1995).

Table 7-15 Range of Down Wood in Un-managed Forests, Oregon Coast Range (Stand Age < 80 Years)

Coarse Woody Debris (CWD)	Cu. Ft./ Ac.	Percent Cover
Range	525 - 1979	2.5% - 5.1%
Average	1102	3.8%

c. Trees Per Acre (TPA); Natural and Managed Stands Comparison for CWD

Based on timber cruise data from 10 timber sales in late seral stands on 1043 acres of the Calapooya watershed, the number of trees per acre (greater than 10 inches DBH) for natural stands would be expected to average 76 TPA. Commercial thinnings usually are located in existing stands that have between 150 and 300 TPA. Normally about 80 to 120 TPA are left after thinnings. For managed stands, the TPA remaining in a normal thinning provides room for some of the standing trees to die, contributing CWD, while the standing TPA closely matches that of natural old growth stands. Although specific TPA or basal area objectives would be defined on a site by site basis, these types of thinnings in Riparian Reserves could more quickly move stands toward late seral characteristics.

The above information is used in the next section, **Restoration Opportunities and Management Recommendations** to discuss what management techniques might enhance development of late seral structures in Riparian Reserves where these structures are lacking.

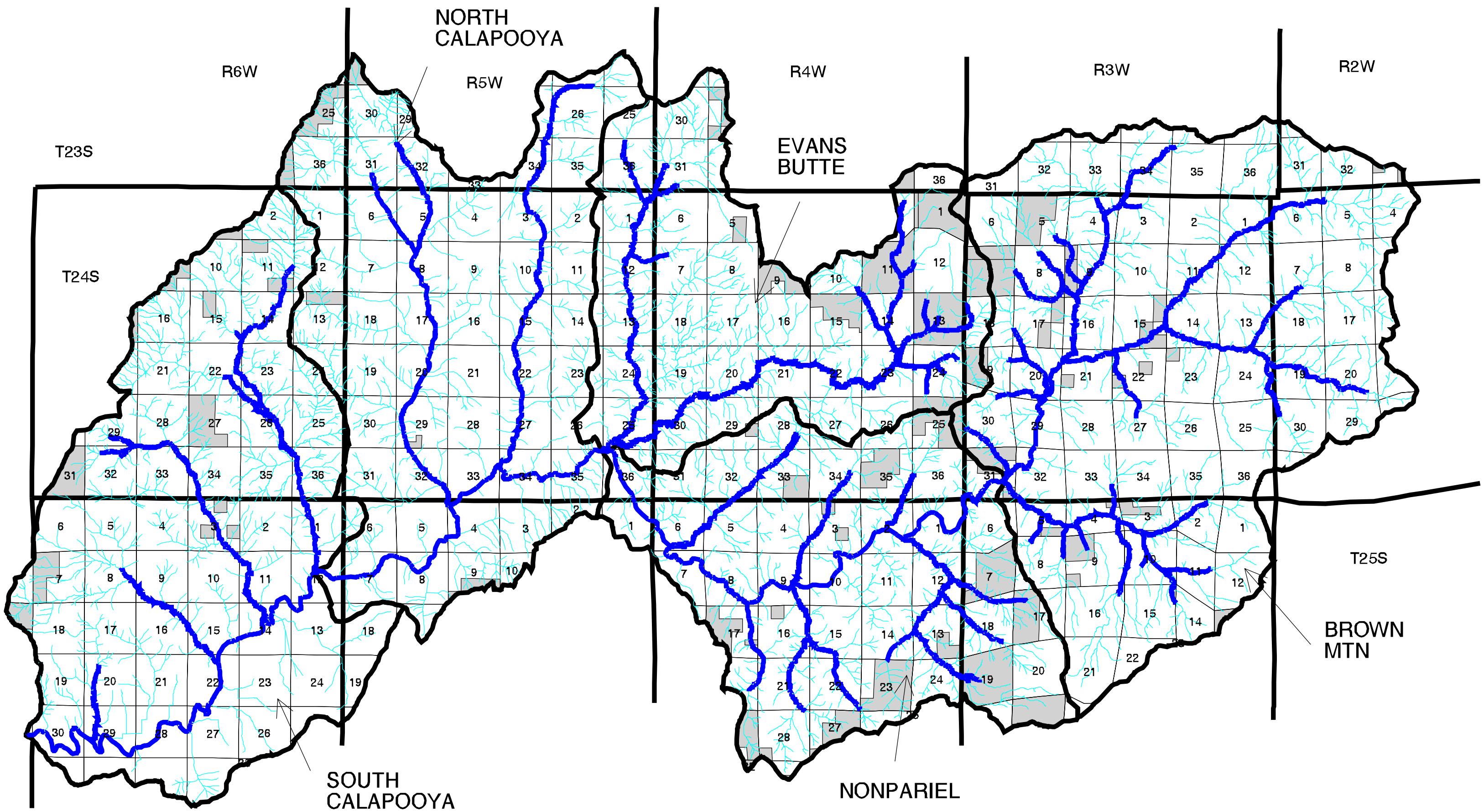
Table 7-2	CALAPOOYA CREEK WATERSHED ODFW STREAM SURVEY DATA								
Stream Name	**Reach**	**PCT POOL**	**RESIDPD**	**WD RATIO**	**RIFSNDOR**	**RIFGRAV**	**SHADE**	**CWD PIECE1**	**CWD VOL1**
Cabin Creek	1	48.8	0.6	13.7	25.0	52.0	74.0	2.0	0.7
	2	35.1	0.7	13.6	17.0	41.0	59.0	0.9	0.1
	3	44.1	0.7	14.4	24.0	53.0	73.0	1.8	0.6
	4	52.4	0.7	20.0	5.0	33.0	73.0	2.0	1.0
	5	43.0	0.6	13.9	43.0	34.0	70.0	1.4	0.5
	6	69.9	0.5	17.1	56.0	35.0	84.0	3.3	1.8
Calapooya Creek	1	46.2	0.6	51.8	3.0	46.0	39.0	0.4	0.2
	2	65.4	1.2	69.7	4.0	28.0	63.0	1.5	3.0
	3	73.6	1.2	9.0	0.0	5.0	85.0	2.1	7.6
	4	74.2	0.9	76.6	2.0	28.0	75.0	2.6	4.8
	5	48.8	0.6	165.3	1.0	45.0	74.0	2.5	1.9
	6	8.5	1.7	38.4	3.0	26.0	62.0	0.5	0.3
	7	26.9	0.8	44.3	1.0	24.0	64.0	0.5	0.5
	8	15.4	0.8	26.4	2.0	43.0	62.0	2.0	3.4
	9	18.1	0.8	26.9	3.0	38.0	82.0	4.0	10.5
	10	17.2	0.6	20.9	8.0	20.0	92.0	3.6	7.6
	11	10.4	0.6	18.1	5.0	15.0	71.0	5.9	9.7
Coon Creek	1	46.6	0.7	24.8	5.0	46.0	72.0	5.4	8.8
	2	33.9	0.6	24.7	2.0	31.0	73.0	6.2	9.0
	3	43.7	0.5	22.2	7.0	47.0	80.0	21.1	37.3
	4	23.0	0.4	8.5	55.0	45.0	48.0	23.5	43.6
	5	19.2	0.5	18.2	23.0	62.0	76.0	40.7	84.6
Coon Creek	1	56.7	0.7	23.8	9.0	73.0	75.0	2.1	2.8
	2	36.2	0.7	23.6	7.0	42.0	75.0	2.0	1.6

Table 7-2	CALAPOOYA CREEK WATERSHED ODFW STREAM SURVEY DATA								
Stream Name	**Reach**	**PCT POOL**	**RESIDPD**	**WD RATIO**	**RIFSNDOR**	**RIFGRAV**	**SHADE**	**CWD PIECE1**	**CWD VOL1**
Coon Creek Trib #1	1	36.4	0.4	87.7	9.0	47.0	93.0	14.7	44.9
	2	74.6	0.3	32.1	20.0	51.0	87.0	20.6	48.0
Dodge Canyon Creek	1	74.9	0.7	20.7	4.0	37.0	76.0	3.4	2.7
	2	--	--	--	--	--	--	--	--
	3	61.8	0.7	25.3	8.0	51.0	76.0	2.7	2.8
	4	86.6	0.7	17.0	5.0	80.0	74.0	5.6	2.1
	5	77.3	0.6	27.5	10.0	71.0	71.0	4.7	15.7
Field Creek	1	41.9	0.3	101.5	12.0	57.0	88.0	4.2	6.0
	2	23.7	0.3	57.8	17.0	54.0	95.0	10.3	27.8
Gassy Creek	1	66.6	0.6	27.5	3.0	53.0	89.0	2.6	4.0
	2	56.8	0.5	20.8	2.0	68.0	93.0	2.9	3.9
	3	--	--	--	--	--	--	--	--
	4	20.2	0.5	24.0	8.0	32.0	100.0	6.0	15.8
	5	22.4	0.6	24.3	14.0	62.0	98.0	15.0	35.8
Haney Creek	1	75.1	0.4	73.8	10.0	50.0	91.0	1.6	0.8
	2	53.2	0.3	100.0	14.0	58.0	98.0	7.1	4.3
	3	89.5	0.3	105.0	80.0	5.0	89.0	25.6	39.0
	4	2.8	0.3	50.0	15.0	83.0	93.0	12.3	21.6
Middle Fork	1	4.5	0.4	11.0	0.0	25.0	67.0	4.2	6.3
	2	10.6	0.6	19.3	0.0	41.0	57.0	15.2	21.3
Mill Creek	1	11.8	0.6	36.0	5.0	35.0	95.0	10.1	24.0
	2	33.8	0.5	44.0	14.0	44.0	99.0	11.2	22.4
	3	5.0	0.4	20.0	10.0	50.0	100.0	8.9	14.8
NF Calapooya Creek	1	33.2	1.2	30.3	2.0	36.0	85.0	15.0	37.5
	2	22.0	0.9	23.0	0.0	40.0	94.0	7.8	18.5
	3	20.5	0.6	37.0	0.0	38.0	92.0	18.3	44.8
	4	17.6	0.6	18.0	22.0	50.0	78.0	20.3	51.1

Table 7-2	CALAPOOYA CREEK WATERSHED ODFW STREAM SURVEY DATA								
Stream Name	**Reach**	**PCT POOL**	**RESIDPD**	**WD RATIO**	**RIFSNDOR**	**RIFGRAV**	**SHADE**	**CWD PIECE1**	**CWD VOL1**
NF Hinkle Creek	1	4.0	0.6	15.4	15.0	45.0	99.0	7.8	23.3
	2	13.5	0.6	--	25.0	50.0	98.0	23.0	59.4
	3	0.0	0.0	--	40.0	57.0	100.0	18.0	60.2
Oldham Creek	1	70.0	0.9	28.2	2.0	45.0	31.0	4.7	2.2
	2	84.2	0.8	40.9	9.0	76.0	88.0	6.8	3.0
	3	56.5	0.6	--	4.0	45.0	98.0	4.6	1.3
	5	71.5	0.5	--	4.0	43.0	85.0	3.6	2.7
	6	31.7	0.6	75.9	7.0	29.0	95.0	2.5	4.0
	6	31.7	0.6	--	7.0	29.0	95.0	2.5	4.0
Pollock Creek	1	77.2	0.7	15.5	11.0	59.0	46.0	4.2	1.6
	2	62.2	0.6	13.8	19.0	66.0	55.0	2.3	1.3
	3	38.1	0.6	17.2	13.0	56.0	72.0	1.4	2.2
	4	61.6	0.6	13.9	47.0	24.0	62.0	4.7	20.6
	5	75.2	0.5	11.1	48.0	39.0	41.0	2.8	4.8
	6	70.0	0.5	7.3	68.0	32.0	52.0	2.6	1.5
	7	84.8	0.5	16.5	43.0	44.0	84.0	1.5	4.2
Slide Creek	1	17.0	0.3	--	8.0	54.0	91.0	3.5	6.9
	2	23.1	0.2	72.0	21.0	46.0	97.0	14.4	21.8
	3	5.5	0.2	110.0	33.0	58.0	100.0	29.8	56.5
White Creek	1	34.2	0.3	18.2	7.0	42.0	89.0	6.7	5.5
	2	19.1	0.3	11.3	5.0	50.0	84.0	19.3	40.6
	3	12.3	0.4	16.4	18.0	43.0	47.0	23.6	45.8
Williams Creek	1	67.7	0.6	23.3	3.0	17.0	63.0	2.9	1.1
	2	69.1	0.7	26.3	4.0	24.0	67.0	2.5	1.0
	3	60.9	0.7	15.2	29.0	55.0	65.0	4.1	3.6
	4	57.9	0.5	16.9	23.0	66.0	66.0	0.6	0.7

Figure 7-1

Calapooya Creek Watershed - Fish Distribution



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Scale 1:200000

1 0 1 2 3 4 5 6 Miles

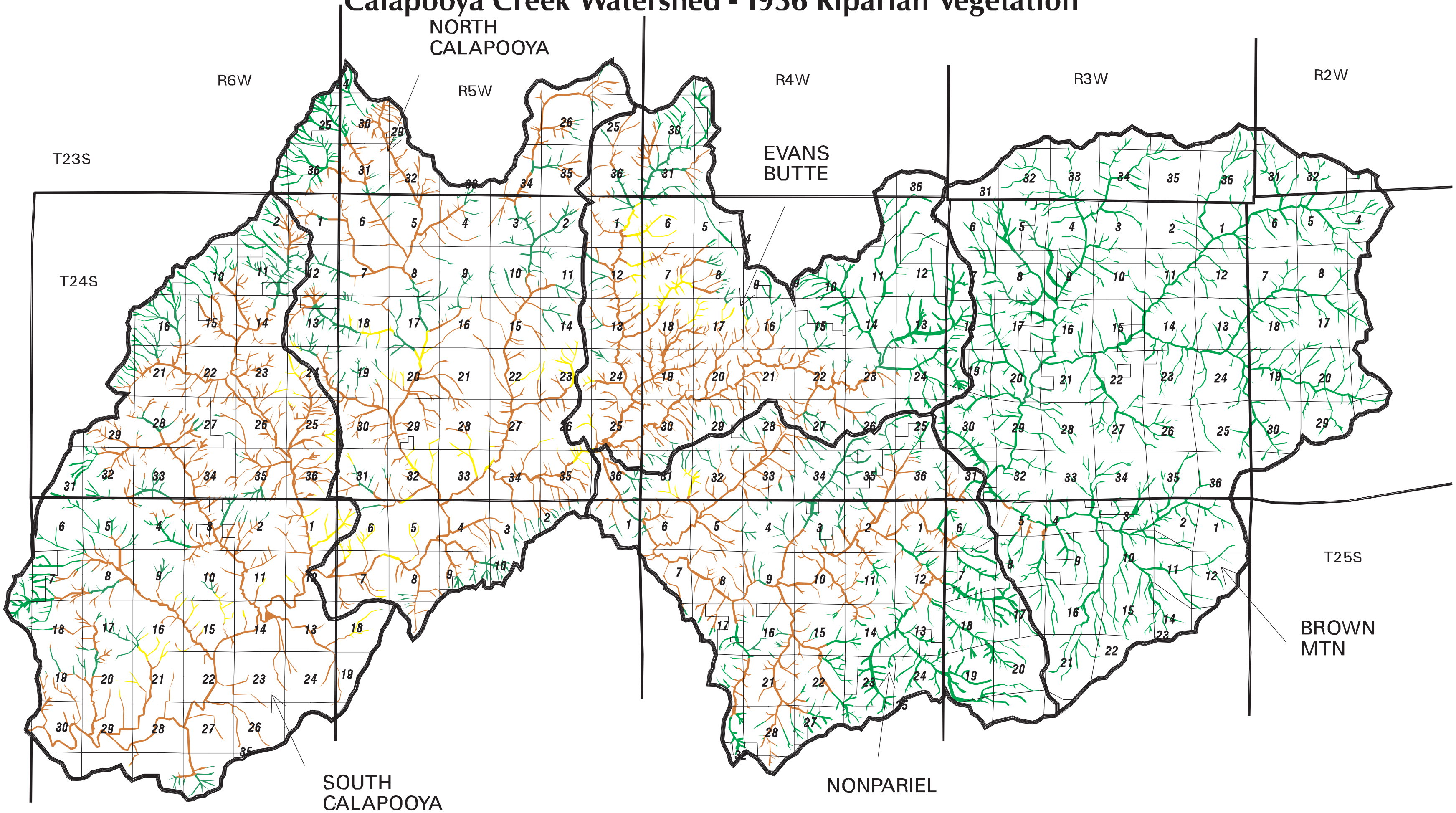
Fish Bearing Streams

BLM

N

Figure 7-2

Calapooya Creek Watershed - 1936 Riparian Vegetation



Scale 1:200000

0 1 2 3 4 5 6 Miles

- Early Seral Stage (0-30 yrs)
- Mid Seral Stage (31-80 yrs)
- Late Seral Stage (81+ yrs)
- Hardwoods
- Agricultural Lands

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N

Table 7-3	TOTAL CALAPOOYA 1936 RIPARIAN VEGETATION (acres)	
BLM acres	**Vegetation Class**	Private acres
145	Early Seral Stage	7484
152	Mid Seral Stage	2199
1627	Late Seral Stage	5458
0	Hardwoods	752
1780	**TOTAL**	**7657**

Chart 7-1 Calapooya 1936 Riparian Vegetation
BLM Lands

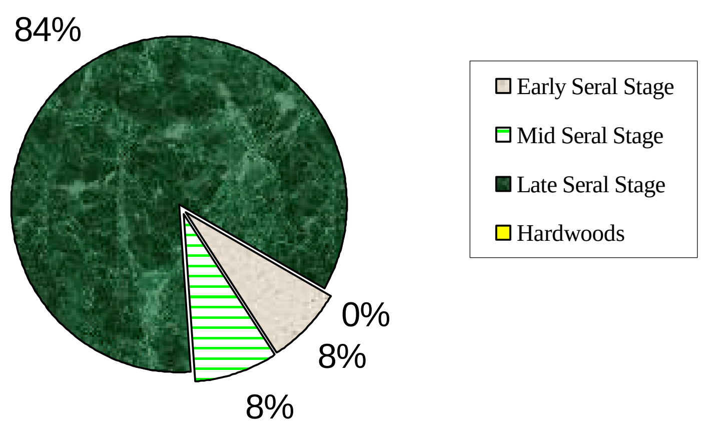


Chart 7-2 Calapooya 1936 Riparian Vegetation
Private Lands

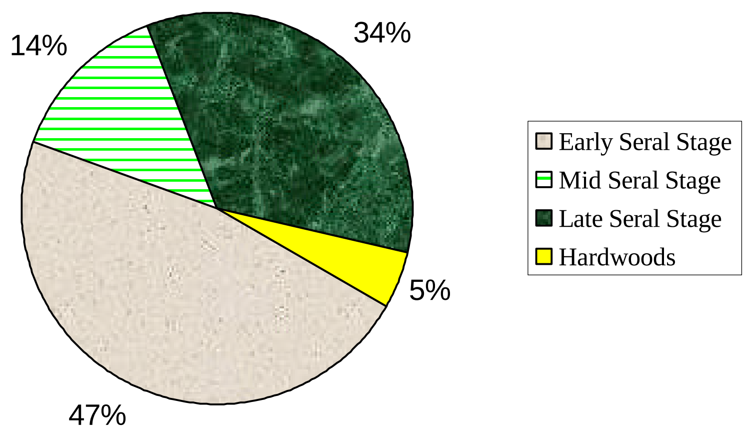


Table 7-4

	CALAPOOYA CREEK WATERSHED - 1936 RIPARIAN VEGETATION (acres)											
	BROWN MTN		EVANS BUTTE		NONPARIEL		NORTH CALAPOOYA		SOUTH CALAPOOYA		TOTAL	
	BLM	Private	BLM	Private	BLM	Private	BLM	Private	BLM	Private	BLM	Private
Vegetation Class	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres
Early Seral Stage	11	26	0	1433	35	1458	24	2076	75	2492	145	7484
Mid Seral Stage	10	70	9	452	67	414	32	768	35	495	152	2199
Late Seral Stage	355	3594	428	440	555	822	124	163	165	439	1627	5458
Hardwoods	0	0	0	209	0	34	0	313	0	196	0	752
TOTAL	**376**	**3690**	**436**	**2534**	**658**	**2726**	**179**	**3320**	**275**	**3623**	**1925**	**15893**

Table 7-5

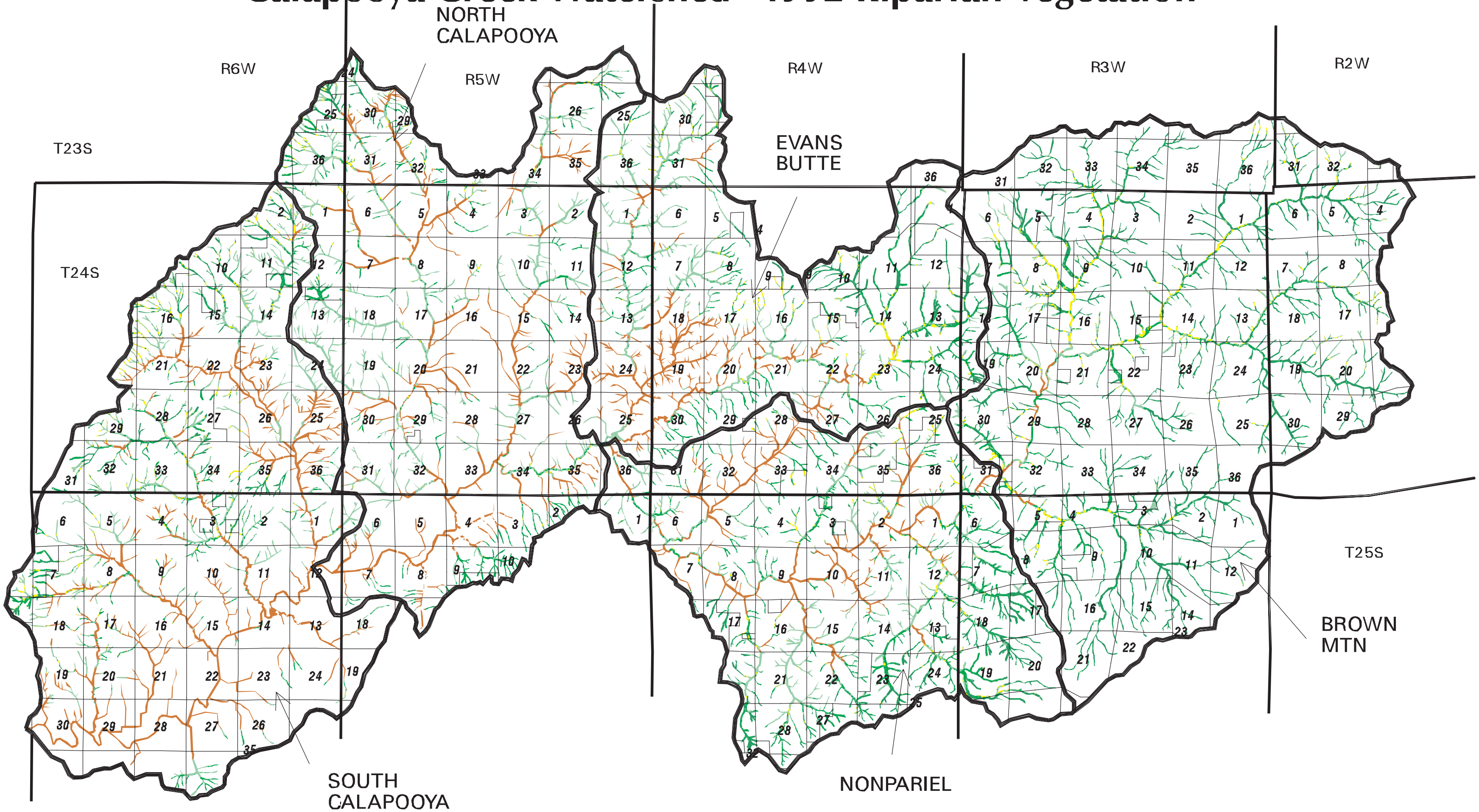
	CALAPOOYA CREEK WATERSHED - 1936 RIPARIAN VEGETATION (% by ownership & subwatershed)											
	BROWN MTN		EVANS BUTTE		NONPARIEL		NORTH CALAPOOYA		SOUTH CALAPOOYA		TOTAL	
Vegetation Class	BLM %	Private %	BLM %	Private %	BLM %	Private %	BLM %	Private %	BLM %	Private %	BLM %	Private %
Early Seral Stage	2.9%	0.7%	0.0%	56.5%	5.4%	53.5%	13.1%	62.5%	27.2%	68.8%	7.5%	47.1%
Mid Seral Stage	2.6%	1.9%	2.0%	17.9%	10.2%	15.2%	17.8%	23.1%	12.7%	13.7%	7.9%	13.8%
Late Seral Stage	94.5%	97.4%	98.0%	17.4%	84.4%	30.1%	69.1%	4.9%	60.1%	12.1%	84.6%	34.3%
Hardwoods	0.0%	0.0%	0.0%	8.2%	0.0%	1.2%	0.0%	9.4%	0.0%	5.4%	0.0%	4.7%

Table 7-6

	CALAPOOYA CREEK WATERSHED - 1936 RIPARIAN VEGETATION (data)											
	BROWN MTN		EVANS BUTTE		NONPARIEL		NORTH CALAPOOYA		SOUTH CALAPOOYA		TOTAL	
Diameter Class	BLM	Private	BLM	Private	BLM	Private	BLM	Private	BLM	Private	BLM	Private
or Forest Type	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres
Non-Forest	11	26		1433	35	1458	24	2076	75	2492	145	7484
Burned											0	0
6-20" Conifer	10	70	9	452	67	414	32	768	35	495	152	2199
20-40" Conifer	34	37	252	141	507	714	68	156	133	401	995	1448
Old Growth Conifer	321	3558	176	300	48	108	56	7	32	38	633	4010
Hardwoods				209		34		313		196	0	752
TOTAL	**376**	**3690**	**436**	**2534**	**658**	**2726**	**179**	**3320**	**275**	**3623**	**1925**	**15893**

Figure 7-3

Calapooya Creek Watershed - 1992 Riparian Vegetation



Scale 1:200000

0 1 2 3 4 5 6 Miles

- Early Seral Stage (0-30 yrs)
- Late Seral Stage (31-80 yrs)
- Late Seral Stage (81+ yrs)
- Hardwoods
- Agricultural Lands

N

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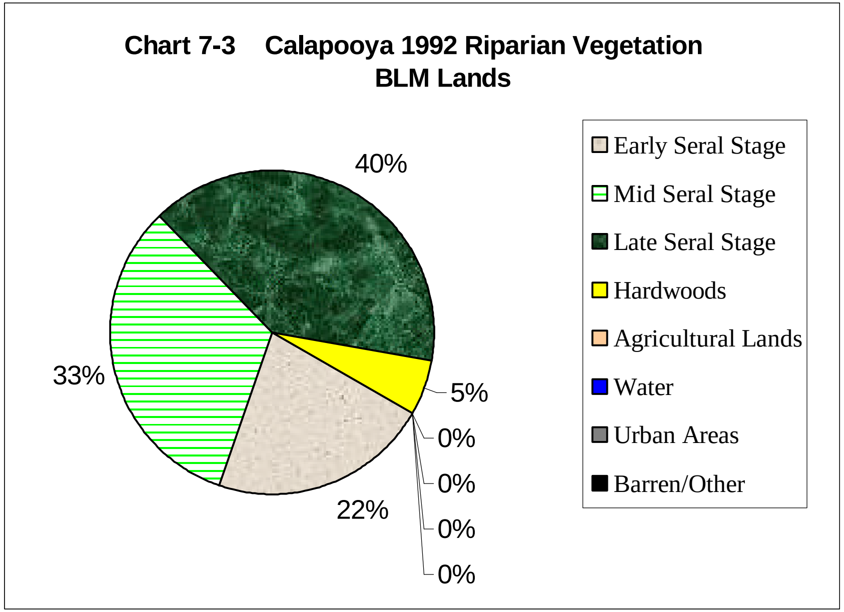
Table 7-7	TOTAL CALAPOOYA 1992 RIPARIAN VEGETATION (acres)	
BLM acres	**Vegetation Class**	Private acres
420	Early Seral Stage	4913
629	Mid Seral Stage	3068
771	Late Seral Stage	2547
105	Hardwoods	611
0	Agricultural Lands	4575
0	Water	17
0	Urban Areas	154
0	Barren/Other	8
1924	**TOTAL**	**15893**



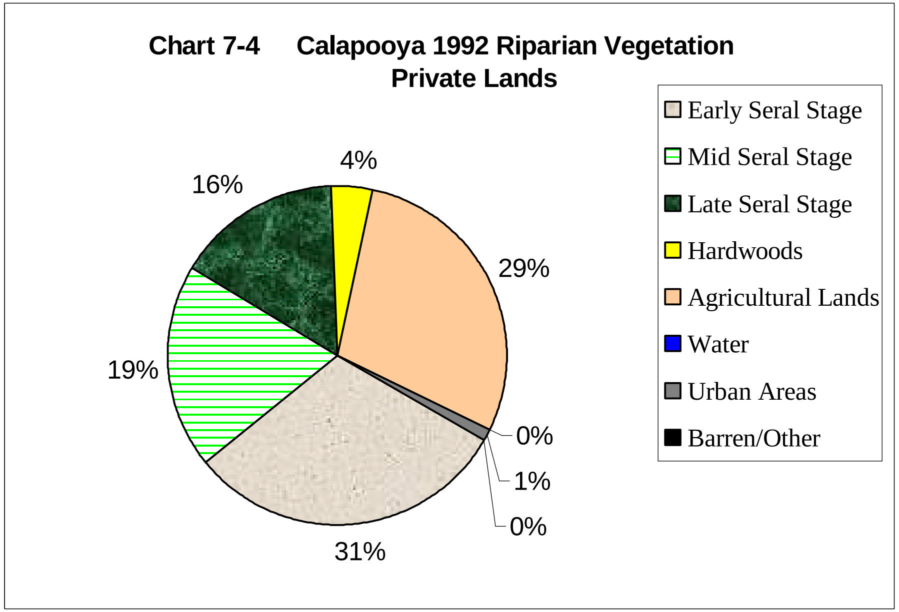


Table 7-8

CALAPOOYA CREEK WATERSHED - 1992 RIPARIAN VEGETATION (acres)

	BROWN MTN		EVANS BUTTE		NONPARIEL		NORTH CALAPOOYA		SOUTH CALAPOOYA		TOTAL	
	BLM	Private	BLM	Private	BLM	Private	BLM	Private	BLM	Private	BLM	Private
Vegetation Class	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres
Early Seral Stage	77	586	100	966	130	858	49	1354	63	1149	420	4913
Mid Seral Stage	127	2007	175	275	212	361	36	140	79	285	629	3068
Late Seral Stage	143	812	138	400	287	608	86	392	116	336	771	2547
Hardwoods	29	227	23	105	29	79	8	62	16	138	105	611
Agricultural Lands	0	58	0	781	0	817	0	1271	0	1647	0	4575
Water	0	0	0	2	0	1	0	3	0	11	0	17
Urban Areas	0	0	0	4	0	1	0	96	0	53	0	154
Barren/Other	0	0	0	1	0	1	0	4	0	2	0	8
TOTAL	**376**	**3690**	**436**	**2534**	**658**	**2726**	**179**	**3320**	**275**	**3623**	**1924**	**15893**

Table 7-9

CALAPOOYA CREEK WATERSHED - 1992 RIPARIAN VEGETATION (% by ownership & subwatershed)

	BROWN MTN		EVANS BUTTE		NONPARIEL		NORTH CALAPOOYA		SOUTH CALAPOOYA		TOTAL	
Vegetation Class	BLM %	Private %	BLM %	Private %	BLM %	Private %	BLM %	Private %	BLM %	Private %	BLM %	Private %
Early Seral Stage	20.5%	15.9%	23.0%	38.1%	19.8%	31.5%	27.2%	40.8%	23.0%	31.7%	21.8%	30.9%
Mid Seral Stage	33.8%	54.4%	40.1%	10.8%	32.2%	13.2%	20.0%	4.2%	28.8%	7.9%	32.7%	19.3%
Late Seral Stage	38.1%	22.0%	31.6%	15.8%	43.6%	22.3%	48.1%	11.8%	42.3%	9.3%	40.1%	16.0%
Hardwoods	7.6%	6.2%	5.2%	4.1%	4.3%	2.9%	4.7%	1.9%	5.9%	3.8%	5.4%	3.8%
Agricultural Lands		1.6%	0.0%	30.8%	0.0%	30.0%	0.0%	38.3%	0.0%	45.5%	0.0%	28.8%
Water		0.0%		0.1%		0.0%		0.1%		0.3%	0.0%	0.1%
Urban Areas		0.0%		0.2%		0.0%		2.9%		1.5%	0.0%	1.0%
Barren/Other	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%		0.1%	0.0%	0.1%	0.0%	0.1%

Table 7-10

CALAPOOYA CREEK WATERSHED - 1992 RIPARIAN VEGETATION DATA (Western OR Digital Image Project)

	BROWN MTN		EVANS BUTTE		NONPARIEL		NORTH CALAPOOYA		SOUTH CALAPOOYA		TOTAL	
VEGETATION	BLM	Private	BLM	Private	BLM	Private	BLM	Private	BLM	Private	BLM	Private
Diameter or Type	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres
Recent Harvest Areas	35	205	51	764	81	638	17	1112	22	858	206	3576
Conifer - 0 to 10"	42	381	49	202	49	220	32	242	41	292	214	1337
Conifer - 11 to 19"	127	2007	175	275	212	361	36	140	79	285	629	3068
Conifer - 20 to 29"	115	722	106	328	207	480	47	308	81	270	557	2108
Conifer - 30 + "	28	90	32	71	80	128	39	84	35	66	214	439
Hardwoods	29	227	23	105	29	79	8	62	16	138	105	611
Agricultural Lands		58	0	781	0	817		1271		1647	0	4575
Urban Areas				4		1		96		53	0	154
Water				2		1		3		11	0	17
Barren/Other		0	0	1	0	1		4	0	2	0	8
TOTAL	**376**	**3690**	**436**	**2534**	**658**	**2726**	**179**	**3320**	**275**	**3623**	**1924**	**15893**

RESTORATION OPPORTUNITIES AND MANAGEMENT RECOMMENDATIONS

A. Watershed Restoration in Calapooya

With federal lands only controlling 7% of the watershed, long-term restoration within Calapooya Creek will depend to a great extent on the efforts of private landowners. As mentioned in the Overview section, Geoffrey Habron's dissertation, *An Assessment of Community-based Adaptive Watershed Management in Three Umpqua Basin Watersheds*, provides an excellent backdrop for combining willing landowners with areas of high priority for restoration. **Figure 2-1** (Figure 32 in the dissertation) shows how to prioritize within Calapooya based on ecological criteria as well as by willing landowners.

Calapooya Creek 5th field watershed was ranked as low priority for restoration by the Umpqua Basin Watershed Council Technical Advisory Committee. Thus, from a strategic standpoint as well as in light of the budgetary constraints, restoration activities will not be focused in this watershed except as financed through the sale of timber. The following gives a brief synopsis of federal restoration work that has been planned under timber sales as well as restoration that will occur over time as a result of the federal reserve system.

1. Short Term Active Restoration (completed or to be completed within next 5 years)

The following **Table 8-1** summarizes the restoration planned under 3 federal timber sales within Calapooya Creek (Coon Creek CT, Pine Creek Regen Harvest, and Whatagas Regen Harvest). Two of these timber sales (Pine Creek Regen Harvest, and Whatagas Regen Harvest) are currently held up by lawsuits and may or may not be completed depending on their outcome.

Table 8-1 Calapooya Watershed Restoration Summary

Type of Restoration	Quantity
Full Decommission of Existing Roads	0.7 mi.
Subsoil Existing Skid Trails	1.7 mi.
Road Improvement	4.2 mi.
Stream Crossings Replaced to Improve Fish Passage or Accommodate 100 Year Flow Capacity	1

2. Long Term Natural Restoration (10+ years)

The reserve system on federal lands was set up in the Northwest Forest Plan and Roseburg District Resource Management Plan to allow natural restoration to occur as forest stands grow. Riparian Reserves in particular are meant to provide functions that are vital to aquatic and riparian associated species that are dependent on forests that exhibit late successional characteristics (live old-growth trees, standing dead trees, fallen trees or logs on the forest floor, and logs in the stream). These characteristics begin to appear in forest stands at approximately 80 years of age (NFP, pg. B-2). Of the approximately 3,776 acres of the federal Riparian Reserve about 34% are over 80 years of age. Within the next decade about 36% of the federal Riparian Reserve forest will be 80 years or older. Within the next fifty years about 58% of the federal Riparian Reserve forest will be 80 years or older (**Chart 8-1**).

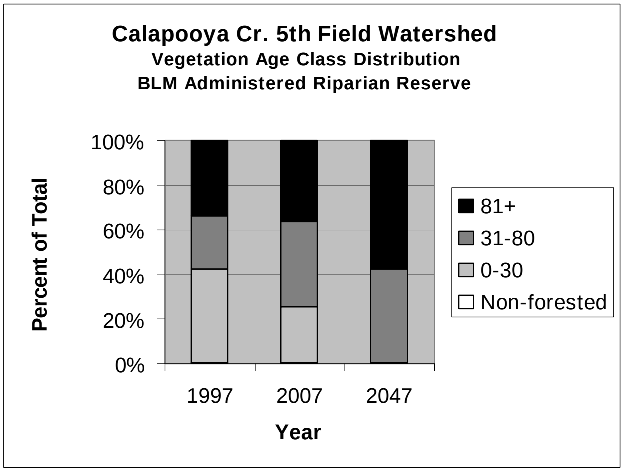


Chart 8-1

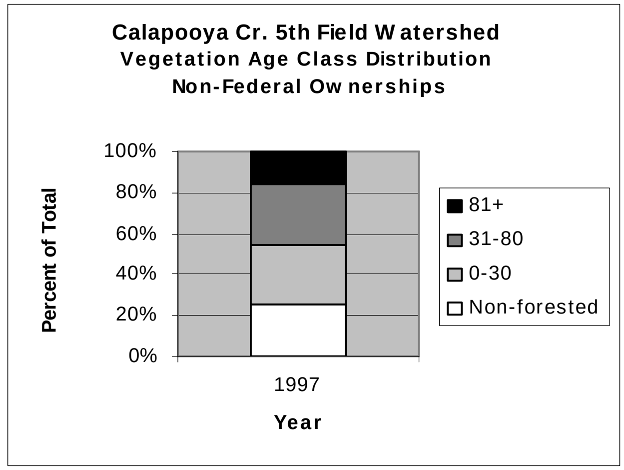


Chart 8-2

Non-federal forested lands within the watershed are regulated through the Oregon Forest Practices Act (OFPA) and related administrative rules. The rules establish a desired future condition for riparian vegetation. For most fish-bearing streams, the desired future condition is to grow and maintain stands similar to "mature forest conditions" within riparian management areas (RMA) of specified widths. These widths represent approximately 70 to 95 percent of the potential source area for large woody debris recruitment, respectively. For non-fish-bearing streams the desired future condition is to grow and retain vegetation sufficient to support the functions and processes that are important to downstream waters that have fish, maintain the quality of domestic water, and supplement wildlife habitat across the landscape (Oregon Plan 1997).

Due to the variability in RMA widths, the variability in RMA management guidelines, and inherent limitations in available vegetation data, it is difficult to accurately assess the current vegetative age class distribution and trend in RMA's for non-federal lands with a high degree of confidence. For purposes of this analysis only it is assumed that vegetative conditions within non-federal RMA's generally reflects the current vegetation age class distribution for non-federal lands within the watershed (**Chart 8-2**). At this time it is assumed that activities on non-federal forest lands will be in accordance with the OFPA and applicable aspects of the *Oregon Plan for Salmon and Watersheds* where appropriate.

The following recommendations are for the most part directed at processes that are within the influence of the BLM on federally administered lands. For any recommendations involved with those processes that may affect beyond property lines, the recommendations are not meant to preempt the objectives of individual landowners. Also these recommendations are given with the realization that other watersheds, such as Smith River, Rock Creek, and Canton Creek, will have a higher funding priority for restoration. It is assumed that most funding for restoration in Calapooya watershed will come from revenue generating projects (ie. timber sales).

B. Human Uses/Fire Recommendations

Due to the large percentage of private lands intermingled with the scattered BLM lands, all fires should be suppressed immediately. Douglas Fire Protection Association provides protection against fire for the BLM and industrial forest land owners. For this watershed with intermixed landownership it is recommended to continue rapid initial attack efforts on all fires to protect the existing resource values, and reduce potential liability to the BLM from fire spreading on to private land. Because of the high value of roads for quickly accessing initial fires, the initial transportation management objectives take into consideration the need for fire access (see Road Restoration and Transportation Management Objectives below). Transportation management objectives for roads should balance the need for fire protection and human uses against the impacts those roads may be having on fish and wildlife resources.

All activity fuels (slash) created by logging, thinning, etc. should be assessed to determine if fuel treatments are necessary for reforestation and/or wildfire hazard reduction purposes. Treatments could include prescribed fire (broadcast burning, hand piling, swamper), gross yarding of unmerchantable material and tops not needed to meet large woody debris requirements, lopping and scattering of tops and limbs, and other treatments to reduce activity fuels.

It is recommended that federal land managers continue efforts to establish and nurture direct communications with private landowners prior to implementing actions affecting the landowners, particularly regarding road use and access. Improvements to the watershed can be more effective with private landowners' cooperation, given the checkerboard land tenure pattern.

C. Restoration of Vegetation and Late Successional Dependent Terrestrial Wildlife Habitat

1. Special Status Plant Species Management Recommendations

a. Assess impacts of any weed populations found and work with the district weed coordinator to develop and implement a control plan. The methods will vary according to species of weed, size and location of infestation. Most sites will require a combination of methods: mechanical removal, herbicide application, biological controls, prescribed fire, and native plant re-vegetation.

b. To prevent the spread of noxious weeds require all construction and logging equipment to be free from any debris which may contain noxious weed seed or vegetative parts before operations begin on BLM land. Require access roads to timber sales to be surveyed and maintained weed free prior to logging.

c. Revisit known noxious weed sites and establish that control or eradication of populations has occurred. Small populations of noxious weeds that are limited in the watershed should be the highest priority for control and eradication.

d. Revisit known sites of special status plants and assess the viability of populations. Assess the feasibility of enhancing or restoring sites if needed.

e. Continue surveying Late Successional Reserves to assess the range and abundance of SAS listed in the Roseburg District BLM ROD. Surveys should be in stands representative of areas located in General Forest Management Areas where projects occur.

f. Survey LSRs within watershed to locate protected populations of species of concern.

g. Require certified weed free seed and mulch for re-vegetation projects to prevent weeds from being

introduced to a site.
h. When new noxious weed sites are discovered they should be reported to the District Weed Specialist.

2. Terrestrial Wildlife Management Recommendations

-What stands should be retained to meet the 15 percent LS/OG retention standard for the watershed? What stands should be retained to meet the 25-30 percent LS/OG retention standard for Connectivity Blocks ?

Federal reserves alone in the Calapooya Creek Watershed contain 1836 acres of late seral forests. This amounts to 15.7 percent of the federal ownership in the watershed and does not include the late seral stands in the matrix land use allocation. Thus the 15 percent requirement of the NFP is met, and should increase over time as early and mid- seral stands develop.

It has been determined that for management purposes “connectivity blocks” will be defined at the section level. Calapooya Creek Watershed contains all or parts of six “connectivity blocks” (**Figure 1-9, Table 8-2**). Twenty-five to thirty percent of each block will therefore be maintained in a late seral condition. **NOTE: This does not mean an additional reserve is created in each “block”. Late seral habitat will still be harvested in each block while maintaining 25 to 30% late seral habitat.**

Table 8-2 Calapooya Late Seral Habitat in Connectivity Blocks

		Late Seral Habitat	
Connectivity Block	Federal Ownership (ac)	Area (ac)	(% of federal)
T25S-R3W-7	500	129*	26%
T24S-R4W-25	516	144	28%
T24S-R4W-11	659	262	40%
T24S-R4W-9	606	283	47%
T23S-R4W-35	632	111	18%
T23S-R5W-19	542	226	42%

*As noted in the Whatagas Timber Sale EA, five regeneration harvest units from the Whatagas timber sale would remove 54 acres of late-successional forest within the connectivity / diversity block of T25S-R3W-7 leaving approximately 129 acres of late-successional forest (26% of the block) post harvest. The numbers in the table above assume the units will be harvested at some point in the future.

Based on the numbers in **Table 8-2** additional regeneration harvest could take place in all connectivity blocks except T25S-R3W-7 and T23S-R4W-35. These two connectivity blocks will need time for younger stands to reach late seral type characteristics in order to meet the 25 to 30% requirement.

-How can connectivity within the watershed and between adjacent watersheds be improved?

Linear connectivity will never be achieved. However, management should be directed at developing the large patches of LS/OG in LSRs and Riparian Reserves Manage riparian reserves and LSRs to accelerate the development of LS/OG characteristics with the appropriate silvicultural and forest management techniques. Appropriate techniques may include, but not limited to, density management, burning, planting, release, fertilization, stand conversion. Place management where it will assist in developing larger contiguous units of habitat.

D. Hydrological Restoration and Aquatic Habitat

Generally, water quality and channel morphology information needs to be collected to better understand current conditions and watershed processes in the watershed. Rigorous data collection may not occur in the Calapooya watershed because it is a low priority watershed for restoration within the Umpqua Basin.

1. Riparian Reserve Management Recommendations

a. GOALS

Long Term: Maintain and enhance later seral forest in as much of the Riparian Reserve network as possible. All of the attributes associated with late seral forest are present, including CWD and snags.

Short Term: Actively manage Riparian Reserves to maintain, produce, or enhance late seral forest characteristics, including CWD and snags.

b. Using Existing Information for Riparian Reserve Evaluation

There are several factors that need to be considered in meeting the above goals. These include:

-What Riparian Reserves are the highest priority for treatment?
-When is the best time to analyze Riparian Reserves to make management recommendations?
-How much CWD and how many snags are desired? What is the optimal piece size?
-How do we meet the desired quantities of CWD and snags?

Other considerations include:

-Increased risk of fire and insect damage with increases in CWD and snags.
-The cost associated with creating CWD and snags.
-The stand age when CWD and snags are at sufficient levels to meet the objectives for Riparian Reserves.

c. Process for Evaluating and Managing Riparian Reserve for CWD and Snags.

The current amount of CWD will be evaluated in light of the previously discussed guidelines of appropriate down wood. Because these studies show that existing CWD in natural un-managed stands is highly variable, the goal for CWD will have to be determined for each management action.

Riparian Reserves in late seral forests are lowest priority for treatment. Riparian Reserves in the 30 and 40-year age class lacking CWD and snags are the highest priority. The best time to analyze the need for a particular treatment is during the planning phase for commercial thinning. If the quantities of CWD and snags are below the desired amounts, additional trees would be left for CWD and snags by silvicultural prescription. Two to four years after thinning another stand exam would be conducted to determine the quantity of snags and CWD and further treatment needs. The following steps are recommended as part of the planning process:

1) Measure/estimate existing amounts of CWD during pre-planning stand exams in Riparian Reserves.
2) Describe the wildlife and fisheries objectives for desired amounts and types of CWD and snags in Riparian Reserves in the Environmental Assessment (EA).
3) Treatment within the Riparian Reserves could include felling some trees to add CWD to meet wildlife and fisheries objectives.
4) Post treatment surveys would be conducted within 2 to 4 years. Additional treatments to enhance late seral forest characteristics including CWD and snags are based on the survey results. Examples of these include falling and leaving trees in streams and on the ground, killing live trees to create snags, and removing the tops of live trees to create snags.

The following is the rationale for these recommendations:

- Young managed stands established following clear-cut harvest are uniform in structure and composition. Thus the Riparian Reserves in these stands are the highest priority for treatment.
- The best time to analyze for and implement treatments to enhance Riparian Reserves is during the planning and implementation of commercial thinnings. Any treatments to enhance the CWD and snag components could possibly be paid for through the sale of timber.
- Trees die and some trees may fall over from wind throw after a commercial thinning operation. Post treatment surveys 2 to 4 years following thinning allow for these occurrences. This would minimize the risk of accumulating excess CWD and snags that would jeopardize the Riparian Reserve objectives (i.e. increased risk of fire and insect damage).
- Based on modeling projections the stand age at which Riparian Reserves begin to function as late seral forest ranges from 80 to 120 years total stand age.
- This approach provides short term supplemental CWD that would last until late seral forest conditions develop and begin to contribute appropriate levels of CWD. The goal is to provide short term CWD and hasten the development of late successional characteristics. Remnants from the previous stand would be protected, and live trees would be left to contribute to future CWD and snags.

2. Road Risk Assessment, Objectives, and Restoration Opportunities

Calapooya is estimated to have over 600 miles of road (**Table 5-2**). Because this estimate only considers roads within the BLM database, and does not take into consideration many roads on private lands, it is most likely a low estimate. These roads can have an indirect impact on aquatic habitat. BLM controls only 84 miles of these roads. The process below is meant to outline the highest priority BLM roads for road risk reduction, restoration and decommissioning work..

Many of the BLM roads within Calapooya watershed are intermingled with privately owned or controlled road segments. An interdisciplinary (ID) process was developed to evaluate and rate each road segment for its impacts to aquatics as well as its current and future human. This evaluation provides guidance for where teams can focus their best efforts for work on BLM controlled roads. The resulting evaluation are represented in **Tables 8-2 through 8-6** and **Figures 8-1 through 8-5**. The Coon Creek commercial thinning and Pine Creek timber sale were developed prior to any of these types of road evaluations. Road risk reduction, upgrading, and decommissioning candidates were developed as part of the timber sale planning process and were identified using different criteria than was used for this watershed analysis. Thus with Pine Creek timber sale, some roads (24-3-31.1 C1, 25-3-9.3, 25-3-9.6) are being improved under this timber sale which will reduce sedimentation. Another existing road (25-3-9.4) is also being decommissioned under this timber sale.

For this watershed analysis, roads were placed in the following categories: high aquatic risk roads that had high human use associated with them, decommission candidates, roads with portions having higher risk for road failures, erosion problem roads, and roads with stream crossing inventory needs. Some of these categories may be overlapping but this inventory is meant to be a guide for more site specific analysis and planning. Roads that posed the highest risk to aquatics were either categorized for decommissioning or as high risk. Because the high risk roads also had high value for human uses, most likely these roads will be maintained as open but should be given higher priority for risk reduction road improvement work. In some cases, as is shown in the comments, road segments that were identified for risk reduction or decommissioning work are planned through specific timber sales.

For all of the roads with Calapooya Creek Watershed, the next step in this process is for the ID team to further refine which roads would be proposed to Douglas Fire Protection Association (DFPA) and Right-of-Way (R/W) permittees for decommissioning. This process would most likely be completed through pre-timber sale planning and would allow DFPA and R/W permittees to give their feedback for roads that they need for current and future access. Finally an environmental assessment would give the public an opportunity to comment on a final list of roads proposed for decommissioning.

Definitions for Tables 8-2 through 8-6

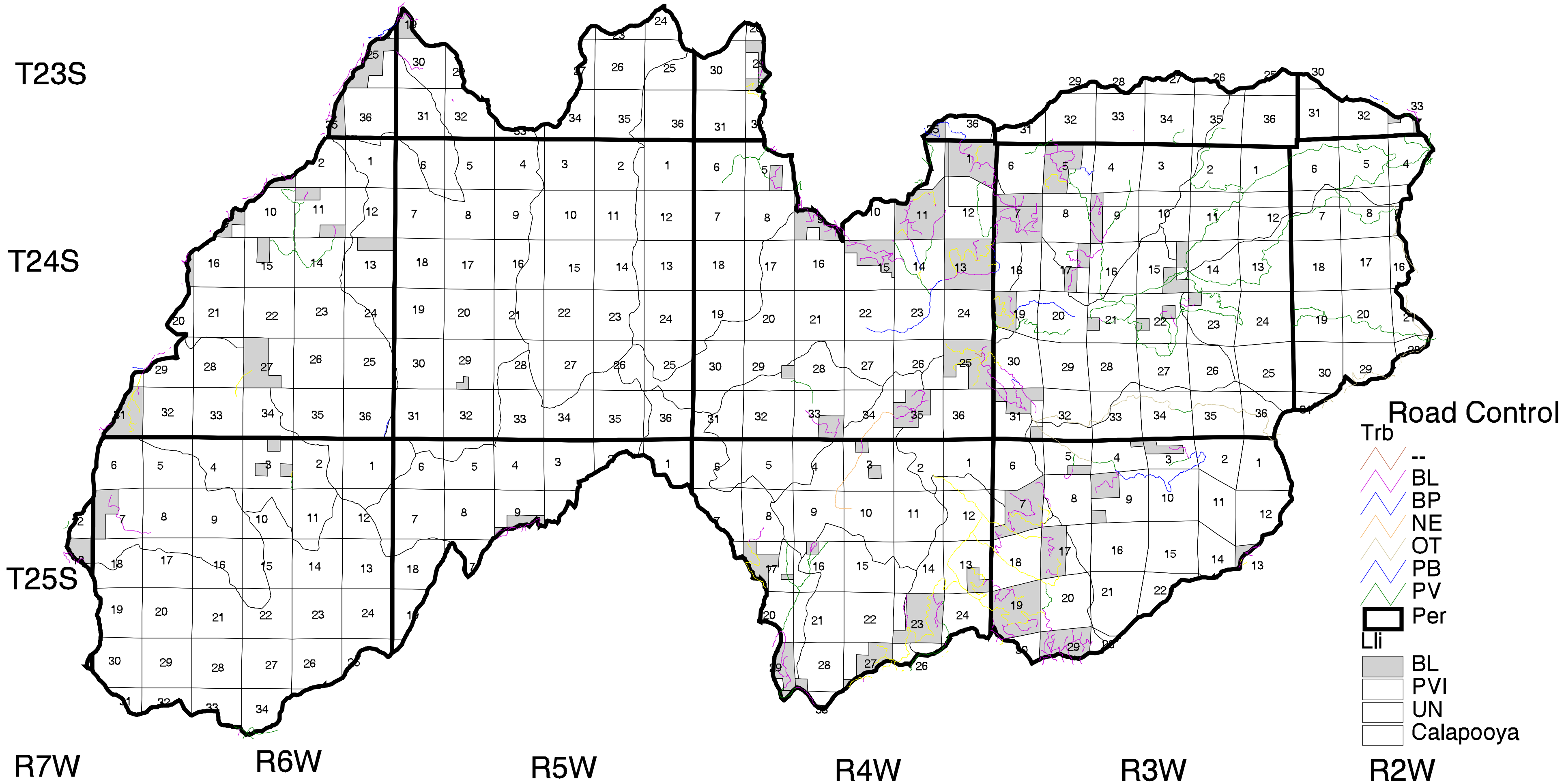
Sur-type = Surface type
- ABC = Aggregate Base Course
- ASC = Aggregate Surface Course
- PRR = Pit Run Rock
- NAT = Natural Surface Material or Dirt

Control = Ownership of the road
- BL = BLM Ownership
- PB = Private Ownership of Base Road, BLM Ownership of Improvements
- BP = BLM Ownership of Base Road, Private Ownership of Improvements
- PV = Private Ownership

Figure 8-1

Calapooya Creek High-Use High-Aqua-Impact Roads

Selected Roads In Yellow



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Scale 1:200,000

5 0 5 Miles

N

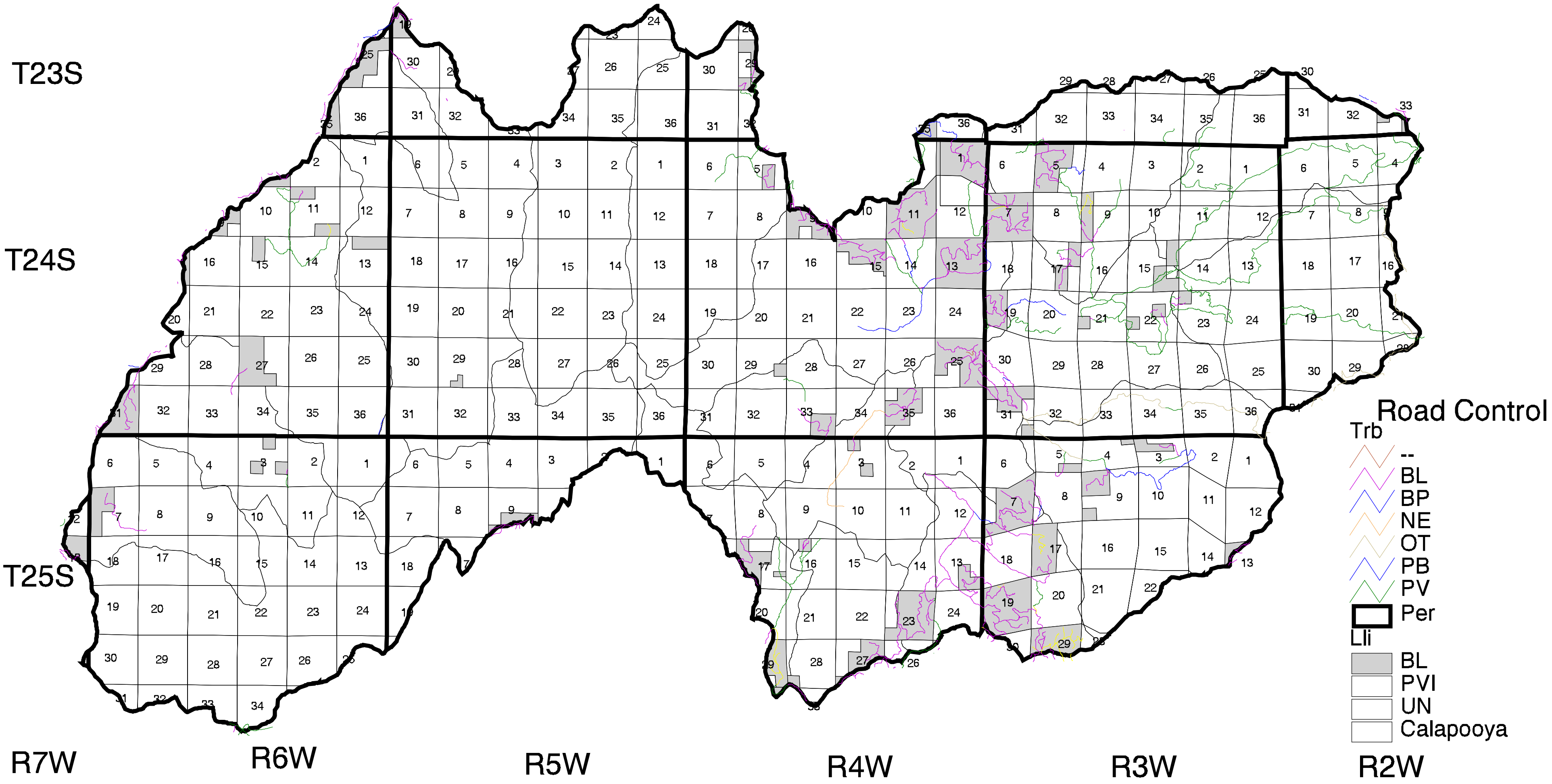
Table 8-3	Calapooya Creek Watershed High Aquatic Risk High Human Use Roads			
Road-id	Sur-type	Control	Miles	Comments
23S 02W 30.00C	PRR	BL	0.09	
23S 04W 32.01B0	NAT	BL	0.35	
24S 03W 05.01A	NAT	BL	0.82	
24S 03W 18.00A	ABC	BL	0.23	
24S 03W 19.01A	ABC	BL	0.61	
24S 03W 19.02A	ABC	BL	0.58	
24S 03W 20.01B	ABC	BL	0.85	
24S 03W 31.00B	ASC	BL	0.78	
24S 04W 01.01A	NAT	BL	0.48	
24S 04W 11.01A	NAT	BL	0.32	
24S 04W 11.02B	ASC	BL	0.77	
24S 04W 13.00A	ABC	BL	1.61	
24S 04W 13.00B	NAT	BL	0.75	
24S 04W 14.01A	ASC	PB	0.19	
24S 04W 25.00A	ASC	BL	0.57	
24S 04W 25.00B	ASC	BL	0.25	
24S 04W 25.01A	ASC	BL	0.55	
24S 04W 25.03A	ASC	BL	0.96	
24S 06W 29.01A0	ASC	BL	0.26	
24S 06W 29.01B0	ASC	BL	1.15	
24S 06W 31.01A0	NAT	BL	0.52	
24S 06W 31.02A0	NAT	BL	0.16	
24S 06W 33.00A0	NAT	BL	0.69	
25S 03W 07.01A	ASC	PB	0.25	Renovation work planned as part of Whatagas Timber Sale
25S 03W 07.01B	ASC	BL	1.1	Renovation work planned as part of Whatagas Timber Sale
25S 03W 08.01A	ASC	BL	0.36	
25S 03W 13.00A	ABC	BL	0.23	
25S 03W 19.00B	NAT	BL	0.14	
25S 03W 19.03A	ASC	BL	0.2	
25S 03W 20.00A	PRR	BL	0.85	Renovation work planned as part of Whatagas Timber Sale
25S 03W 30.00B	PRR	BL	0.06	
25S 04W 02.00A1	ASC	BL	1.35	Renovation work planned as part of Whatagas Timber Sale
25S 04W 02.00A2	ASC	BL	0.42	Renovation work planned as part of Whatagas Timber Sale
25S 04W 02.00A3	PRR	BL	0.54	Renovation work planned as part of Whatagas Timber Sale
25S 04W 02.00B	PRR	BL	1.2	Renovation work planned as part of Whatagas Timber Sale
25S 04W 02.00C	PRR	BL	0.01	Renovation work planned as part of Whatagas Timber Sale
25S 04W 02.00D1	PRR	BL	0.14	Renovation work planned as part of Whatagas Timber Sale
25S 04W 08.01B	PRR	BL	1.6	
25S 04W 12.00A	ASC	PB	0.5	Renovation work planned as part of Whatagas Timber Sale
25S 04W 12.00B	ASC	BL	0.35	Whatagas TS plans to Decom. past 7.0 road junction
25S 04W 12.00C	NAT	BL	0.54	Whatagas TS plans to Decom.
25S 04W 12.01A1	ASC	BL	0.19	Renovation work planned as part of Whatagas Timber Sale
25S 04W 12.01A2	ASC	BL	0.34	Renovation work planned as part of Whatagas Timber Sale
25S 04W 12.01B	PRR	BL	0.31	Renovation work planned as part of Whatagas Timber Sale
25S 04W 12.01C	PRR	BL	2.18	Renovation work planned as part of Whatagas Timber Sale
25S 04W 12.01D	PRR	BL	1.33	Renovation work planned as part of Whatagas Timber Sale
25S 04W 13.00A	PRR	BL	0.82	
25S 04W 13.00A1	ABC	BL	3.44	
25S 04W 13.01A	ASC	BL	0.57	Renovation work planned as part of Whatagas Timber Sale
25S 04W 24.01A1	ASC	BL	1.02	Renovation work planned as part of Whatagas Timber Sale
25S 04W 24.01A4	NAT	BL	0.22	Renovation work planned as part of Whatagas Timber Sale
25S 04W 26.00A	NAT	BL	0.98	
25S 04W 26.01A	ABC	BL	0.61	
25S 04W 27.03A	PRR	BL	0.29	
25S 06W 10.00B0	NAT	BL	0.1	
The Following Roads Were Surveyed Prior to Road Renovation/Upgrade and Then Rerated After Roads Were Improved				
24S 03W 5.0 A1&A2	NAT	BL	1	Dirt road rocked and improved under the Coon Creek Commercial Thinning
24S 03W 21.0 E1&E2	NAT	BL	1.24	Dirt road rocked and improved under the Coon Creek Commercial Thinning

Figure 8-2

Calapooya Creek Road Decommision Candidates

Low to Moderate Use High Aqua-Impact Roads

Selected Roads In Yellow



Scale 1:200,000

5 0 5 Miles

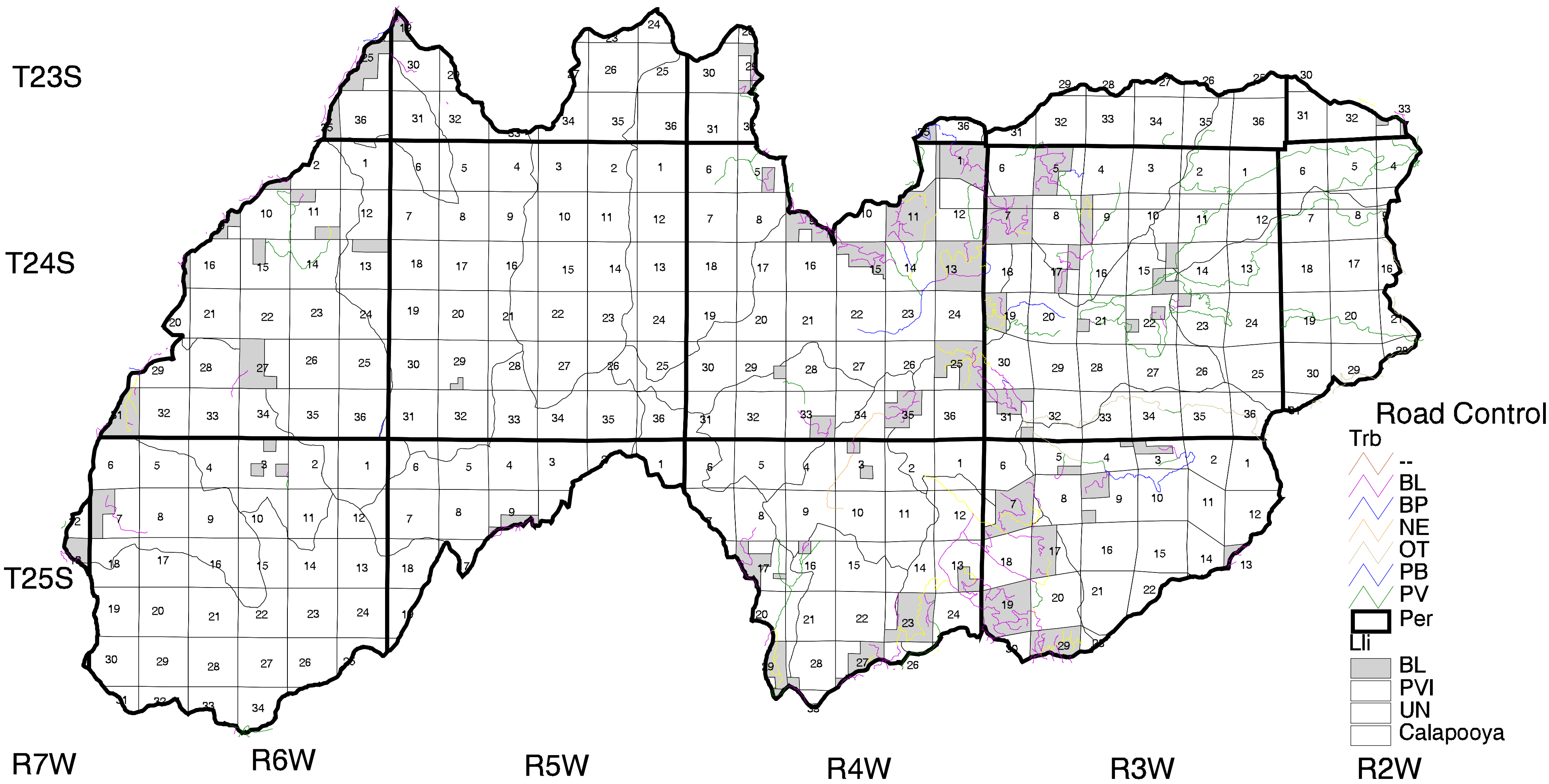
N

Table 8-4	**Calapooya Creek Watershed Road Decommission Candidates**			
Road-id	Sur-type	Control	Miles	Comments
24S 03W 07.07A	ASC	BL	0.35	
24S 03W 08.00A	NAT	BL	1	
24S 04W 14.01C	NAT	BL	0.35	
24S 06W 14.00B0	NAT	BL	0.27	
25S 03W 19.07A	NAT	BL	0.08	Whatagas TS Plans to Decom.
25S 03W 20.01A	ASC	BL	0.18	
25S 03W 29.01A1	PRR	BL	1.36	
25S 03W 29.04A	PRR	BL	0.25	
25S 03W 29.07A	PRR	BL	0.56	
25S 03W 29.10A	NAT	BL	0.24	
25S 03W 29.11A	PRR	BL	0.17	
25S 03W 29.13A	NAT	BL	0.18	
25S 03W 29.14A	NAT	BL	0.1	
25S 04W 12.00D	NAT	BL	0.94	Whatagas TS Plans to Decom.
25S 04W 24.00B	NAT	BL	0.05	
25S 04W 29.01A	NAT	BL	0.34	
25S 04W 29.02A	NAT	BL	0.24	
25S 05W 13.00C	ABC	BL	1.35	
The Following Road Was Identified During Preplanning Timber Sale Layout				
25S 03W 05.02	NAT	BL	0.2	Coon Creek CT Plans to Decom.

Figure 8-3

Calapooya Creek High Risk-Fail Roads

Selected Roads In Yellow



Scale 1:200,000

5 0 5 Miles

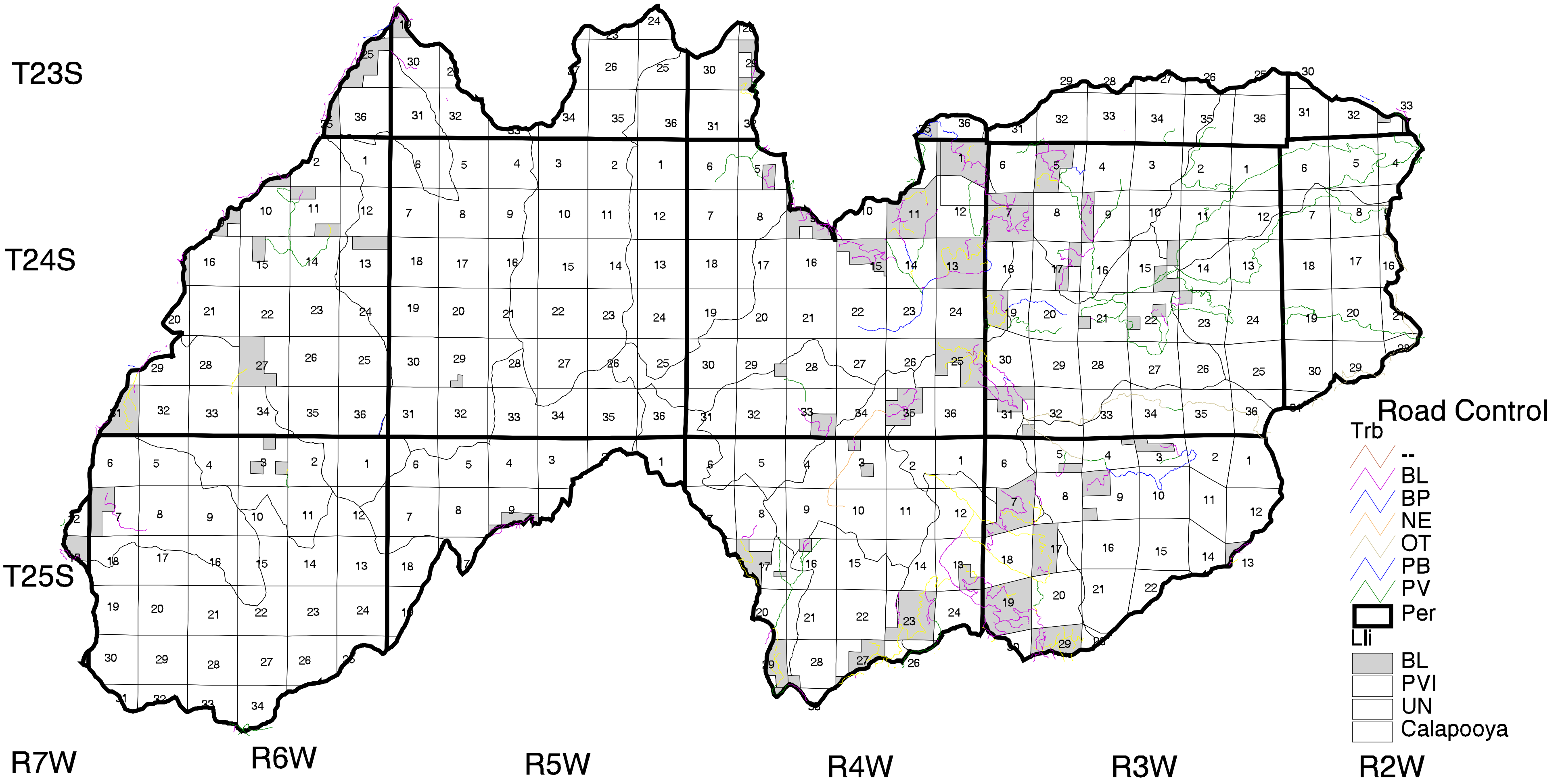
N

Table 8-5	Calapooya Creek Watershed Higher Risk of Road Failure			
Road-id	Sur-type	Control	Miles	Comments
23S 02W 30.00B	PRR	PB	0.26	
23S 02W 30.00C	PRR	BL	0.09	
24S 03W 07.04A	ABC	BL	0.33	
24S 03W 08.00A	NAT	BL	1	
24S 03W 18.00A	ABC	BL	0.23	
24S 03W 19.01A	ABC	BL	0.61	
24S 03W 19.02A	ABC	BL	0.58	
24S 03W 20.01B	ABC	BL	0.85	
24S 03W 31.00B	ASC	BL	0.78	
24S 04W 11.02B	ASC	BL	0.77	
24S 04W 13.00A	ABC	BL	1.61	
24S 04W 13.00B	NAT	BL	0.75	
24S 04W 14.01A	ASC	PB	0.19	
24S 04W 14.02B	NAT	BL	0.69	
24S 04W 25.00A	ASC	BL	0.57	
24S 04W 25.00B	ASC	BL	0.25	
24S 04W 25.01A	ASC	BL	0.55	
24S 04W 25.03A	ASC	BL	0.96	
24S 06W 14.00B0	NAT	BL	0.27	
24S 06W 29.01A0	ASC	BL	0.26	
24S 06W 29.01B0	ASC	BL	1.15	
24S 06W 31.01A0	NAT	BL	0.52	
25S 03W 07.01A	ASC	PB	0.25	Renovation work planned as part of Whatagas Timber Sale
25S 03W 07.01B	ASC	BL	1.1	Renovation work planned as part of Whatagas Timber Sale
25S 03W 08.01A	ASC	BL	0.36	
25S 03W 20.00A	PRR	BL	0.85	Renovation work planned as part of Whatagas Timber Sale
25S 03W 20.01A	ASC	BL	0.18	
25S 03W 29.01A1	PRR	BL	1.36	
25S 03W 29.10A	NAT	BL	0.24	
25S 03W 29.11A	PRR	BL	0.17	
25S 03W 29.13A	NAT	BL	0.18	
25S 03W 30.00B	PRR	BL	0.06	
25S 03W 30.00C	NAT	PV	0.01	
25S 04W 02.00A1	ASC	BL	1.35	Renovation work planned as part of Whatagas Timber Sale
25S 04W 12.00A	ASC	PB	0.5	Renovation work planned as part of Whatagas Timber Sale
25S 04W 12.00B	ASC	BL	0.35	Whatagas TS plans to Decom. past 7.0 road junction
25S 04W 12.00D	NAT	BL	0.94	Whatagas TS Plans to Decom.
25S 04W 13.00A1	ABC	BL	3.44	
25S 04W 13.01A	ASC	BL	0.57	Renovation work planned as part of Whatagas Timber Sale
25S 04W 27.03A	PRR	BL	0.29	
25S 04W 29.01A	NAT	BL	0.34	
25S 04W 29.02A	NAT	BL	0.24	
25S 05W 13.00C	ABC	BL	1.35	

Figure 8-4

Calapooya Creek High-Erosion Roads

Selected Roads In Yellow



Scale 1:200,000

5 0 5 Miles

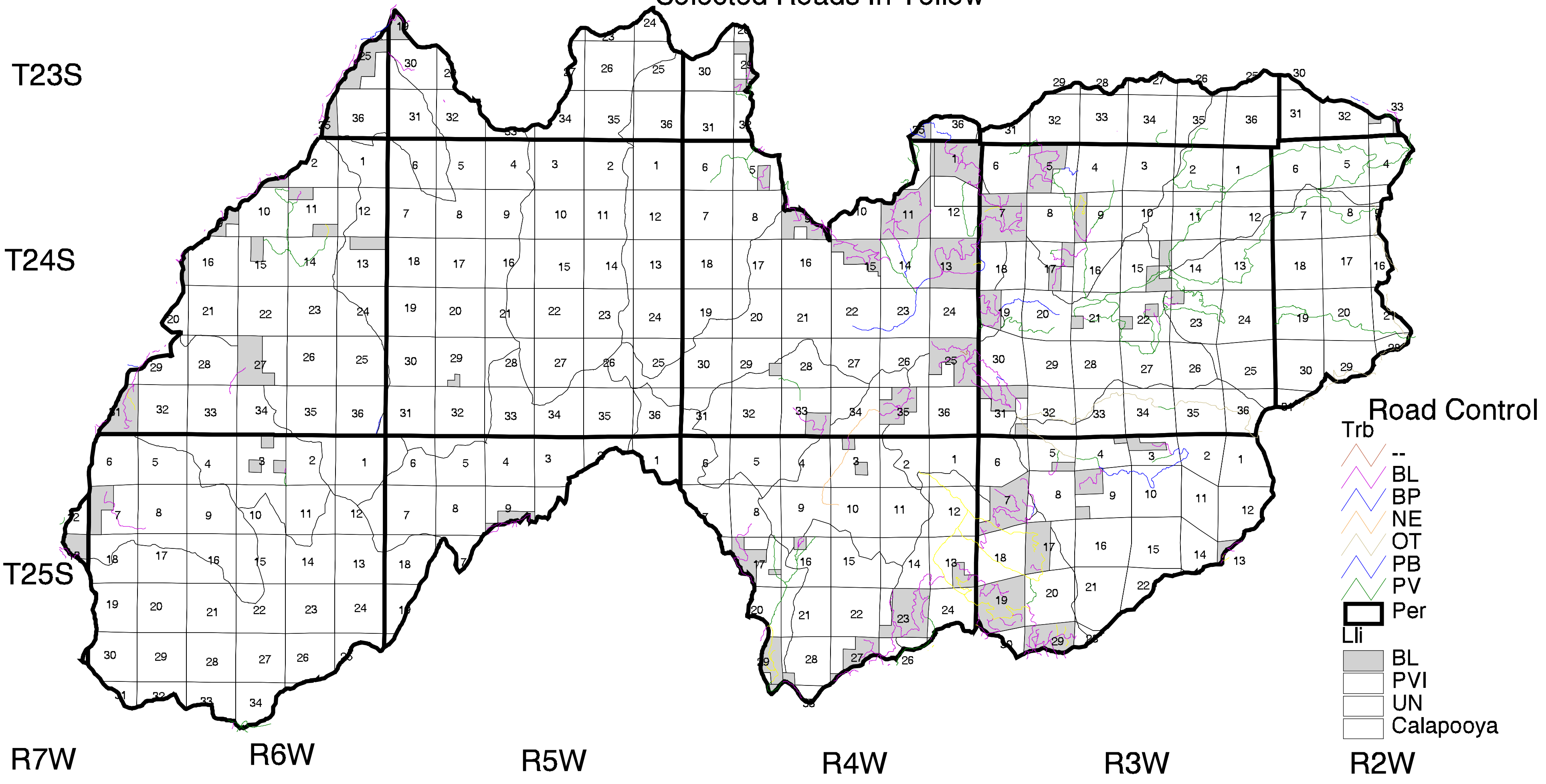
N

Table 8-6	Calapooya Creek Watershed Erosion Problem Roads			
Road-id	Sur-type	Control	Miles	Comments
23S 02W 30.00C	PRR	BL	0.09	
23S 04W 32.01A0	NAT	PV	0.31	
23S 04W 32.01B0	NAT	BL	0.35	
24S 03W 05.01A	NAT	BL	0.82	
24S 03W 07.07A	ASC	BL	0.35	
24S 03W 18.00A	ABC	BL	0.23	
24S 03W 19.01A	ABC	BL	0.61	
24S 03W 19.02A	ABC	BL	0.58	
24S 03W 20.01B	ABC	BL	0.85	
24S 03W 31.00B	ASC	BL	0.78	
24S 04W 01.01A	NAT	BL	0.48	
24S 04W 11.01A	NAT	BL	0.32	
24S 04W 11.02B	ASC	BL	0.77	
24S 04W 13.00A	ABC	BL	1.61	
24S 04W 13.00B	NAT	BL	0.75	
24S 04W 14.01A	ASC	PB	0.19	
24S 04W 14.01C	NAT	BL	0.35	
24S 04W 25.00A	ASC	BL	0.57	
24S 04W 25.00B	ASC	BL	0.25	
24S 04W 25.01A	ASC	BL	0.55	
24S 04W 25.03A	ASC	BL	0.96	
24S 06W 14.00B0	NAT	BL	0.27	
24S 06W 29.01A0	ASC	BL	0.26	
24S 06W 29.01B0	ASC	BL	1.15	
24S 06W 31.01A0	NAT	BL	0.52	
24S 06W 31.02A0	NAT	BL	0.16	
24S 06W 33.00A0	NAT	BL	0.69	
25S 03W 07.01A	ASC	PB	0.25	Renovation work planned as part of Whatagas Timber Sale
25S 03W 07.01B	ASC	BL	1.1	Renovation work planned as part of Whatagas Timber Sale
25S 03W 08.01A	ASC	BL	0.36	
25S 03W 13.00A	ABC	BL	0.23	
25S 03W 19.00B	NAT	BL	0.14	
25S 03W 19.03A	ASC	BL	0.2	
25S 03W 19.07A	NAT	BL	0.08	Whatagas TS Plans to Decom.
25S 03W 20.00A	PRR	BL	0.85	Renovation work planned as part of Whatagas Timber Sale
25S 03W 20.01A	ASC	BL	0.18	
25S 03W 29.01A1	PRR	BL	1.36	
25S 03W 29.04A	PRR	BL	0.25	
25S 03W 29.07A	PRR	BL	0.56	
25S 03W 29.10A	NAT	BL	0.24	
25S 03W 29.11A	PRR	BL	0.17	
25S 03W 29.13A	NAT	BL	0.18	
25S 03W 29.14A	NAT	BL	0.1	
25S 03W 30.00B	PRR	BL	0.06	
25S 03W 30.00C	NAT	PV	0.01	
25S 04W 02.00A1	ASC	BL	1.35	Renovation work planned as part of Whatagas Timber Sale
25S 04W 02.00A2	ASC	BL	0.42	Renovation work planned as part of Whatagas Timber Sale
25S 04W 02.00A3	PRR	BL	0.54	Renovation work planned as part of Whatagas Timber Sale
25S 04W 02.00B	PRR	BL	1.2	Renovation work planned as part of Whatagas Timber Sale
25S 04W 02.00C	PRR	BL	0.01	Renovation work planned as part of Whatagas Timber Sale
25S 04W 02.00D1	PRR	BL	0.14	Renovation work planned as part of Whatagas Timber Sale
25S 04W 08.01B	PRR	BL	1.6	
25S 04W 12.00A	ASC	PB	0.5	Renovation work planned as part of Whatagas Timber Sale
25S 04W 12.00C	NAT	BL	0.54	Whatagas TS Plans to Decom.
25S 04W 12.00D	NAT	BL	0.94	Whatagas TS Plans to Decom.
25S 04W 13.00A	PRR	BL	0.82	
25S 04W 13.00A1	ABC	BL	3.44	
25S 04W 13.01A	ASC	BL	0.57	Renovation work planned as part of Whatagas Timber Sale
25S 04W 24.00B	NAT	BL	0.05	

Figure 8-5

Calapooya Creek High Stream-X

Selected Roads In Yellow



Scale 1:200,000

5 0 5 Miles

N

Table 8-7	Calapooya Creek Watershed Stream Crossing Problem Roads			
Road-id	Sur-type	Control	Miles	Comments
24S 03W 07.07A	ASC	BL	0.35	
24S 03W 08.00A	NAT	BL	1	
24S 03W 18.00A	ABC	BL	0.23	
24S 06W 14.00B0	NAT	BL	0.27	
24S 06W 31.01A0	NAT	BL	0.52	
25S 03W 13.00A	ABC	BL	0.23	
25S 03W 20.00A	PRR	BL	0.85	
25S 03W 29.10A	NAT	BL	0.24	
25S 03W 29.11A	PRR	BL	0.17	
25S 03W 29.13A	NAT	BL	0.18	
25S 03W 30.00B	PRR	BL	0.06	
25S 03W 30.00C	NAT	PV	0.01	
25S 04W 02.00A1	ASC	BL	1.35	Renovation work planned as part of Whatagas Timber Sale
25S 04W 02.00A2	ASC	BL	0.42	Renovation work planned as part of Whatagas Timber Sale
25S 04W 02.00A3	PRR	BL	0.54	Renovation work planned as part of Whatagas Timber Sale
25S 04W 02.00B	PRR	BL	1.2	Renovation work planned as part of Whatagas Timber Sale
25S 04W 02.00C	PRR	BL	0.01	Renovation work planned as part of Whatagas Timber Sale
25S 04W 02.00D1	PRR	BL	0.14	Renovation work planned as part of Whatagas Timber Sale
25S 04W 12.00A	ASC	PB	0.5	Renovation work planned as part of Whatagas Timber Sale
25S 04W 12.00B	ASC	BL	0.35	Whatagas TS plans to Decom. past 7.0 road junction
25S 04W 12.00C	NAT	BL	0.54	Whatagas TS Plans to Decom.
25S 04W 12.00D	NAT	BL	0.94	Whatagas TS Plans to Decom.
25S 04W 12.01A1	ASC	BL	0.19	Renovation work planned as part of Whatagas Timber Sale
25S 04W 12.01A2	ASC	BL	0.34	Renovation work planned as part of Whatagas Timber Sale
25S 04W 12.01B	PRR	BL	0.31	Renovation work planned as part of Whatagas Timber Sale
25S 04W 12.01C	PRR	BL	2.18	Renovation work planned as part of Whatagas Timber Sale
25S 04W 12.01D	PRR	BL	1.33	Renovation work planned as part of Whatagas Timber Sale
25S 04W 24.00B	NAT	BL	0.05	
25S 04W 24.01A1	ASC	BL	1.02	Renovation work planned as part of Whatagas Timber Sale
25S 04W 29.01A	NAT	BL	0.34	
25S 04W 29.02A	NAT	BL	0.24	
25S 05W 13.00C	ABC	BL	1.35	

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APPENDIX A

CALAPOOYA CREEK WATERSHED
BLM PAST YEARS TIMBER SALES AND
OLD GROWTH VEGETATION DATA

Sale	Stems	acres	%D.F.	%P.P.	%G.F.	%W.H.	%I.C.	%WRC	%Hrdwds.	ave.dbh
Field Cr.	13246	173	63.5	—	3.6	1.8	15.8	2.5	12.8	24"
Upp.Gassy Cr.	5594	71	53.1	—	4.6	2.9	22.1	5.9	11.4	23"
Mill Cr	9790	124	56.2	—	9.3	3.5	5.8	12.5	12.7	21"
Up.Calapo..	6467	95	34.2	—	2.1	36.2	1.7	15.0	10.8	26"
Up.Goss. Cr.	14882	194	51.9	—	8.2	6.2	9.9	13.7	10.1	25"
Jeff. Revenge	5034	74	81.7	1.5	0.8	5.7	2.9	5.9	5.9	25"
Cocker.II	3506	54	94.4	—	----	----	1.1	----	4.5	24"
E.Sutherlin	4012	53	90.8	.1	----	----	1.0	----	8.1	23"
Just a Long	4379	73	87.6	—	.6	----	6.3	----	5.5	24"
Whatagas	11966	132	55.0	—	4.1	3.6	19.2	4.2	13.8	22"
	78876	1043								

Stems Per Acre = 78876 / 1043 = **75.6 stems/acre**

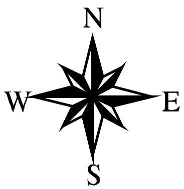
Sale	Stems	acres	DF	PP	GF	WH	IC	WRC	Hrdwds.	Stem/ac
Field Cr.	13246	173	8402	—	472	240	2098	334	1700	76.6
Upp.Gassy Cr.	5594	71	2969	—	259	165	1236	327	636	78.8
Mill Cr	9790	124	5501	—	909	347	567	1227	1239	79.0
Upp.Calapo.	6467	95	2214	—	133	2338	113	967	702	68.1
Up Goss. Cr.	14882	194	7726	—	1216	928	1469	2032	1511	76.7
Jeff. Revenge	5034	74	4114	76	74	41	285	145	299	68.0
Cocker II	3506	54	3309	—	—	—	37	—	160	64.9
E.Sutherlin	4012	53	3604	4	—	—	41	—	323	75.7
Just as Long	4379	73	3833	—	27	—	278	—	241	60.0
Whatagas	11966	132	6576	—	492	433	2302	511	1652	90.6
TOTALS:	**78876**	**1043**	**48288**	**80**	**3582**	**4492**	**8426**	**5543**	**8465**	**75.6**

STEMS	SPECIES	% STAND MIX
48288	***D. Fir***	61.3%
80	***P. Pine***	0.1%
3582	***G. Fir***	4.5%
4492	***W. Hem.***	5.7%
8426	***I. Cedar***	10.7%
5543	***WRCedar***	7.0%
8465	***Hrdwds.***	10.7%
78876		**100.0%**

Mean DBH 23.7"

APPENDIX B

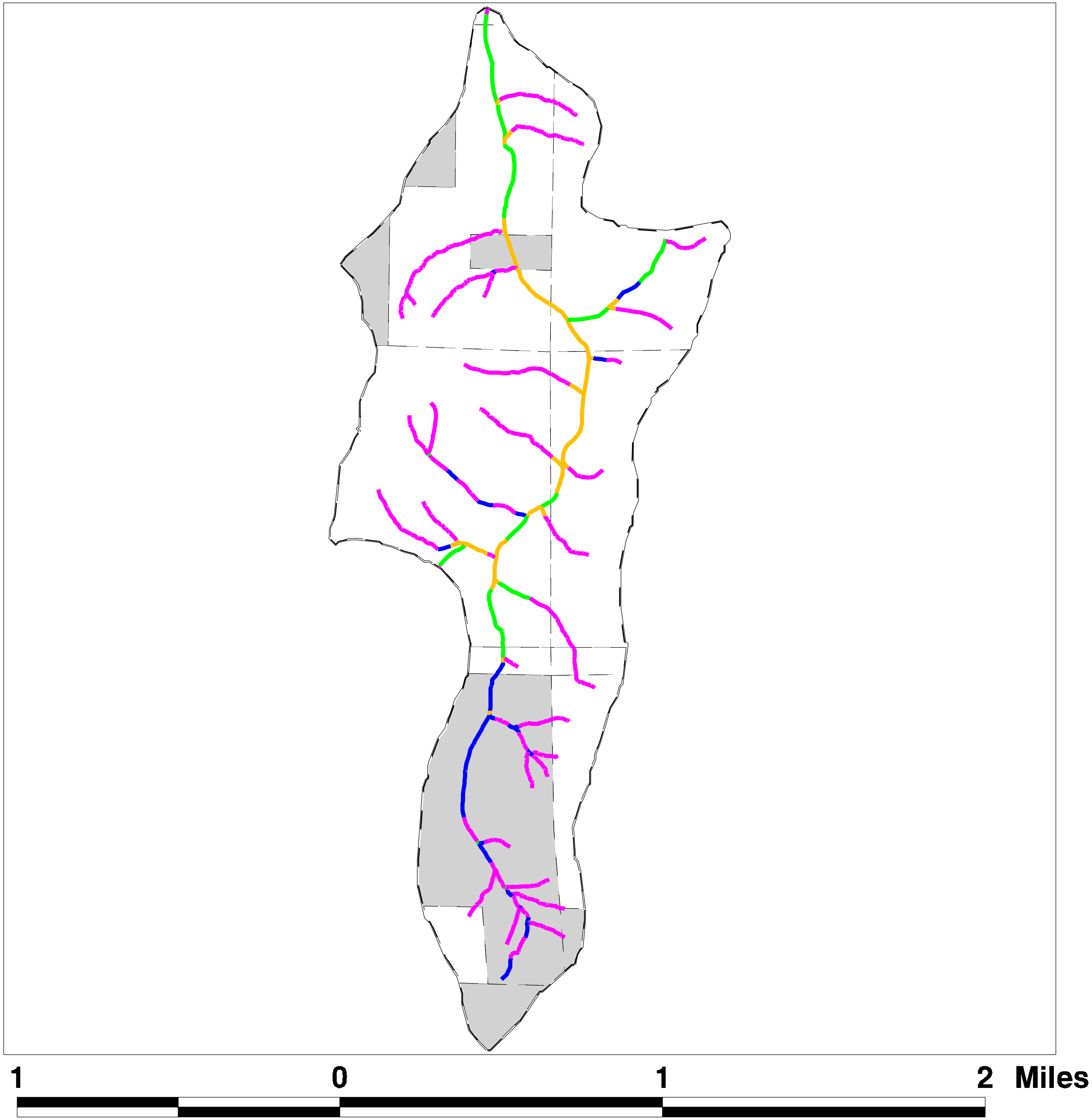
Foster Creek



Channel Types (slope)
- Type C or F (<2%)
- Type B or G (2%-4%)
- Type A (4%-10%)
- Type Aa+ (>10%)

Ownership
- BLM
- Other
- Watershed Boundary

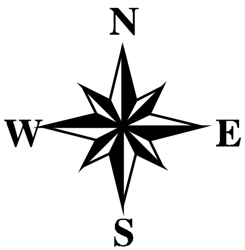
Channel Type	Miles
C or F	1.70
B or G	1.55
A	1.18
Aa+	5.92



Rosgen Level 1 Channel Types

Prepared by LD Standley 7/19/99

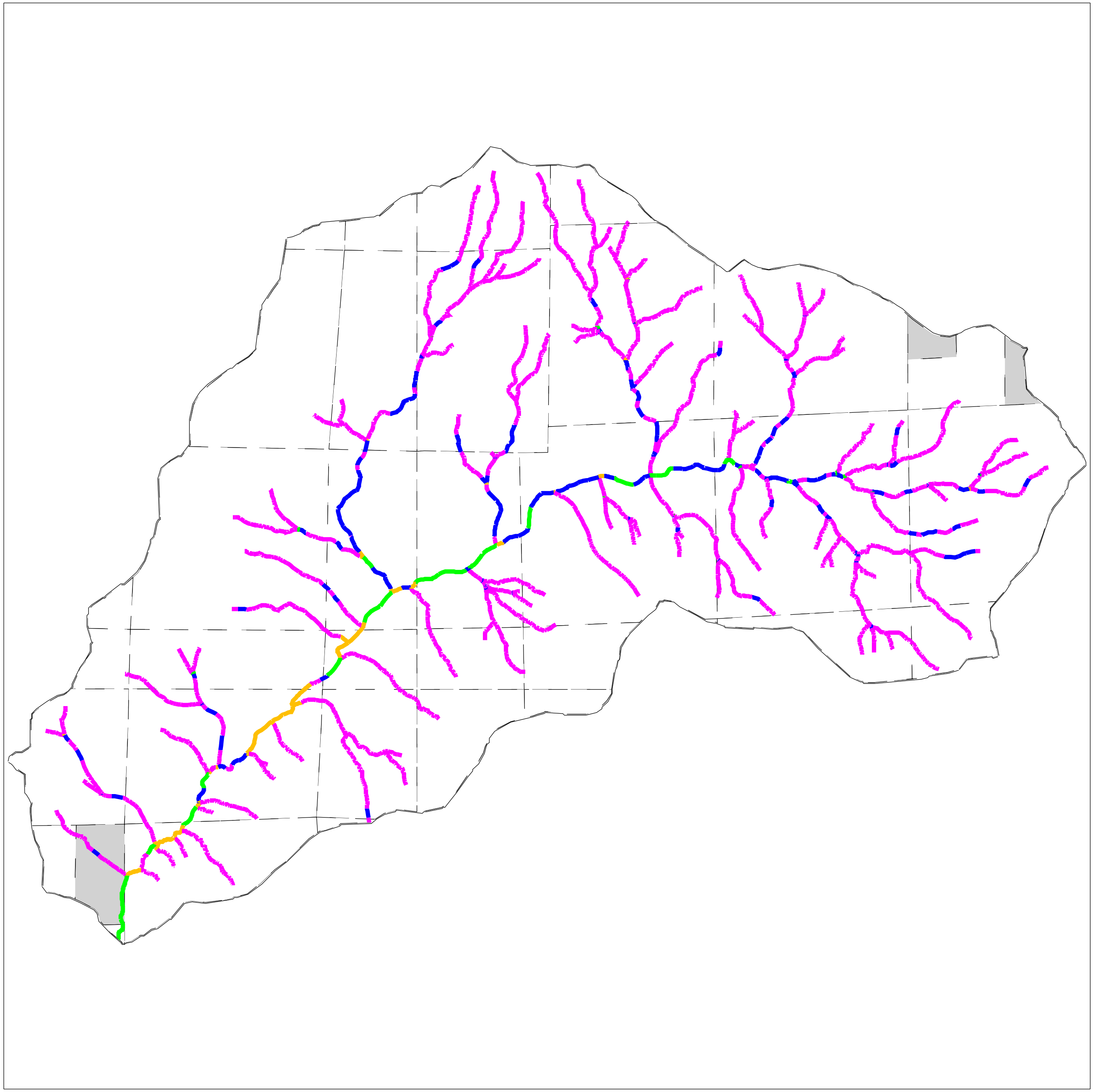
North Fork Calapooya



Channel Types (slope)
- Type C or F (<2%)
- Type B or G (2%-4%)
- Type A (4%-10%)
- Type Aa+ (>10%)

Ownership
- BLM
- Other
- Watershed Boundary

Channel Type	Miles
C or F	1.67
B or G	2.09
A	5.89
Aa+	34.02

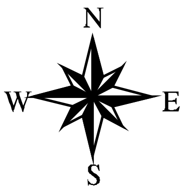


1 0 1 2 Miles

Rosgen Level 1 Channel Types

Prepared by LD Standley 6/17/99

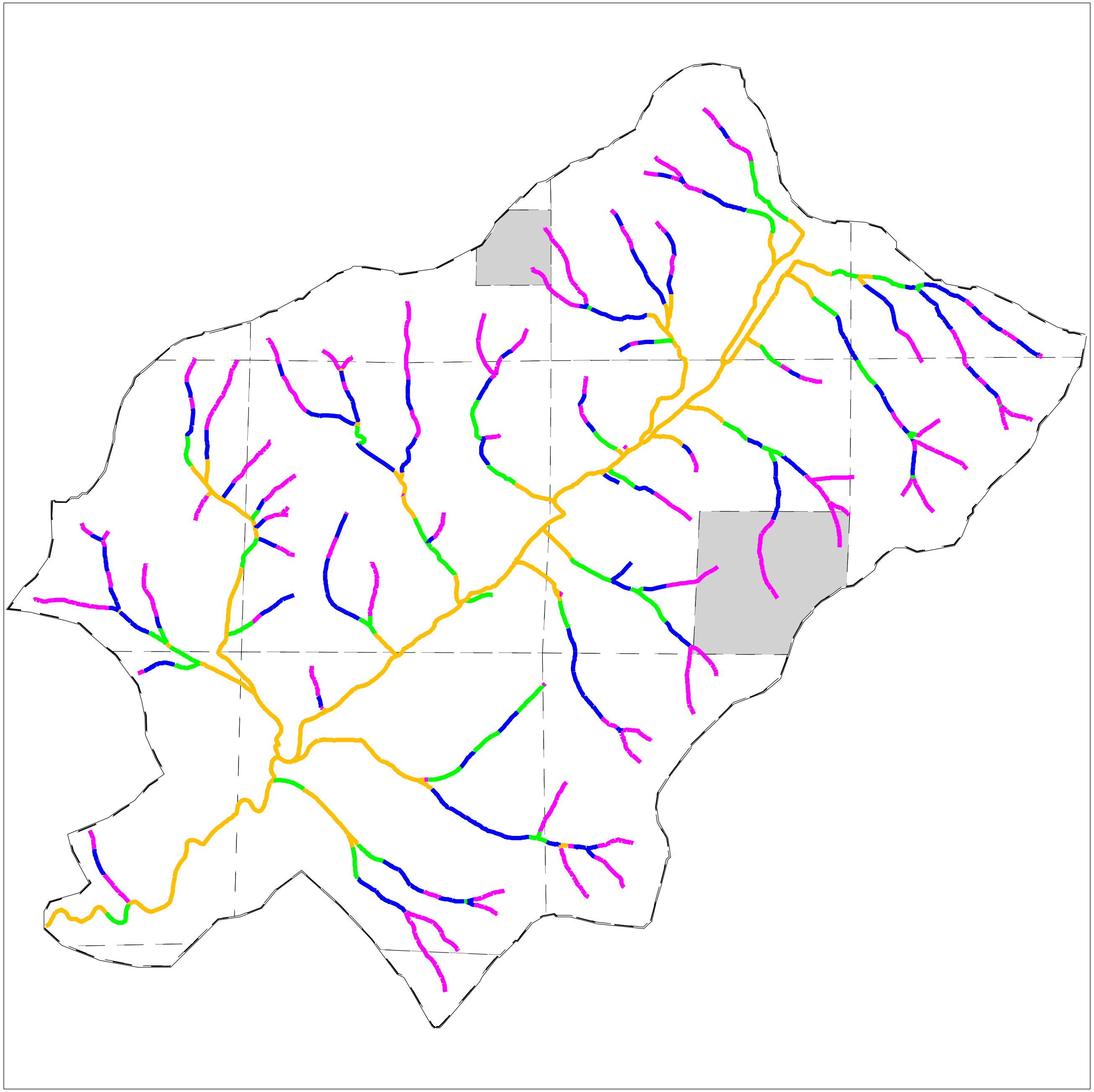
Driver Valley



Channel Types (slope)
- Type C or F (<2%)
- Type B or G (2%-4%)
- Type A (4%-10%)
- Type Aa+ (>10%)

Ownership
- BLM
- Other
- Watershed Boundary

Channel Type	Miles
C or F	9.29
B or G	4.33
A	7.44
Aa+	9.60

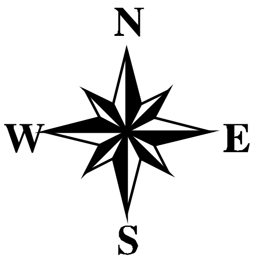


1 0 1 2 Miles

Rosgen Level 1 Channel Types

Prepared by LD Standley 6/28/99

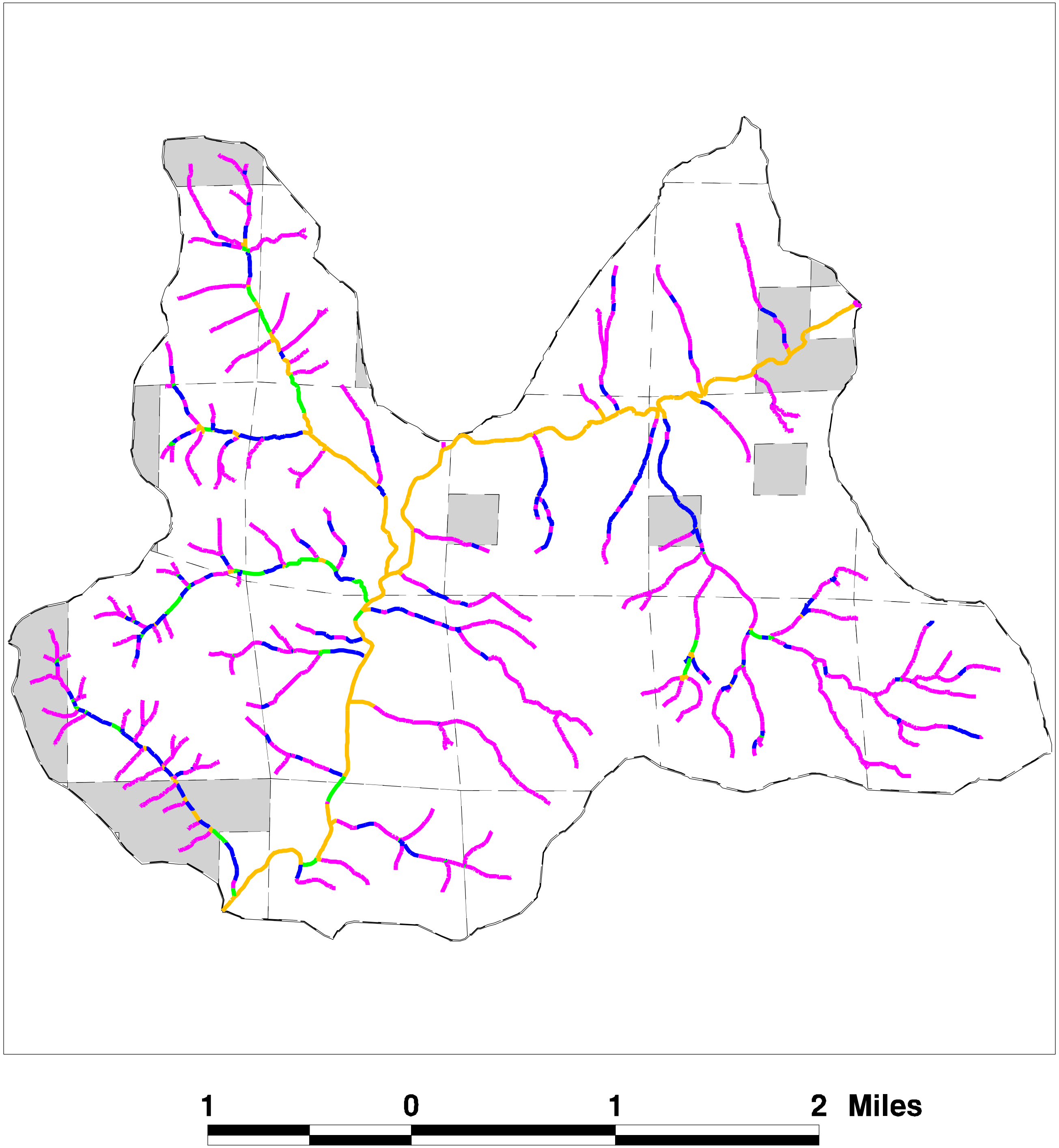
Buzzard Roost



Channel Types (slope)
- Type C or F (<2%)
- Type B or G (2%-4%)
- Type A (4%-10%)
- Type Aa+ (>10%)

Ownership
- BLM
- Other
- Watershed Boundary

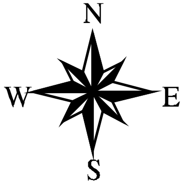
table1.dbf



Rosgen Level 1 Channel Types

Prepared by LD Standley 6/23/99

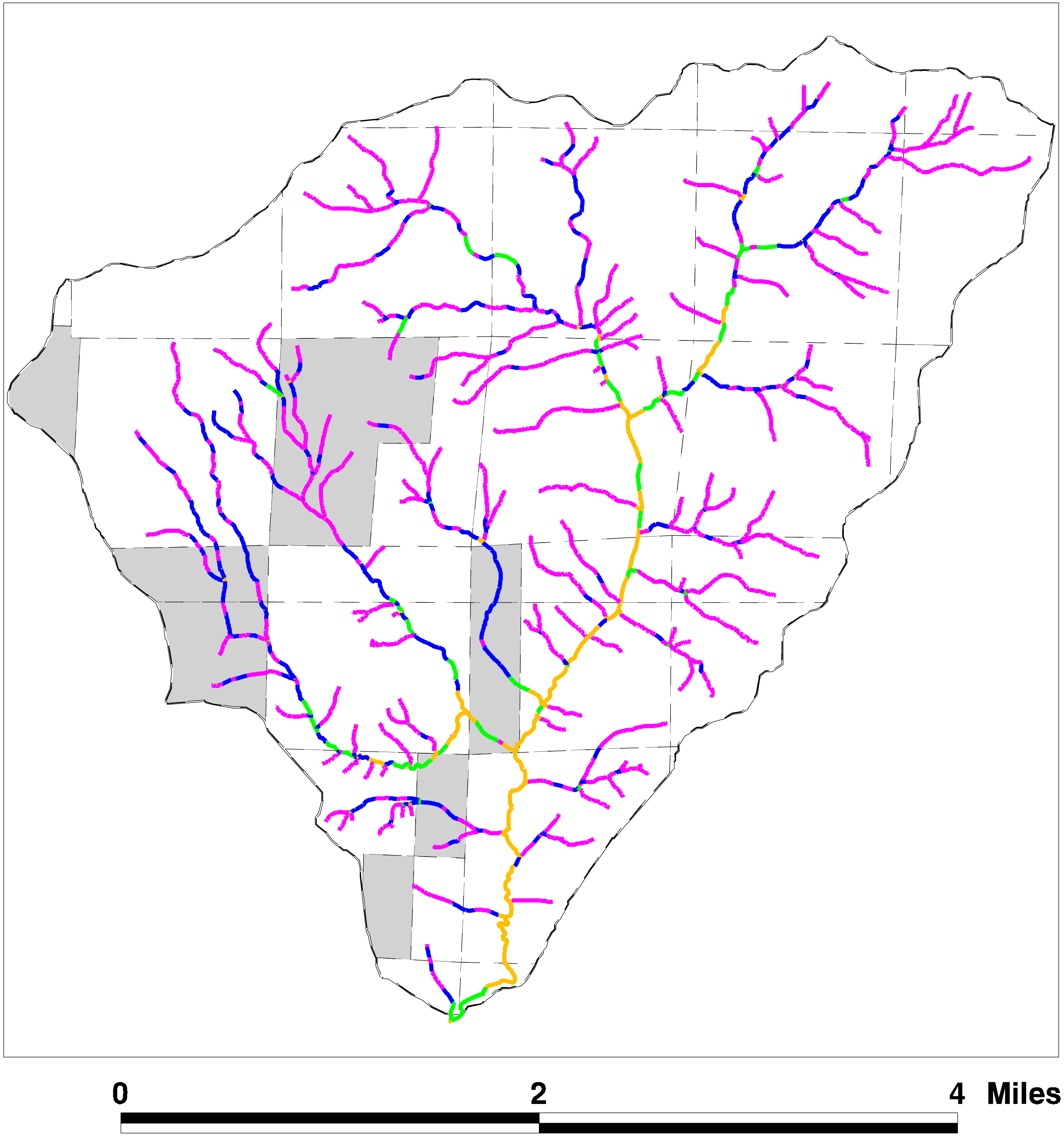
Calapooya Divide



Channel Types (slope)
- Type C or F (<2%)
- Type B or G (2%-4%)
- Type A (4%-10%)
- Type Aa+ (>10%)

Ownership
- BLM
- Other
- Watershed Boundary

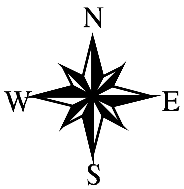
Channel Type	Miles
C or F	4.85
B or G	3.44
A	10.44
Aa+	33.82



Rosgen Level 1 Channel Types

Prepared by LD Standley 6/28/99

Oldham Creek



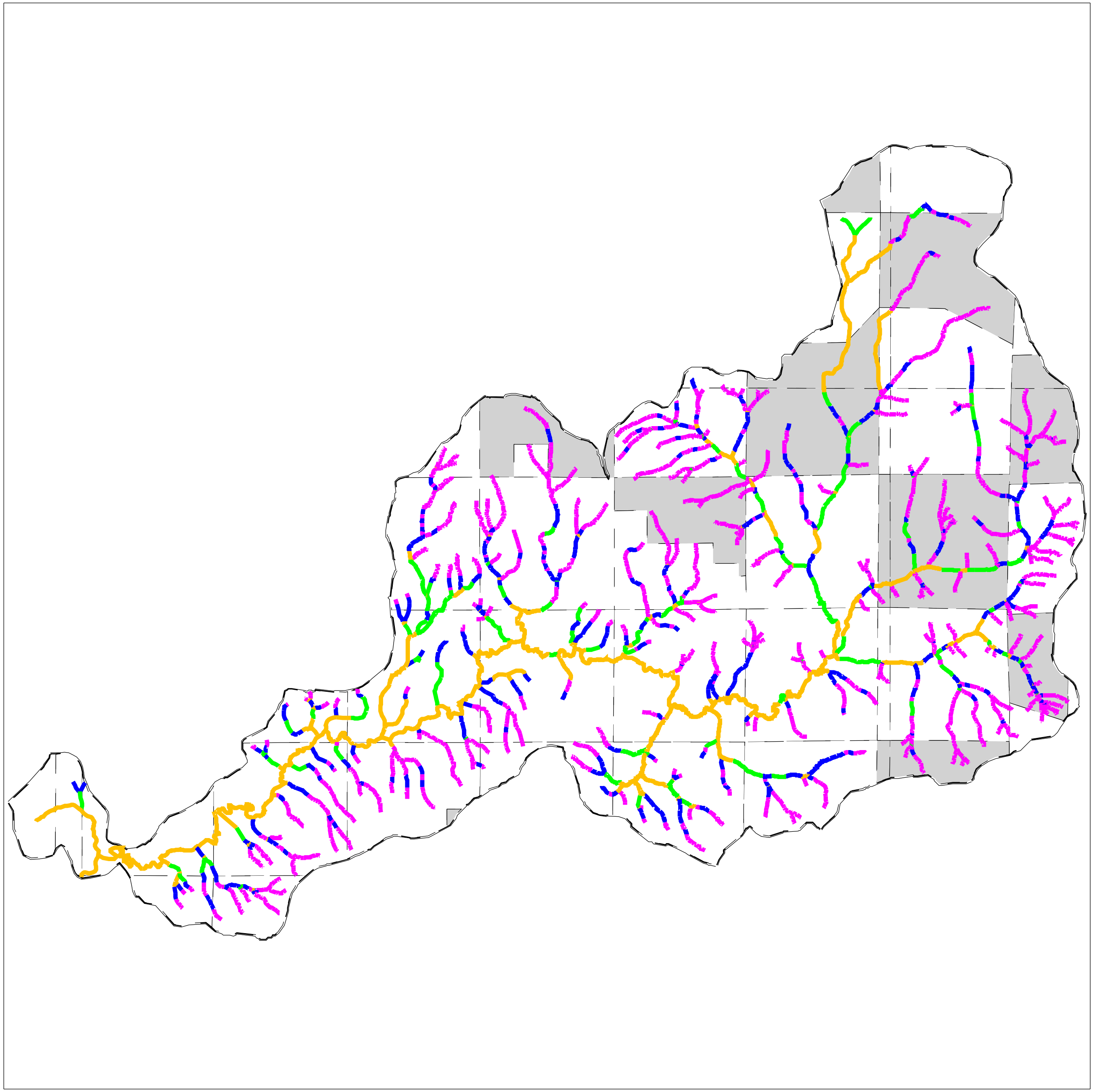
Channel Types (slope)

- Type C or F (<2%)
- Type B or G (2%-4%)
- Type A (4%-10%)
- Type Aa+ (>10%)

Ownership

- BLM
- Other
- Watershed Boundary

Channel Type	Miles
C or F	23.54
B or G	11.01
A	18.45
Aa+	45.72

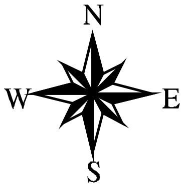


1 0 1 2 3 4 5 Miles

Rosgen Level 1 Channel Types

Prepared by LD Standley 7/19/99

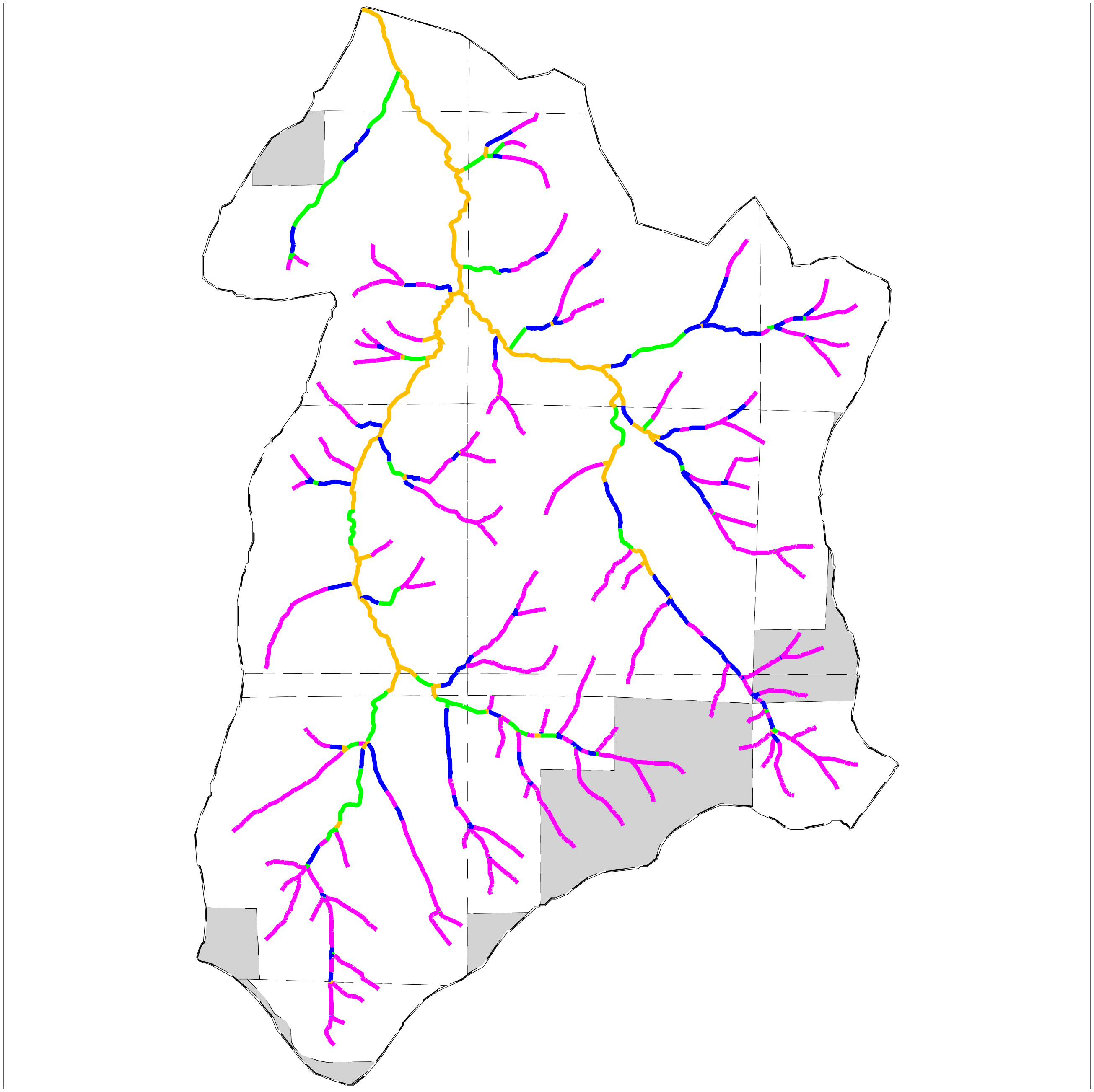
Nonpariel



Channel Types (slope)
Type C or F (<2%)
Type B or G (2%-4%)
Type A (4%-10)
Type Aa+ (>10%)

Ownership
BLM
Other
Watershed Boundary

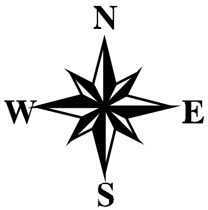
Channel Type	Miles
C or F	4.83
B or G	3.00
A	4.89
Aa+	16.87



Rosgen Level 1 Channel Types

Prepared by LD Standley 6/28/99

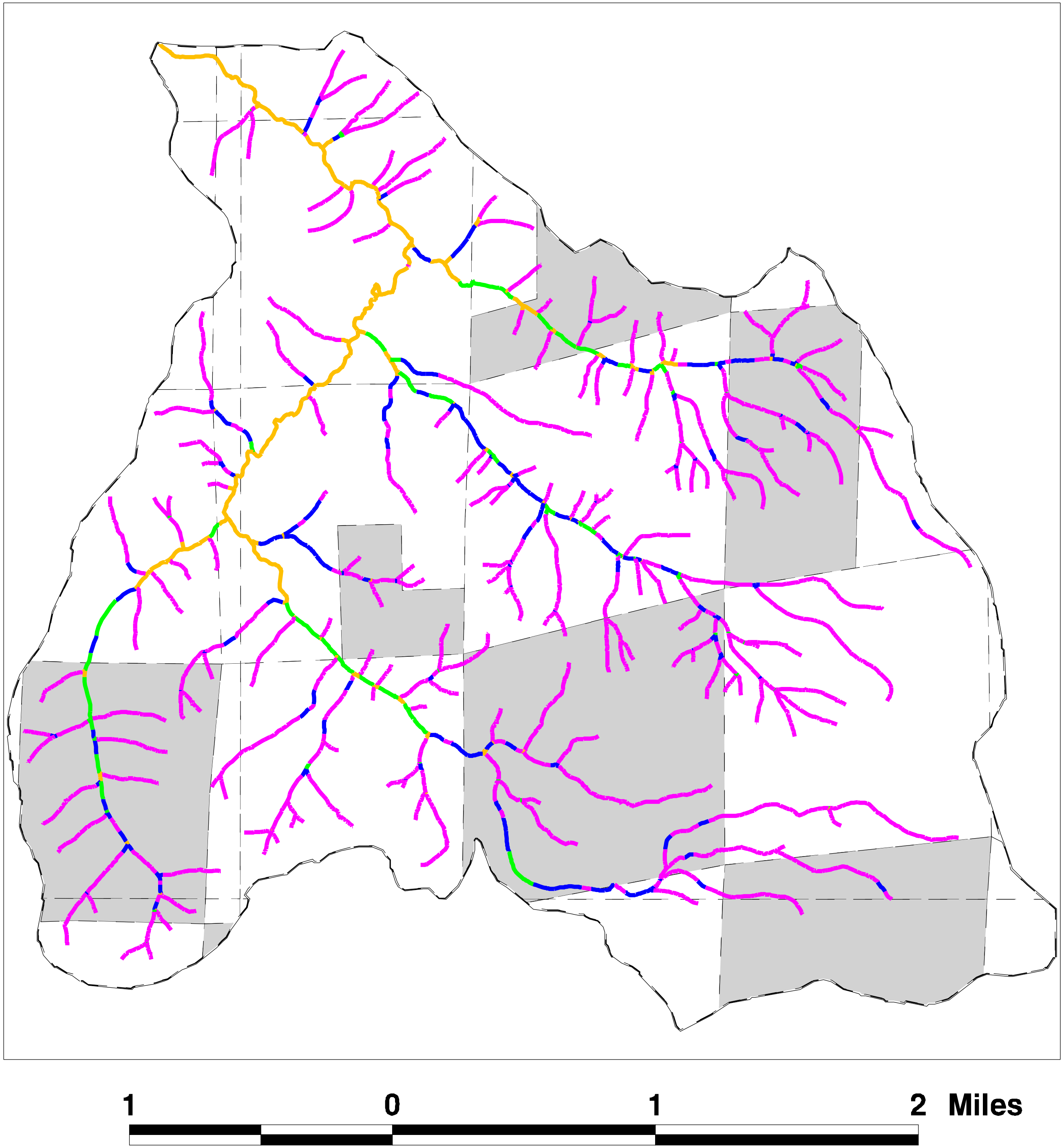
Gassy Creek



Channel Types (slope)
- Type C or F (<2%)
- Type B or G (2%-4%)
- Type A (4%-10%)
- Type Aa+ (>10%)

Ownership
- BLM
- Other
- Watershed Boundary

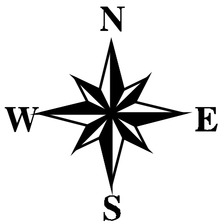
Channel Type	Miles
C or F	5.34
B or G	3.07
A	5.90
Aa+	36.59



Rosgen Level 1 Channel Types

Prepared by LD Standley 6/28/99

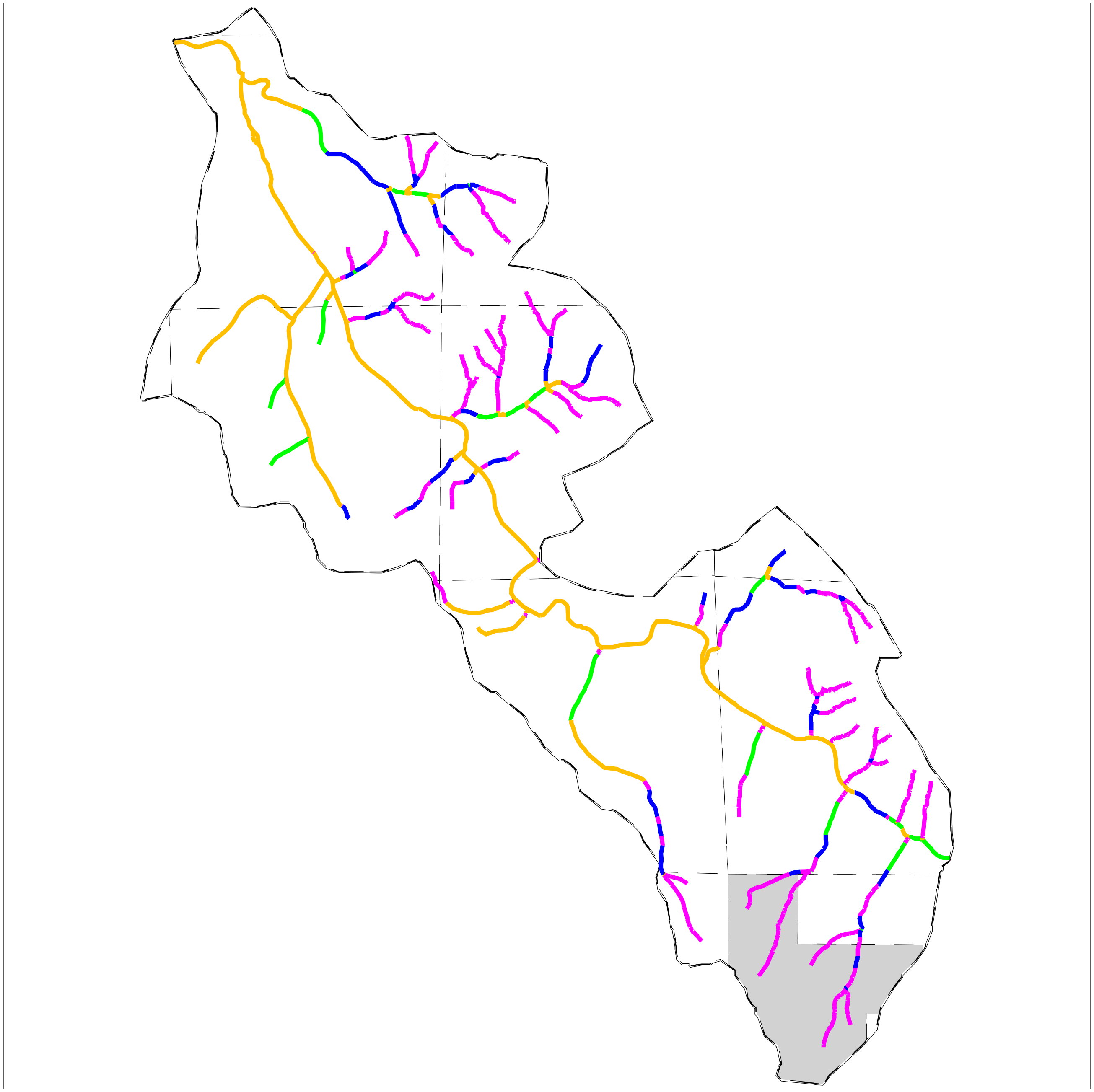
Fair Oaks



Channel Types (slope)
- Type C or F (<2%)
- Type B or G (2%-4%)
- Type A (4%-10%)
- Type Aa+ (>10%)

Ownership
- BLM
- Other
- Watershed Boundary

Channel Type	Miles
C or F	7.83
B or G	1.99
A	3.02
Aa+	8.23



1 0 1 2 Miles

Rosgen Level 1 Channel Types

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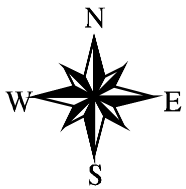
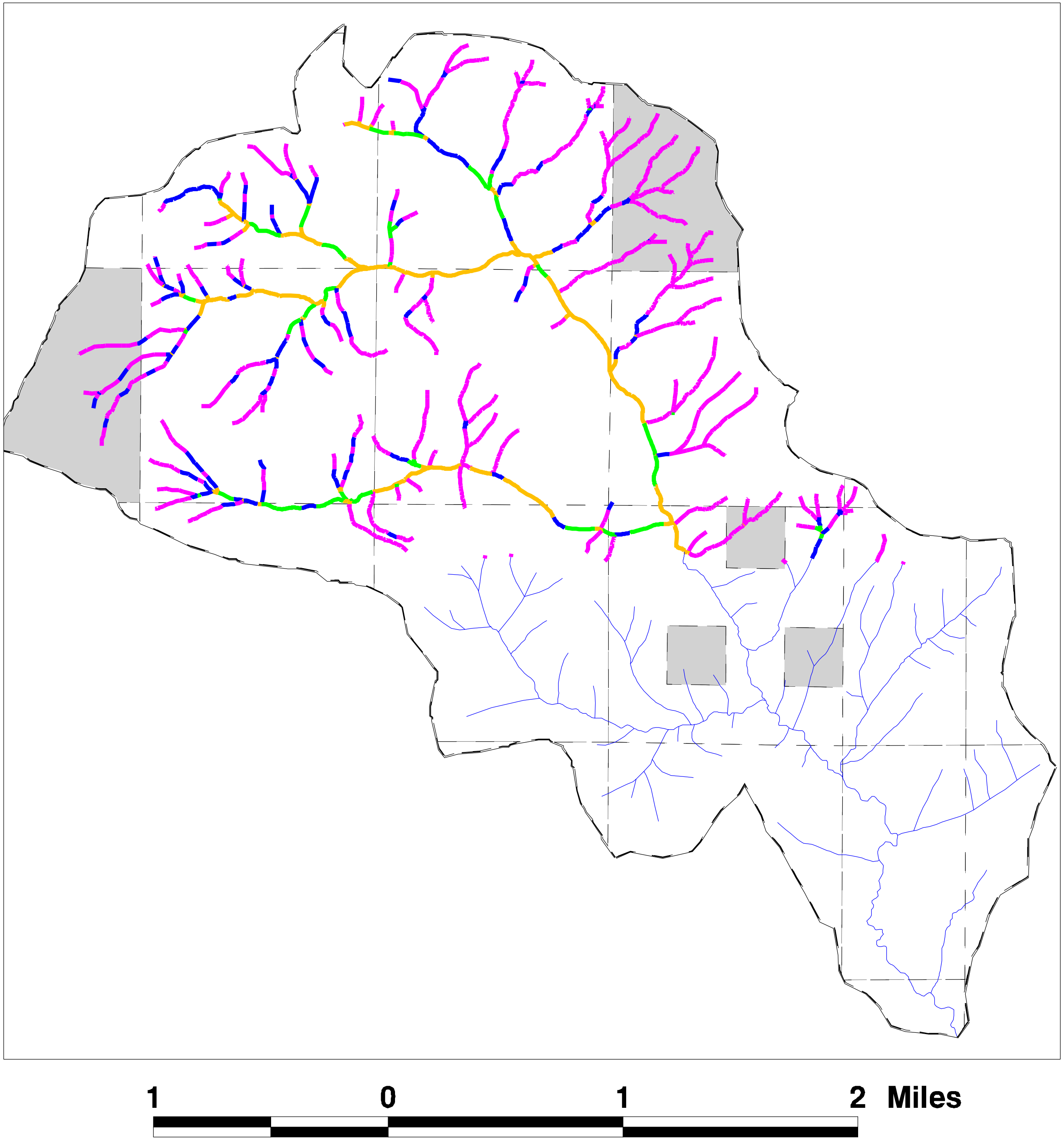
Dodge Canyon



Channel Types (slope)
- Type C or F (<2%)
- Type B or G (2%-4%)
- Type A (4%-10%)
- Type Aa+ (>10%)
- no data

Ownership
- BLM
- Other
- Watershed Boundary

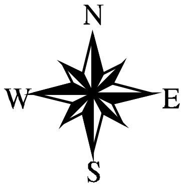
Channel Type	Miles
C or F	5.22
B or G	2.78
A	5.66
Aa+	18.79
no data	18.47



Rosgen Level 1 Channel Types

Prepared by LD Standley 6/28/99

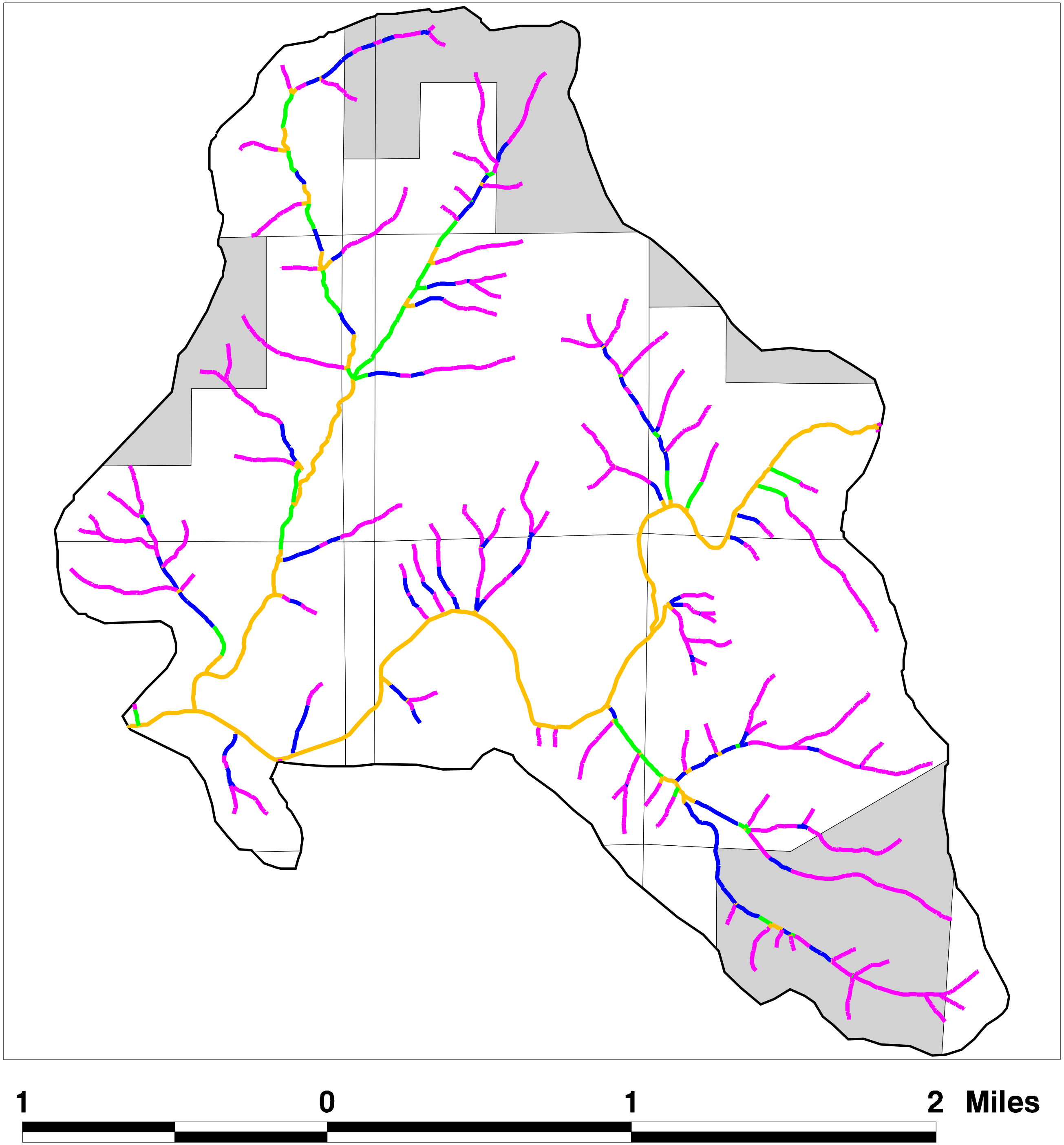
Cantell Creek



Channel Types (slope)
Type C or F (<2%)
Type B or G (2%-4%)
Type A (4%-10%)
Type Aa+ (>10%)

Ownership
BLM
Other
Watershed Boundary

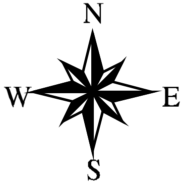
Channel Type	Miles
C or F	6.78
B or G	2.46
A	4.71
Aa+	16.70



Rosgen Level 1 Channel Types

Prepared by LD Standley 6/28/99

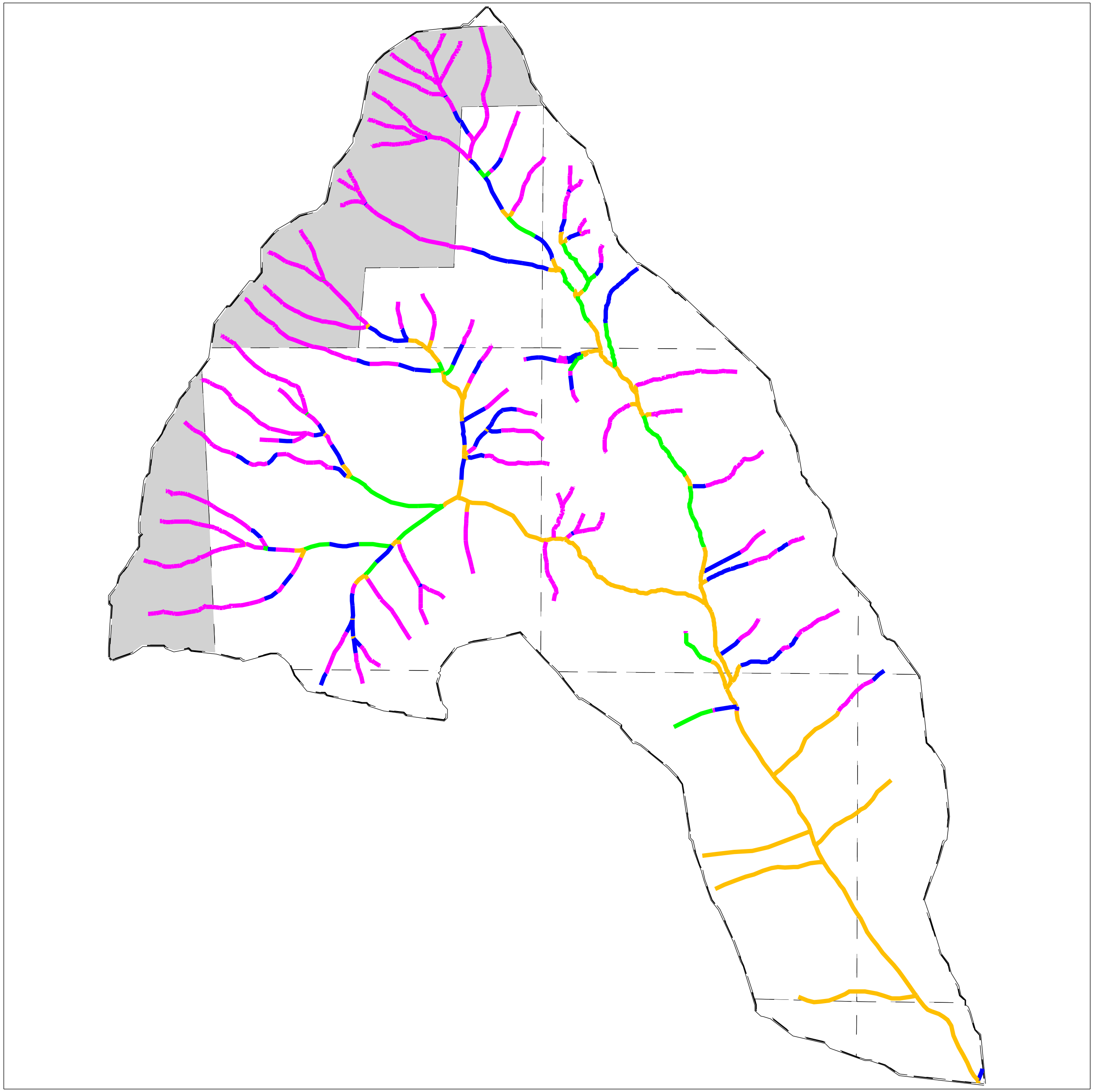
Blackberry Canyon



Channel Types (slope)
Type C or F (<2%)
Type B or G (2%-4%)
Type A (4%-10%)
Type Aa+ (>10%)

Ownership
BLM
Other
Watershed Boundary

Channel Type	Miles
C or F	6.39
B or G	2.29
A	3.82
Aa+	12.24

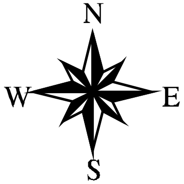


1 0 1 2 Miles

Rosgen Level 1 Channel Types

Prepared by LD Standley 6/28/99

South Fork Calapooya



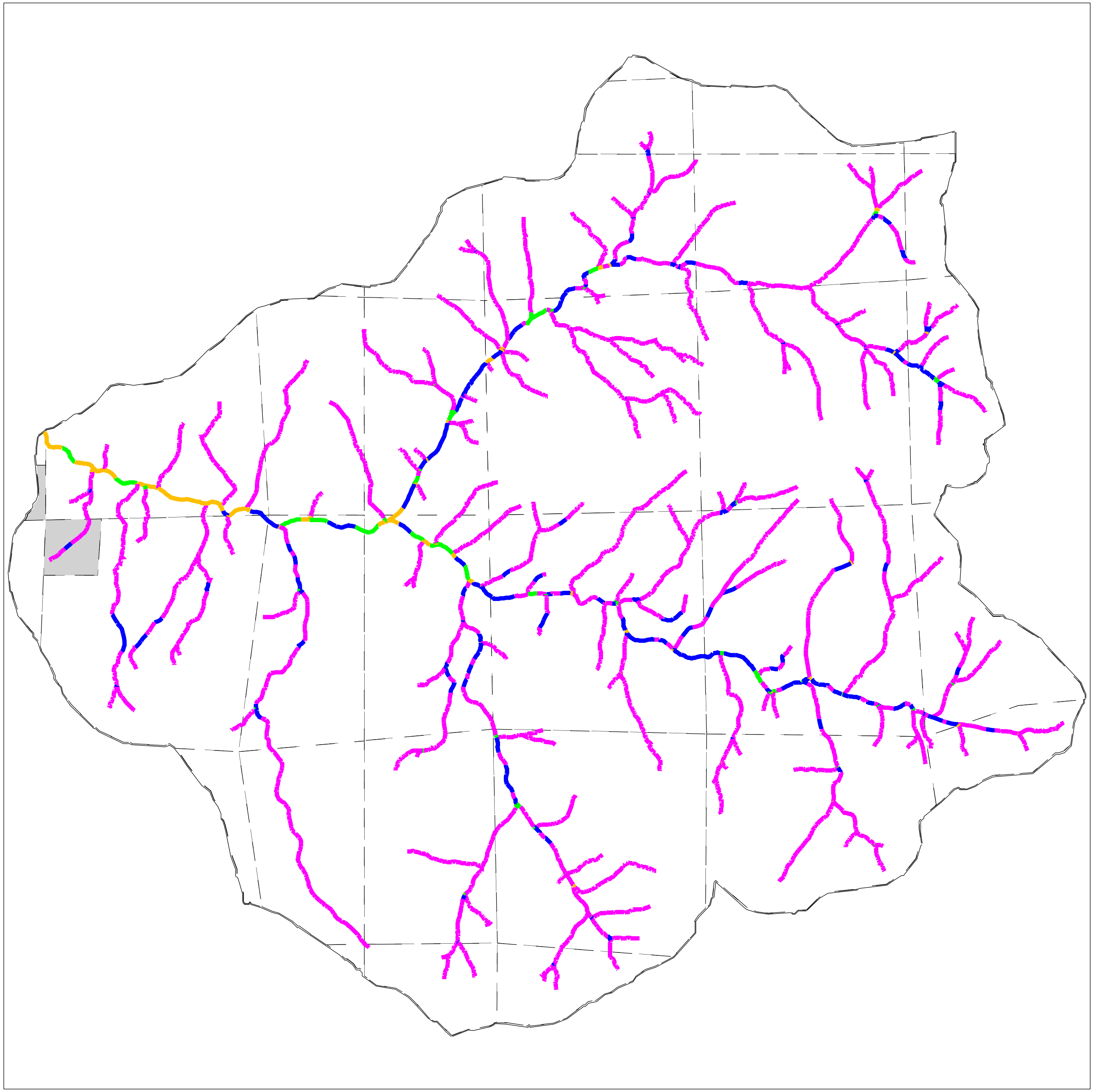
Channel Types (slope)

- Type C or F (<2%)
- Type B or G (2%-4%)
- Type A (4%-10%)
- Type Aa+ (>10%)

Ownership

- BLM
- Other
- Watershed Boundary

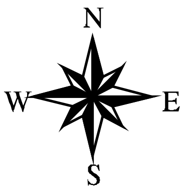
Channel Type	Miles
C or F	1.70
B or G	1.60
A	6.55
Aa+	44.27



Rosgen Level 1 Channel Types

Prepared by LD Standley 7/21/99

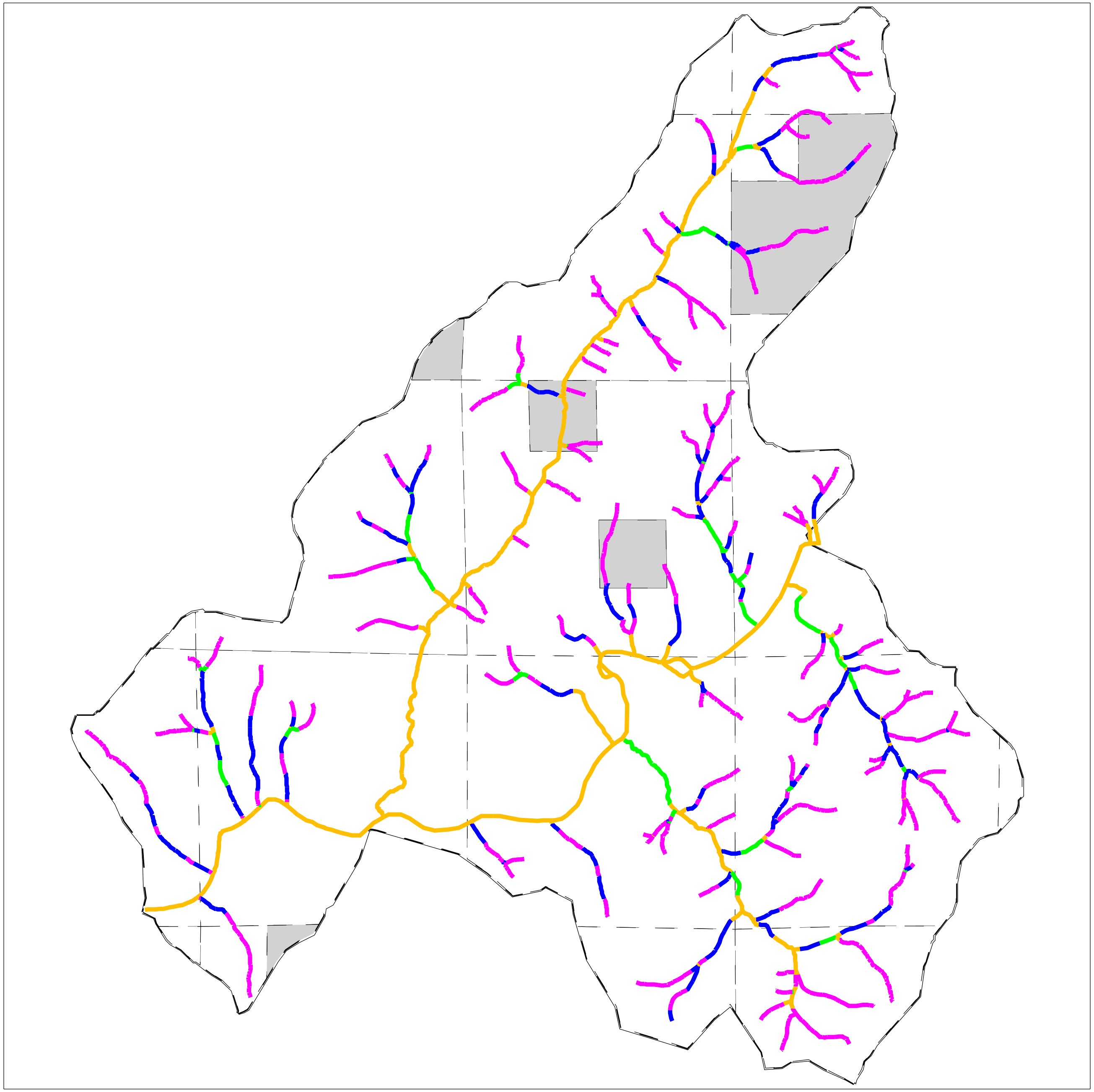
Long Valley



Channel Types (slope)
Type C or F (<2%)
Type B or G (2%-4%)
Type A (4%-10%)
Type Aa+ (>10%)

Ownership
BLM
Other
Watershed Boundary

Channel Type	Miles
C or F	9.74
B or G	2.43
A	6.76
Aa+	15.65

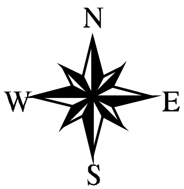


1 0 1 2 Miles

Rosgen Level 1 Channel Types

Prepared by LD Standley 7/19/99

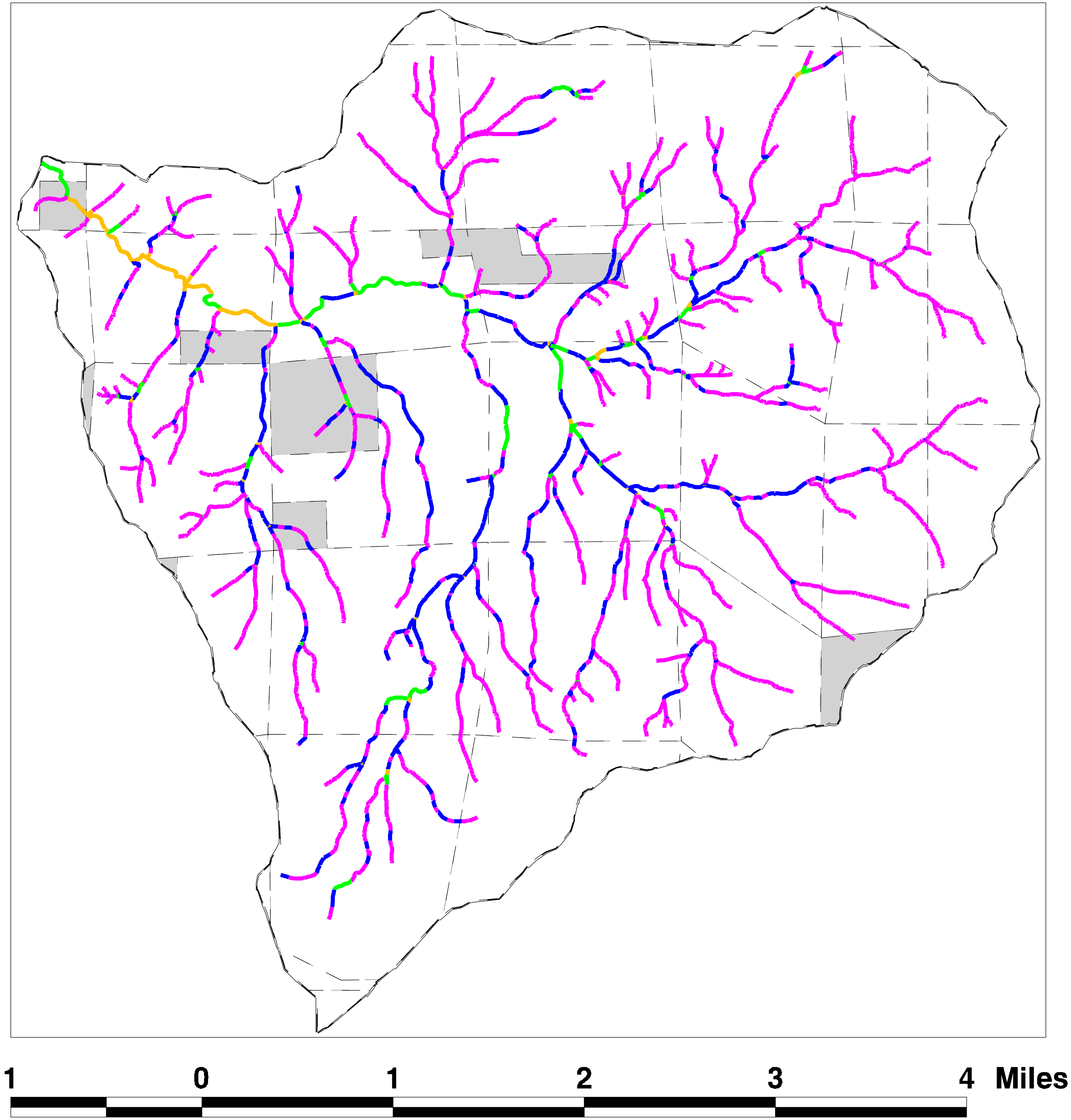
Hinkle Creek



Channel Types (slope)
- Type C or F (<2%)
- Type B or G (2%-4%)
- Type A (4%-10%)
- Type Aa+ (>10%)

Ownership
- BLM
- Other
- Watershed Boundary

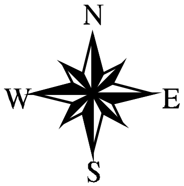
Channel Types	Miles
C or F	2.33
B or G	3.91
A	16.05
Aa+	45.78



Rosgen Level 1 Channel Types

Prepared by LD Standley 7/18/99

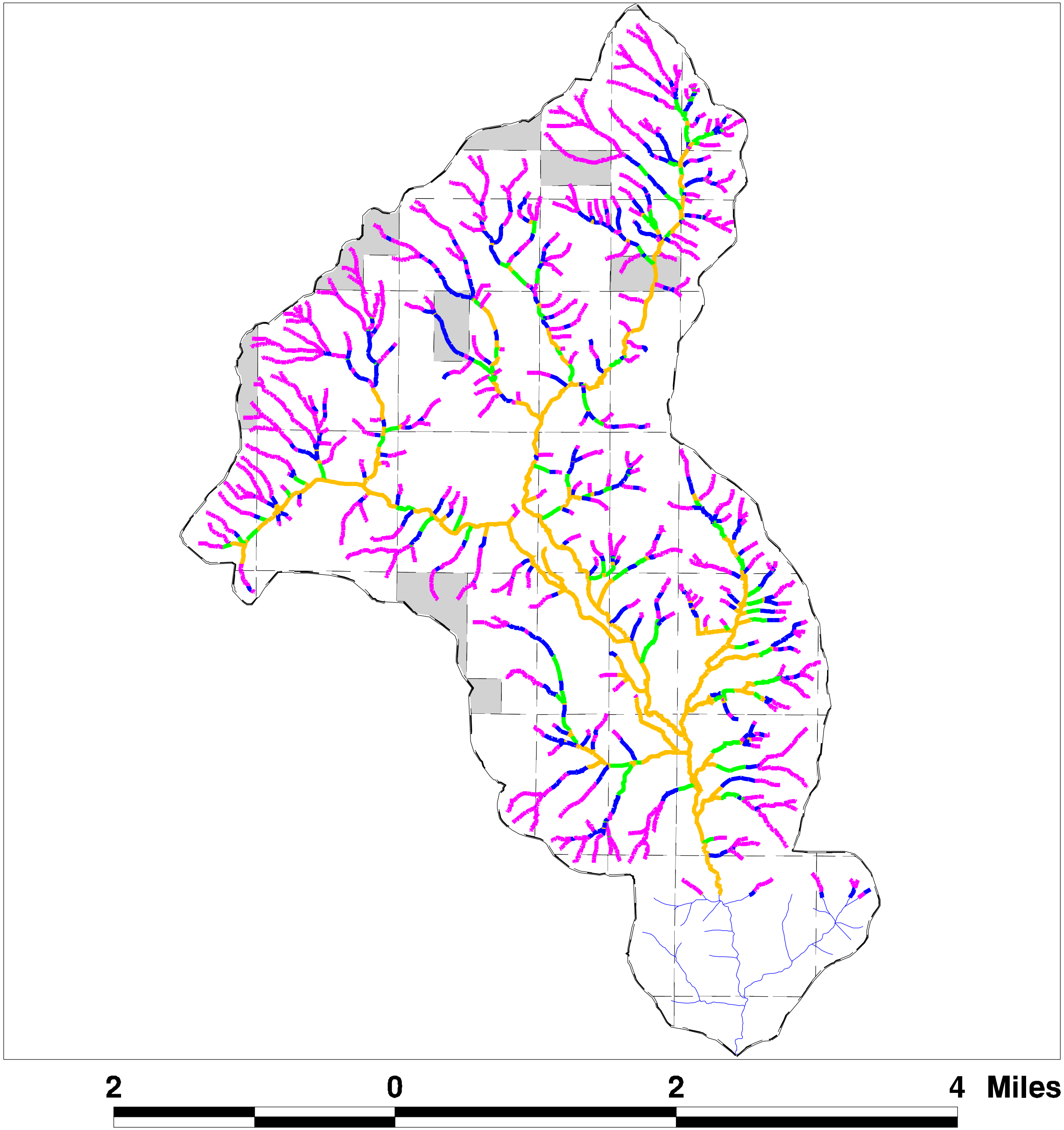
Green Valley



Channel Types (slope)
- Type C or F (<2%)
- Type B or G (2%-4%)
- Type A (4%-10%)
- Type Aa+ (>10%)
- no data

Ownership
- BLM
- Other
- Watershed Boundary

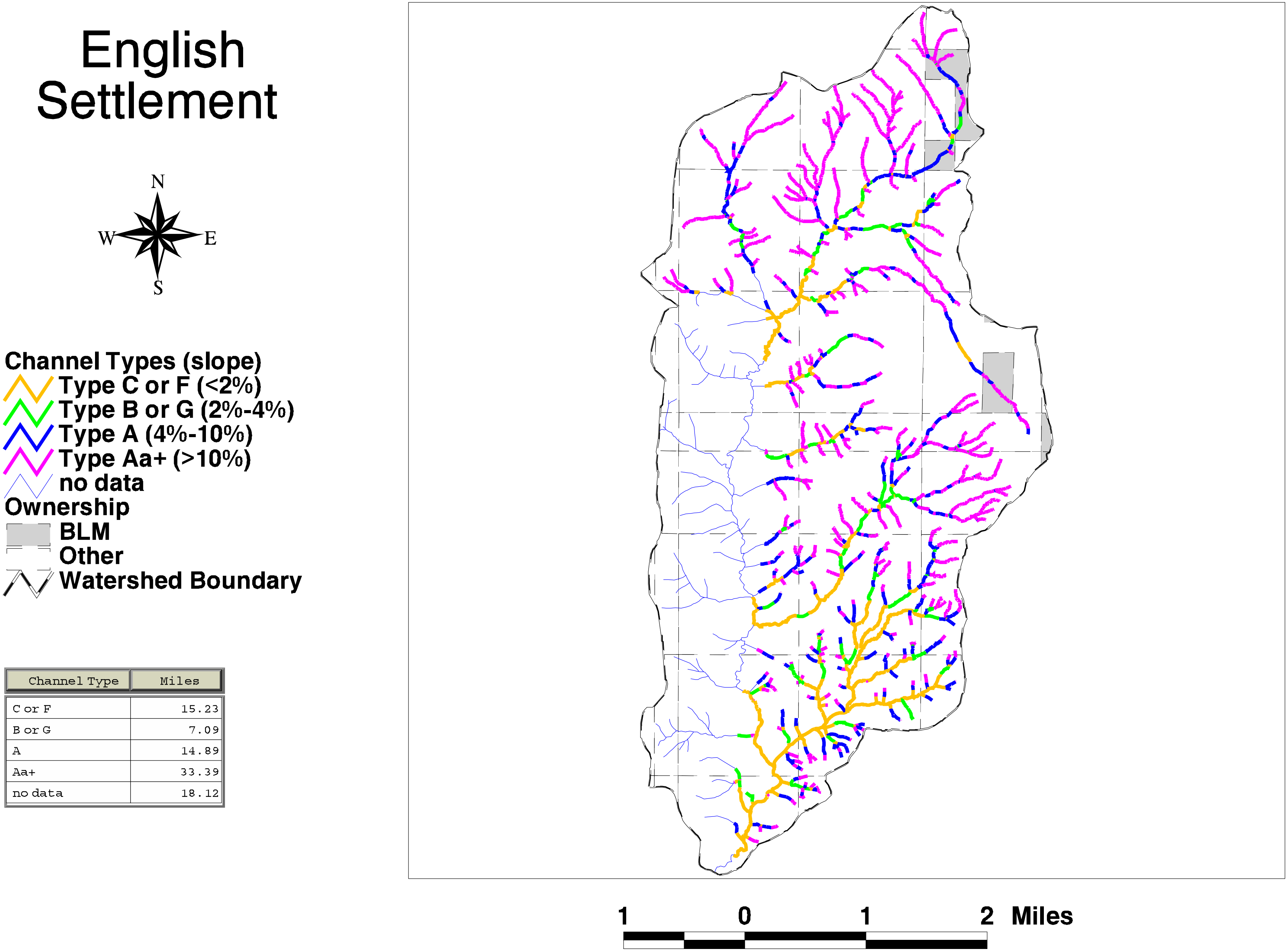
Channel Type	Miles
C or F	20.85
B or G	9.53
A	17.89
Aa+	50.43
no data	6.87



Rosgen Level 1 Channel Types

Prepared by LD Standley 6/29/99

English Settlement



Channel Type	Miles
C or F	15.23
B or G	7.09
A	14.89
Aa+	33.39
no data	18.12

Rosgen Level 1 Channel Types

Prepared by LD Standley 6/30/99