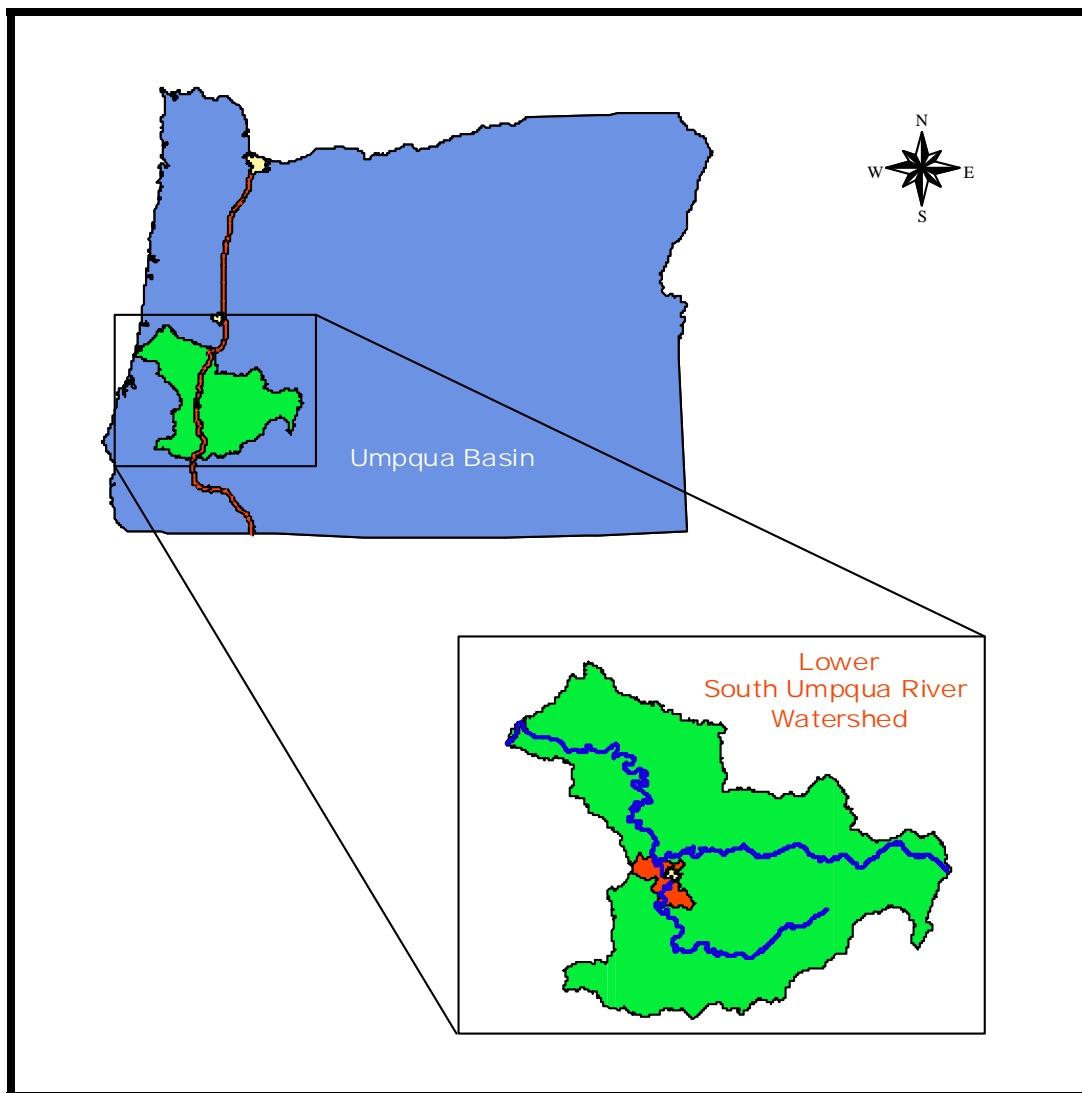


Lower South Umpqua

Watershed Assessment and Action Plan



Prepared by Nancy A. Geyer for the
Umpqua Basin Watershed Council



July, 2003



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July, 2003

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Acronym List

BLM	Bureau of Land Management
Cfs	Cubic feet per second
DFPA	Douglas Forest Protective Association
GIS	Geographic information system
NTU	Nephelometric turbidity units
ODEQ	Oregon Department of Environmental Quality
ODF	Oregon Department of Forestry
ODFW	Oregon Department of Fish and Wildlife
OWEB	Oregon Watershed Enhancement Board
OWRD	Oregon Water Resources Department
RUSA	Roseburg Urban Sanitary Authority
TMDL	Total maximum daily load
TSZ	Transient snow zone
UBWC	Umpqua Basin Watershed Council
USDI	United States Department of the Interior
USGS	United States Geological Survey
WAB	Water availability basin

Forward

We often hear the term “watershed” these days. We all live within a watershed. Fish habitat and water quality can be affected by the watershed’s condition and by the activities within it. All of us depend upon the water that flows from our watershed. But what exactly is a watershed?

A watershed is the area of land where all surface and groundwater drains into the same body of water, such as a river, wetland, or the ocean. Watersheds can be many millions of acres like the Colombia River Basin, or less than a dozen acres for a single small stream. Since the term “watershed” can be used for drainage areas of any size, the US Geological Survey (USGS) has divided watersheds into distinct units, or “fields,” based on size. Sizes range from multi-million acre first-field watersheds to seventh-fields that can be less than 3,000 acres.

For this assessment, the most important fields are third-field and fifth-field watersheds.¹ Third-field watersheds are large river basins. The Umpqua River Basin includes the South, North, and main Umpqua Rivers, as well as Smith River, and has roughly the same boundary as Douglas County. Third-field watersheds are usually referred to as “basins,” and in this document “basin” will be used to refer to the Umpqua Basin third-field watershed. Fifth-field watersheds have become the standard size used for research and projects by a variety of agencies and organizations. Therefore, it is convenient for fifth-field watershed to be the unit usually referred to herein by the term “watershed.” Watersheds are around 40,000 to 120,000 acres, and there are 33 fifth-fields in the Umpqua Basin.

Although the borders of the watersheds are standardized, the names are not. Different organizations and agencies may call the watersheds by different names, but, in general, all watersheds are named for the creek or the section of stream into which all tributaries drain.² For example, the Calapooya Creek Watershed includes all land that drains into Calapooya Creek or its tributaries. A very large stream, such as the South Umpqua River, is usually separated into multiple fifth-field watersheds.

All watersheds have their own features, challenges, and potential. The conditions in one watershed may not reflect the conditions in a neighboring watershed. This assessment evaluates the unique past, present, and potential future conditions of the Lower South Umpqua Watershed in terms of fish habitat and water quality.

¹ Fourth-field watersheds refer to sub-basins. Just as there are three main rivers in the Umpqua Basin, there are also three fourth-field watersheds, or sub-basins: the Umpqua River fourth-field watershed, the North Umpqua River fourth-field watershed, and the South Umpqua River fourth-field watershed.

² When one watershed does not encompass the entire drainage area, such as with a river or large creek, names reflect the relative location of the watershed along the main stem. Upper South Umpqua would be near the headwaters of the South Umpqua River, while Middle Cow Creek is somewhere in the middle of Cow Creek.

1. Introduction

The introduction provides a general description of the watershed in terms of its natural and human-made features, ownership and current land uses, and the communities within the watershed. Information in sections 1.2 and 1.3 were compiled from the following documents: *The Oregon Watershed Assessment Manual* (Watershed Professionals Network, 1999), the *Lower South Umpqua Watershed Analysis* (USDI Bureau of Land Management, 2000), and the *Middle South Umpqua Watershed Analysis* (USDI Bureau of Land Management, 1999). Additional information is from the following sources' databases: The Oregon Climate Service, the US Census Bureau, and the Douglas County Assessor.

Key Questions

- What is the Umpqua Basin Watershed Council?
- What is the purpose of the watershed assessment and action plan document?
- How was the watershed assessment developed?
- Where is the Lower South Umpqua Watershed and what are its defining characteristics?
- What are the demographic, educational, and economic characteristics of Lower South Umpqua Watershed residents?
- What is land ownership, use, and parcel size within the watershed?

1.1. Purpose and development of the watershed assessment

1.1.1. The Umpqua Basin Watershed Council

The Umpqua Basin Watershed Council (UBWC) is a non-profit, non-government, non-regulatory charitable corporation that works with willing landowners on projects to enhance fish habitat and water quality in the Umpqua Basin. The council has its origins in 1992 as the Umpqua Basin Fisheries Restoration Initiative (UBFRI) and was changed to the UBWC in May of 1997. Three years later, the council was incorporated as a non-profit organization. The UBWC's 16-member Board of Directors represents resource stakeholders in the Umpqua Basin. The board develops localized and basin-wide fish habitat and water quality improvement strategies that are compatible with community goals and economic needs. Activities include enhancing salmon and trout spawning and rearing grounds, eliminating barriers to migratory fish, and conducting workshops with landowners and residents about fish habitat and water quality issues in their areas. Depending on the need, the UBWC will provide direct assistance to individuals and groups, or coordinate cooperative efforts between multiple partners over a large area.

1.1.2. The watershed assessment and action plan

The Lower South Umpqua Watershed Assessment has two goals:

- 1) To describe the past, present, and potential future conditions that affect water quality and fish habitat within the Lower South Umpqua Watershed; and
- 2) To provide a research-based action plan that suggests voluntary activities to improve fish habitat and water quality within the watershed.

The action plan developed from findings in Chapter Three is a critical component of the assessment. The subchapters include a summary of each section's key findings and a list of action recommendations developed by UBWC staff, landowners, and restoration specialists. Chapter Six is a compilation of all key findings and action recommendations and includes a summary of potential UBWC Lower South Umpqua Watershed enhancement opportunities. Activities within the action plan *are suggestions for voluntary projects and programs*. The action plan should not be interpreted as landowner requirements or as a comprehensive list of all possible restoration opportunities.

1.1.3. Assessment development

This document is the product of a collaborative effort between the UBWC and Lower South Umpqua Watershed residents, landowners, and stakeholders. Members of the UBWC staff assembled information about each assessment topic and compiled the data into graphic and written form.³ Landowners and other interested parties met with Nancy Geyer of the UBWC staff to review information about the Lower South Umpqua Watershed and offer comments and suggestions for improvement.

The Lower South Umpqua watershed assessment meetings were held in conjunction with Middle South Umpqua assessment meetings.⁴ Landowners and residents of both groups met 12 times from September, 2001, until January, 2003. A total of 53 people attended one or more meetings, with an average of 9.7 participants per meeting. Meeting participants included farmers and ranchers, family forestland owners, industrial timber company employees, city officials, city residents, and Bureau of Land Management personnel.

1.2. Watershed description

1.2.1. Location, size, and major features

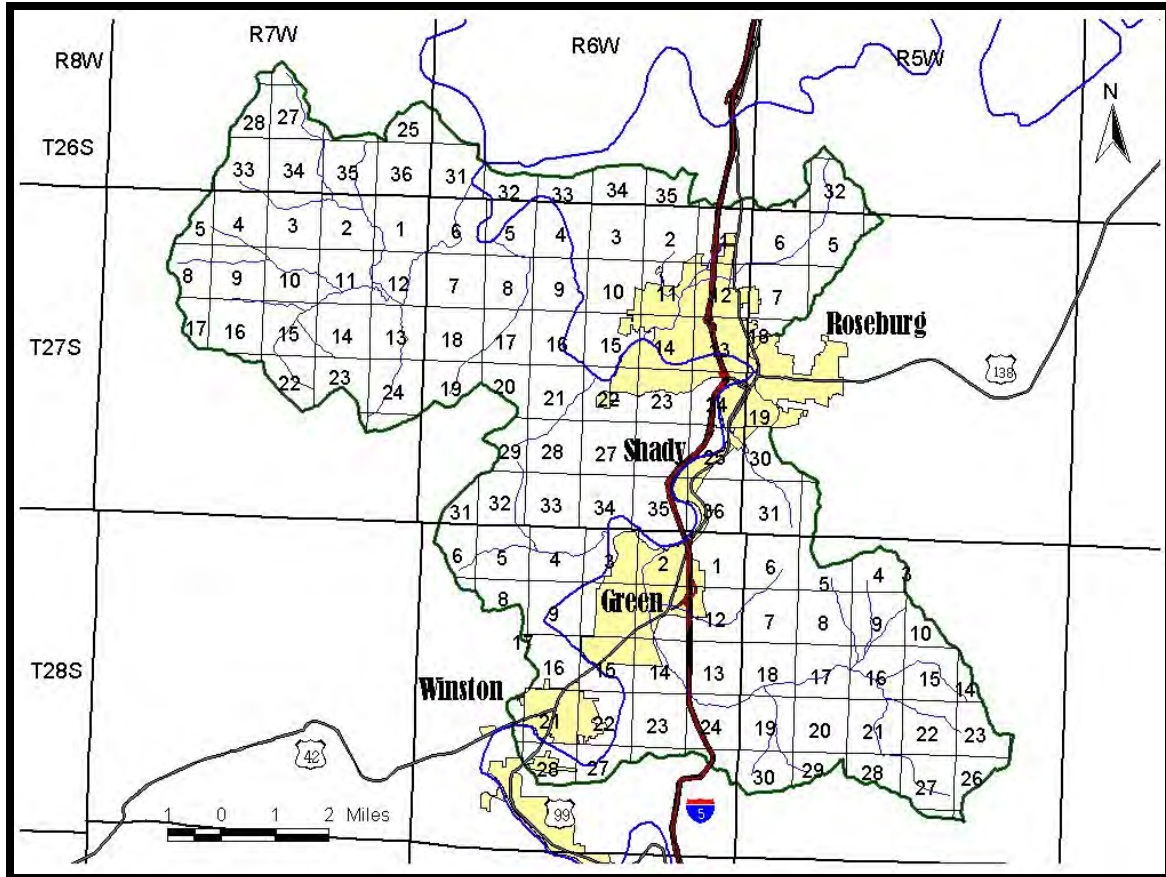
The Lower South Umpqua fifth-field watershed is located in Douglas County, Oregon, and is 110,419 acres. The eastern-most section of this watershed was assessed by the UBWC in the Deer Creek Watershed Assessment and Action Plan.⁵ Therefore, this assessment focuses only on the western portion of this watershed, which is 67,328.8 acres (see Map 1-1). This area is referred to as the "Lower South Umpqua Watershed" for the purpose of this document.

The Lower South Umpqua Watershed stretches a maximum of 12.6 miles east to west and 11.3 miles north to south (see Map 1-1). Interstate Five (I-5) and Highway 42 transect the watershed in the east-central region. Most of the City of Roseburg and all of the City of Winston are within the Lower South Umpqua Watershed, as well as the population areas of Green, Shady, and Melrose.

³ Unless otherwise indicated, Nancy Geyer and Heidi Kincaid of the Umpqua Basin Watershed Council developed all text, tables, maps, and figures.

⁴ The Middle South Umpqua Watershed Assessment and Action Plan is available from the UBWC office.

⁵ Digital copies of this document are available at www.ubwc.org.



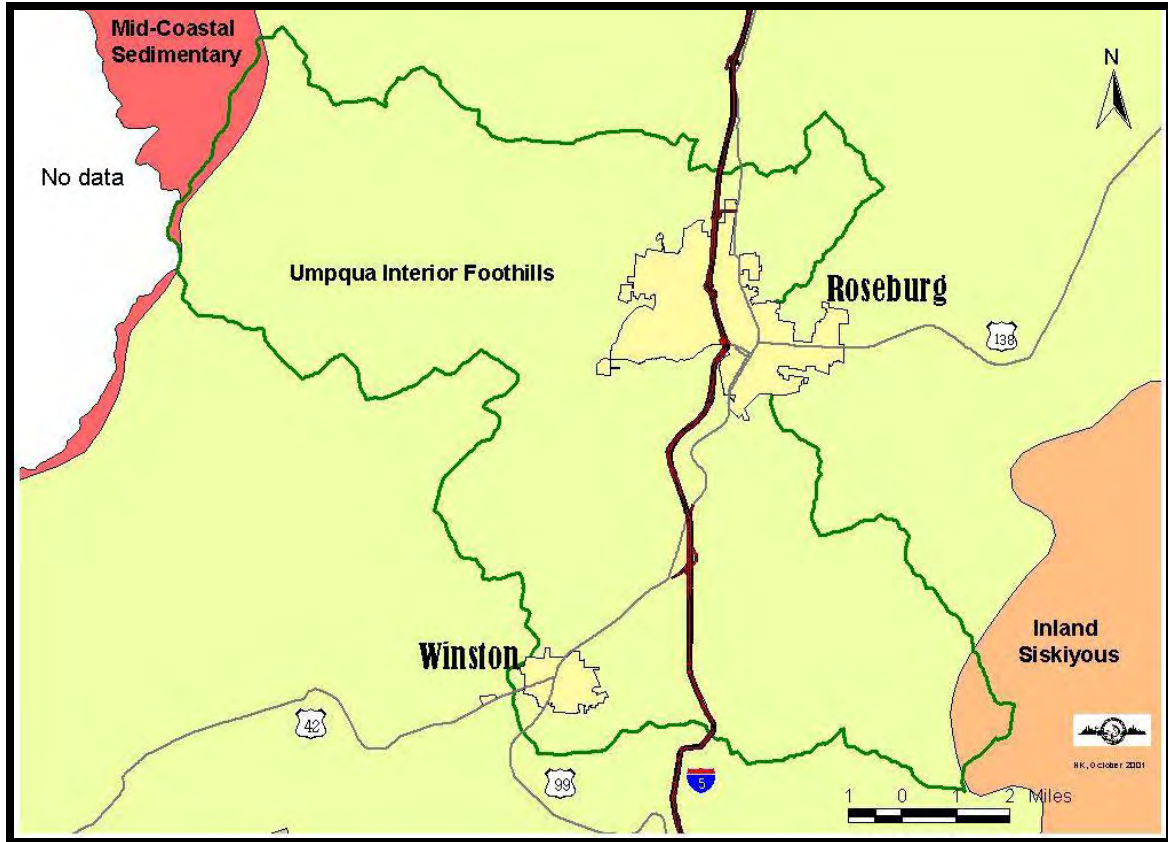
Map 1-1: Location of the Lower South Umpqua Watershed.

1.2.2. Ecoregions

Ecoregions are areas with similar type, quality, and quantity of environmental resources, including landscape, climate, vegetation, and human use.⁶ Ecoregion information is not specific to an individual watershed and is too general for the purposes of this assessment. However, ecoregions are useful because they divide the watershed into areas based on natural characteristics rather than on political boundaries or township, ranges, and sections. In this section, ecoregions are used to distinguish three unique areas in the Lower South Umpqua Watershed. In some cases, ecoregion information is used to supplement other data.

Map 1-2 and Table 1-1 show the Lower South Umpqua Watershed's location, acres, and percent within each ecoregion. Over 97% of the watershed is within the Umpqua Interior Foothills Ecoregion, which is part of the Klamath Mountains. The Inland Siskiyou Ecoregion, also part of the Klamath Mountains, characterizes the southeastern tip of the watershed. The northwestern-most border falls within the Mid-Coastal Sedimentary Ecoregion, and is part of the Coast Range.

⁶ The Environmental Protection Agency (EPA) and the Oregon Natural Heritage Program (ONHP) developed ecoregion boundaries for the State of Oregon.



Map 1-2: Ecoregions of the Lower South Umpqua Watershed.

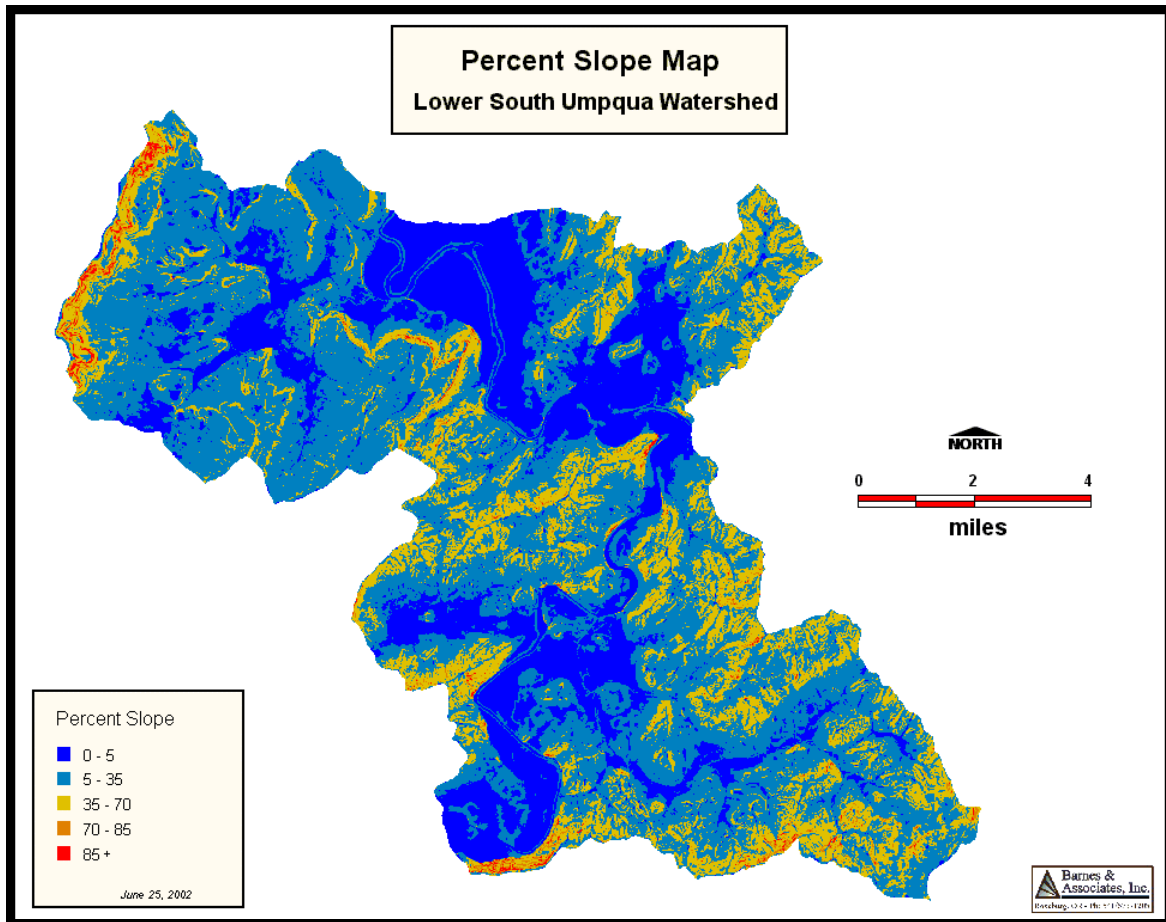
Ecoregion	Acres	Percent of total
Umpqua Interior Foothills	65,679.6	97.5%
Inland Siskiyou	916.2	1.4%
Mid-Coastal Sedimentary	733.0	1.1%
Total	67,328.8	100.0%

Table 1-1: Acres and percent of the Lower South Umpqua Watershed within each ecoregion.

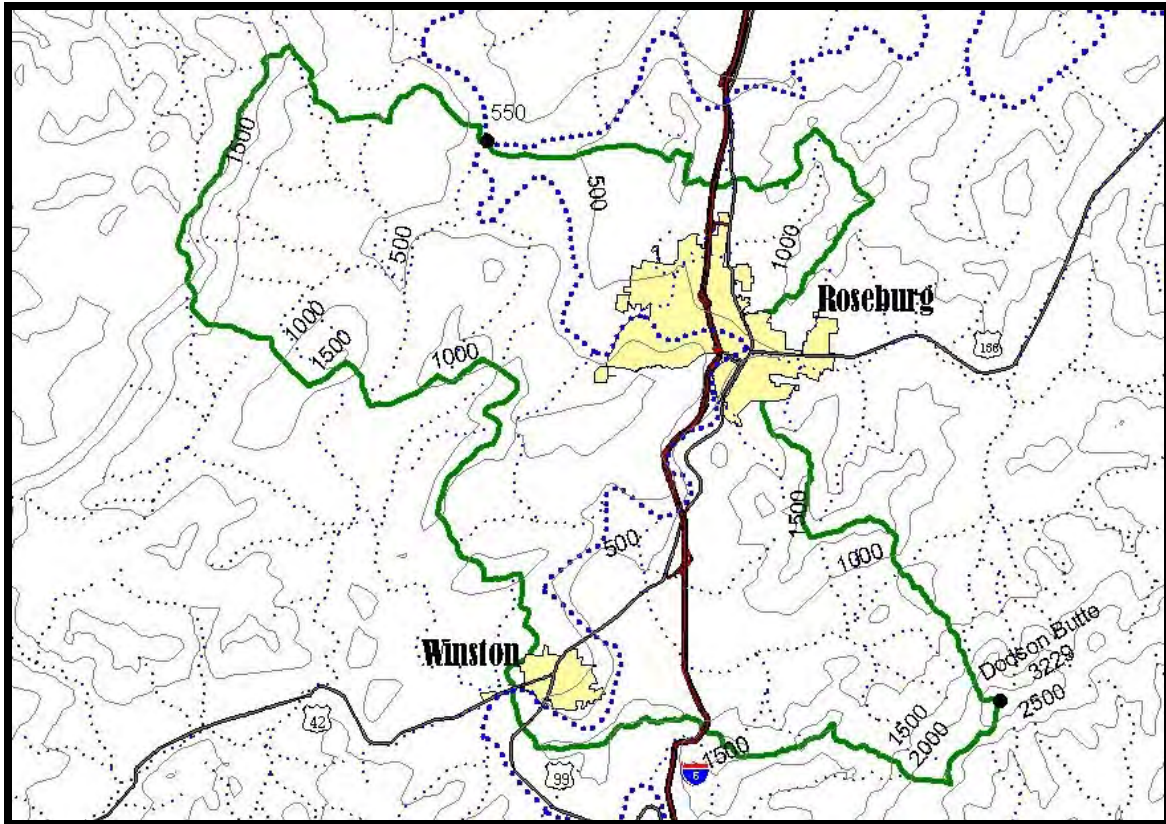
1.2.3. Topography

As shown in Map 1-3, low interior valleys, broad floodplains, and terraces with gentle to moderate slopes characterize the landscape of the Umpqua Interior Foothills. Steep mountains with deep, “v”-shaped valleys characterize the Inland Siskiyou and Mid-Coastal Sedimentary Ecoregions. Within the Lower South Umpqua Watershed, the Inland Siskiyou Ecoregion resembles the Umpqua Interior Foothills Ecoregion.

For most of the watershed, elevations are from 500 to 1,000 feet (Map 1-4). The lowest point in the watershed is at 380 feet at the confluence of the North Umpqua River and the South Umpqua River at River Forks Park. Dodson Butte is the highest point in the watershed (3,229 feet).



Map 1-3: Percent slope for the Lower South Umpqua Watershed.



Map 1-4: Elevation of the Lower South Umpqua Watershed with highest and lowest points.

1.2.4. Geology⁷

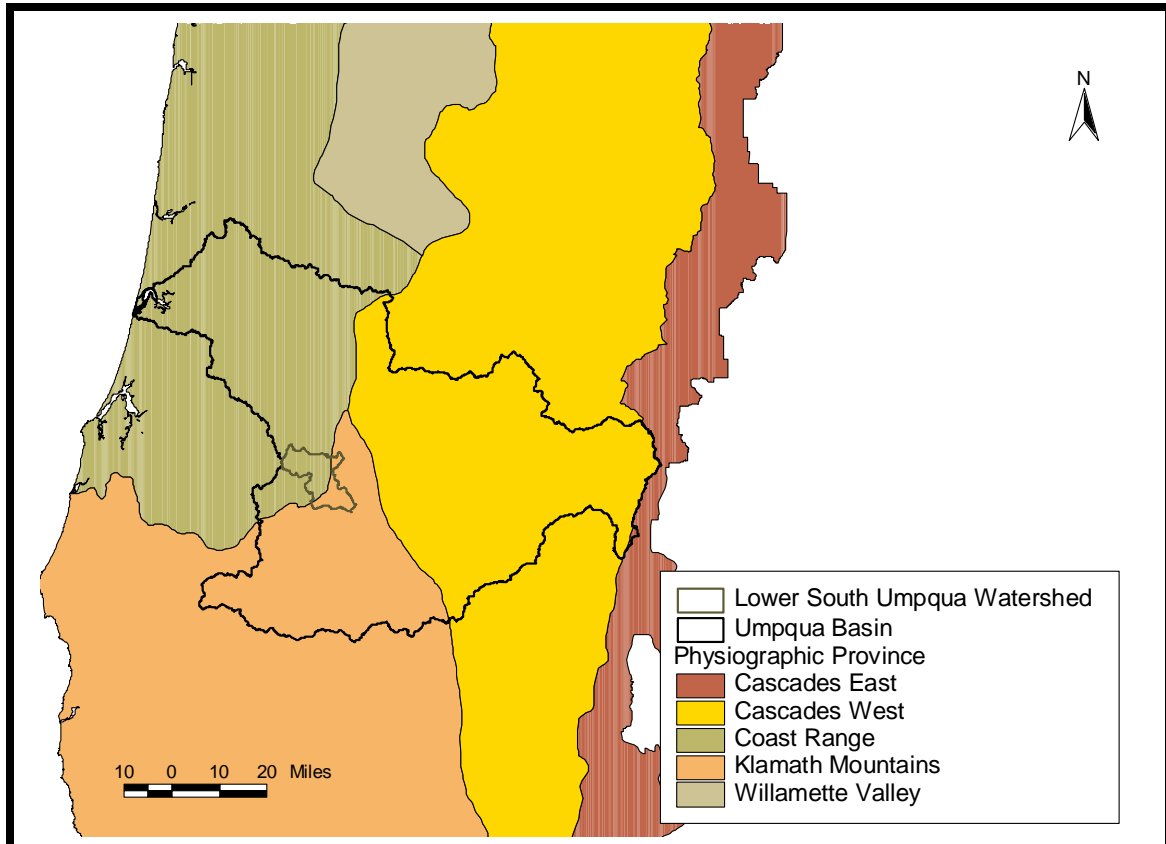
Oregon has a complex geological history resulting in a variety of landscape types throughout the state. In southwestern Oregon, the most significant event in the history of the formation of the present day landscape is the collision of the western North America continental plate with the Pacific oceanic plate. This report summarizes the geology and geomorphology of this watershed. Appendix 1 provides more information about the geologic history of western Oregon and a glossary of terms. Information in this section and in Appendix 1 has been summarized from the following documents: *Northwest Exposures, A Geologic History of the Northwest* (Alt and Hyndman, 1995); *Atlas of Oregon* (Allan et al., 2001); *Geology of Oregon* (Orr et al., 1992); *Earth* (Press and Siever, 1986); and *Geologic Map of Oregon* (Walker and MacCleod, 1991).

Physiography

The Umpqua Basin is located within three physiographic provinces: the Klamath Mountains, the Western Cascades, and the Coast Range. A physiographic province is defined as a geographic area that demonstrates similar climate and geologic structure and

⁷ Jenny Allen, Tim Grubert, and John Runyon of BioSystems, Inc., contributed the text and table for section 1.2.4. Terms such as “Jurassic” and “Cretaceous” refer to periods in the geologic/evolutionary timetable. However, the UBWC takes no position regarding the time periods with which these terms are associated and is using the terms to refer to natural processes and the relative order in which they occurred.

differs topographically from its surrounding areas. Two of these provinces developed under varying geologic processes, resulting in the geologically complex features within the area that defines the Lower South Umpqua Watershed. Approximately 40% of the watershed is within the Klamath Mountains province and roughly 60% percent falls within the Coast Range. Map 1-5 illustrates the physiographic province distribution within the watershed.



Map 1-5: Physiographic provinces of the Lower South Umpqua Watershed.

Klamath Mountains Province

The Klamath Mountains Province encompasses almost 12,000 square miles; it is located just north of Roseburg, Oregon and continues south to Redding, California with portions bordering the coast. Narrow canyons and mountain peaks comprise part of the region; however, the majority of the Klamath Mountains Province exhibits uniform relief. The region is described as an eroded plain that has been fragmented by an extensive stream network (Orr and Orr, 1996). This stream network has developed due to the province's high annual rainfall, which varies between 30 to 100 inches per year. This well-developed system has also distributed Tertiary and Quaternary sediments (sands and silts) within the province (see Table 1-2 for geologic time scale). It is important to note that the some of the geologic units for the Lower South Umpqua Watershed within the Klamath province are more representative of these deposits rather than the older rocks typical of the Klamath Mountains.

Coast Range Province

The Coast Range Province is just over 200 miles long, extending south from Washington State to the Middle Fork of the Coquille River. The terrain consists of mountains and coastal headlands, which create the rolling hill characteristic of this province. The Coast Range Province is also influenced by a maritime climate of moderate temperatures and high annual rainfall exceeding 100 inches in some parts of the province. Due to this maritime climate, the Coast Range Province has developed lush, temperate forests and mature soils. However, the high average rainfall and steep gradients that typify this region can lead to more problematic erosion within this province.

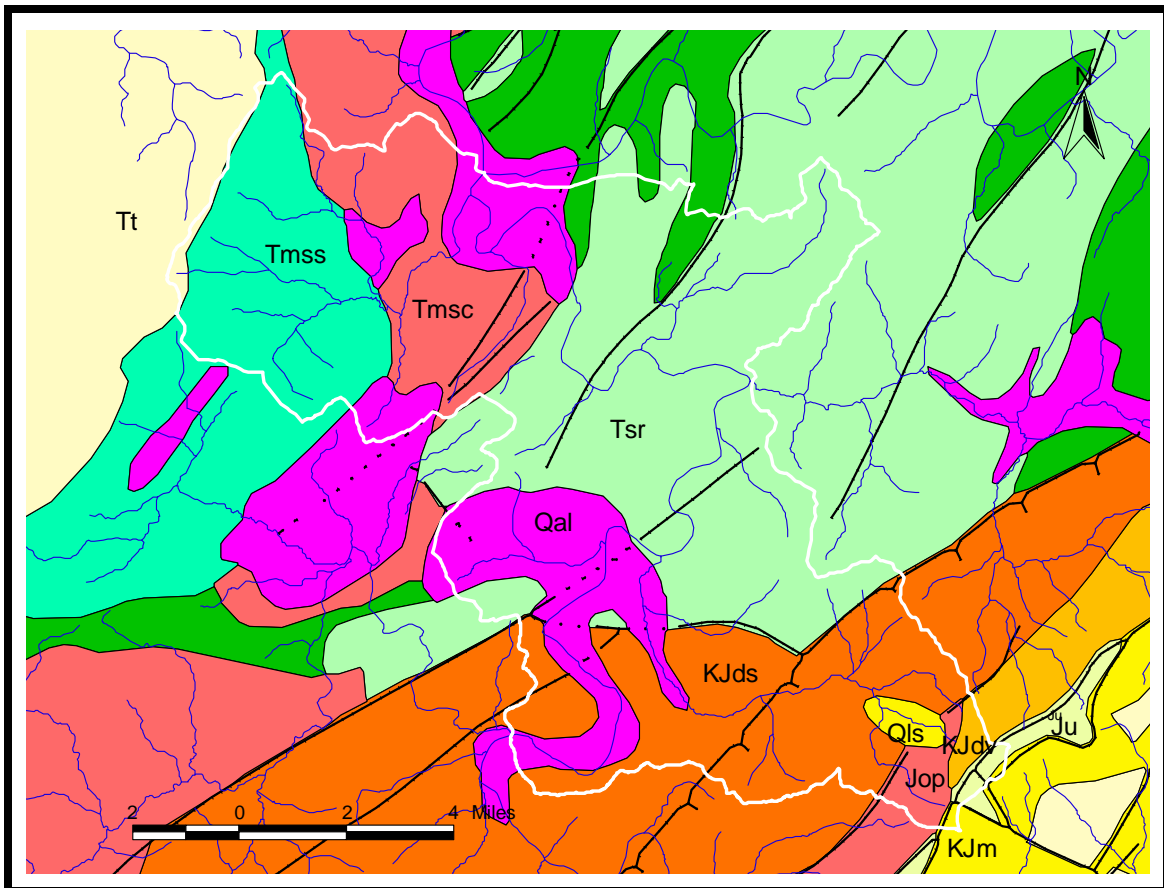
Era	Period	Epoch
Cenozoic	Quaternary	Holocene
		Pleistocene
	Tertiary	Pliocene
		Miocene
		Oligocene
		Eocene
Mesozoic	Cretaceous	
	Jurassic	
	Triassic	
Paleozoic	Permian	
	Pennsylvanian	
	Mississippian	
	Devonian	
	Silurian	
	Ordovician	
	Cambrian	
Precambrian	Proterozoic	
	Archean	

Table 1-2: Relative geologic time scale (most recent to oldest – top to bottom).

Geologic units of the Lower South Umpqua Watershed

Klamath rocks within the watershed date to the Jurassic, Cretaceous, Tertiary, and Quaternary periods. Refer to Map 1-6 for the distribution of the geologic units. During the Jurassic period, ultramafic and related rocks of ophiolite sequences (Ju) and sedimentary rocks of the Otter Point Formation (Jop) were deposited in the watershed. Sedimentary and volcanic rocks of the Dothan Formation (KJds, KJdv), and conglomerate, sandstone, siltstone, and limestone of the Myrtle Group (KJm) are associated with the Cretaceous and/or Upper Jurassic periods. Deposits of the Tertiary and Quaternary periods found within the Klamaths include volcanic rocks of marine origin that comprise the lower portion of the Roseburg Formation (Tsr), alluvial deposits (Qal), and landslide and debris flow deposits (Qls). These units are more typically associated with younger deposits of the Coast Range. It is hypothesized that the Klamath

Mountain deposits extend beneath some of these more recent deposits. Coast Range rocks of the Lower South Umpqua include deposits of the Tertiary and Quaternary periods. Marine sedimentary deposits of sandstone, siltstone, and conglomerate are components of the Roseburg, Umpqua, and Tyee Formations (Tmsc, Tmss, Tt). At this time, the Siletz River Volcanics and related rocks (Tsr) were deposited. These units are also of marine origin and make up the lower part of the Roseburg Formation. These include pillow-flows, tuff-breccias, massive lava flows and sills of tholeiitic and alkalic basalt. Alluvial deposits of sand, silt, and gravel (Qal) are also associated with the Coast Range. These units are generally found adjacent to stream channels and have formed floodplains and filled current stream bottoms. Appendix 1 provides more information about the geologic units within the Lower South Umpqua Watershed.



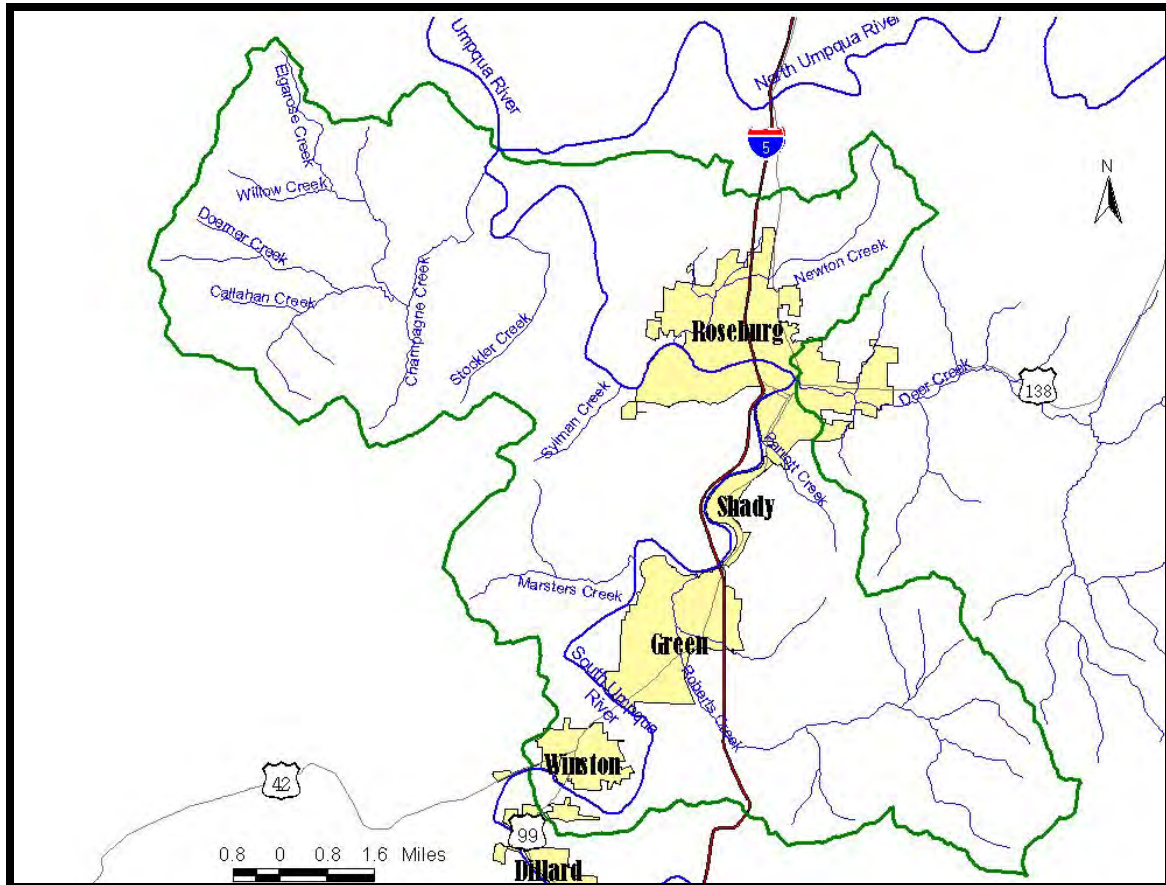
Map 1-6: Lower South Umpqua Watershed geologic units and faults.

Structural Geology

The geologic units of the Lower South Umpqua Watershed are oriented in a predominately northeast-southwest direction. The faults within the watershed are also situated in a northeast-southwest trend. The streams within the watershed do not appear to be strongly influenced by the fault system in terms of location, gradient, or direction of flow. The black lines on Map 1-6 represent the faults of the Lower South Umpqua Watershed.

1.2.5. The Lower South Umpqua Watershed stream network

The Lower South Umpqua Watershed includes the final 25 miles of the South Umpqua River and its tributaries. Map 1-7 shows all the streams that are visible on a US Geological Survey 100,000 resolution map (100.1 total stream miles).^{8,9} Among the larger tributaries is Roberts Creek, running 11 miles from its headwaters to confluence with Lower South Umpqua. Champagne Creek is only six miles long. Within the watershed, the South Umpqua River's gradient, or steepness, averages at 0.1%; tributaries have an average gradient of 4%.



Map 1-7: Major streams of the Lower South Umpqua Watershed.

1.2.6. Climate

The Umpqua Interior Foothills has a Mediterranean climate with warm to hot, dry, summers, and around 32 inches of annual precipitation. The eastern mountains and foothills receive from 35 to 70 inches of annual precipitation. Since most of the

⁸ On a map of this resolution, one inch equals 8,333.3 feet.

⁹Stream miles measure distance from the mouth following the center of the stream channel to a given point. "Total stream miles" is the length of a stream in miles from the mouth to the headwaters. "Stream mile zero" always refers to the mouth.

watershed is below 2,500 feet, precipitation is usually in the form of rain, with any snow mostly occurring in the mountains.

Figure 1-1 shows temperature data from the KQEN radio station in Roseburg (station #357331). From June through September, average high temperatures are in the high 70s and mid-80s, and with extreme highs over 100°F. Average low temperatures are in the high 40s and 50s. From November through February, average high temperatures are in 40s and 50s. Average low temperatures are in the 30s, but have been recorded as low as 9°F.

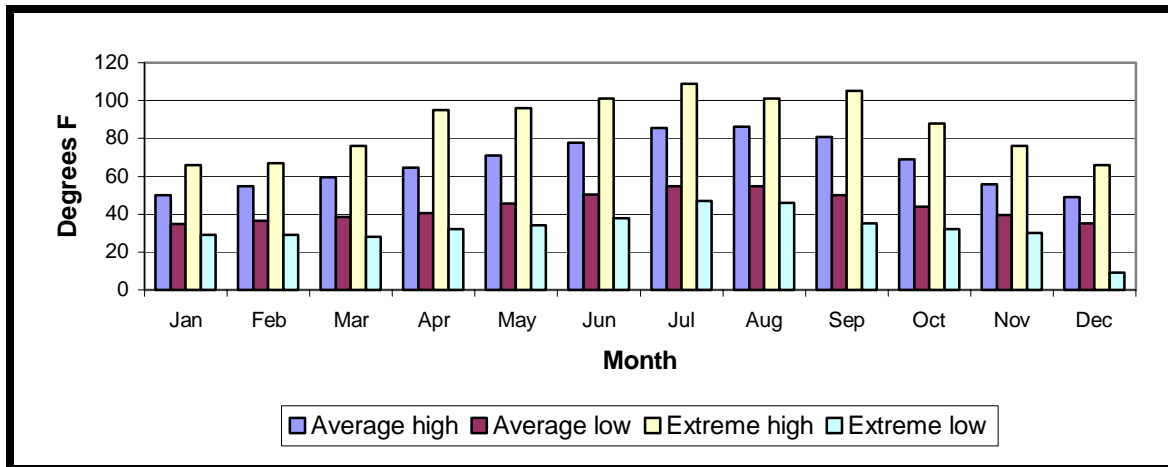


Figure 1-1: Average and extreme maximum and minimum temperatures for Roseburg from 1971 through 2000 (station #357331).

Figure 1-3 and Figure 3-2 show precipitation data for the KQEN television station in Roseburg (station #357331). Annual precipitation varies from year to year. As is typical of southwestern Oregon, precipitation is greatest in the winter months. Extreme 24-hour storm events can be more than 50% of average monthly precipitation.

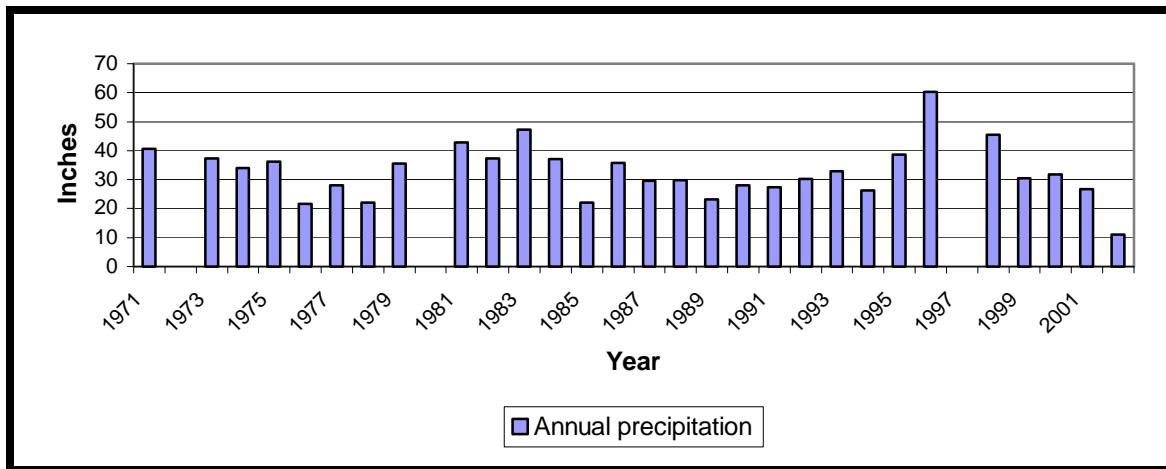


Figure 1-2: Annual precipitation from 1971 through 2002 (station #357331).

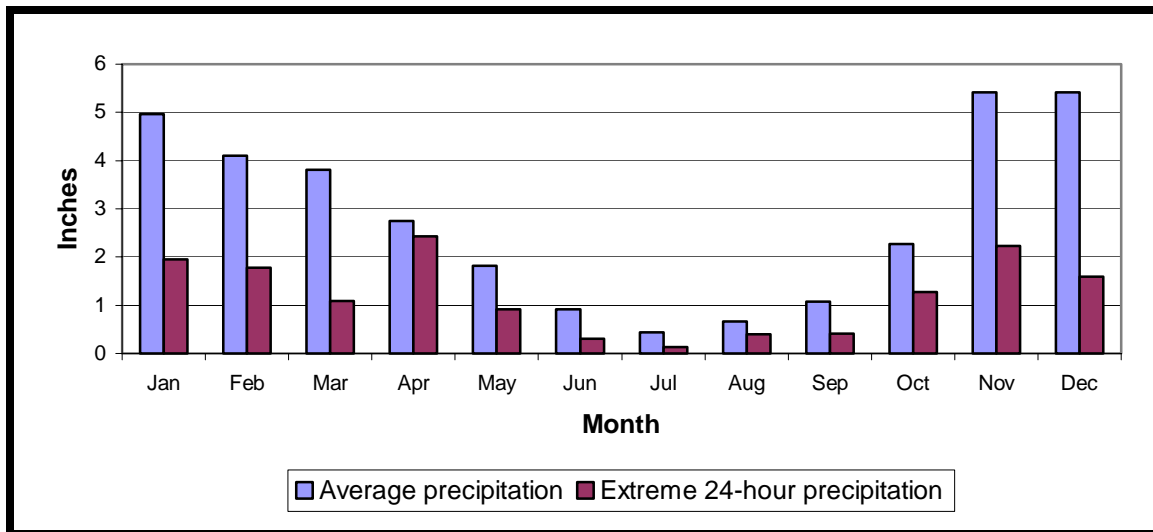
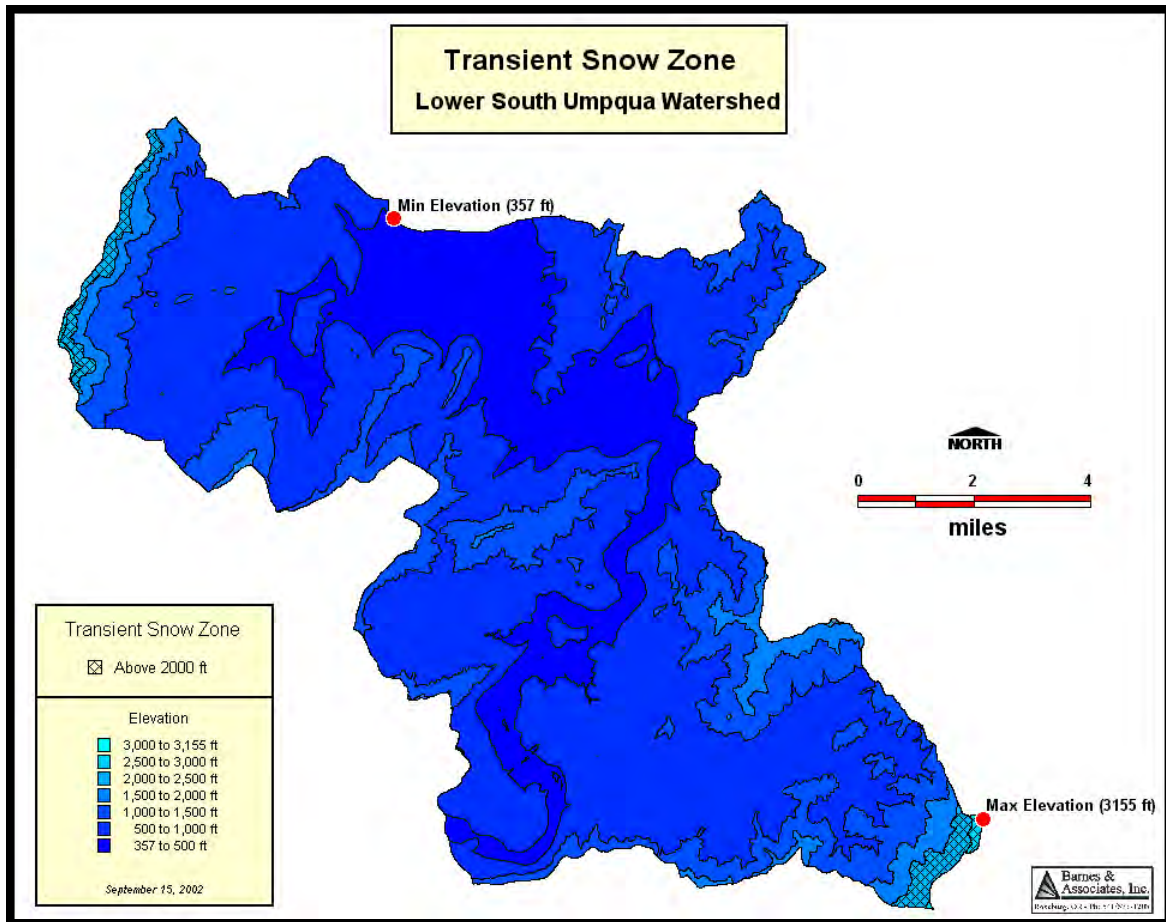


Figure 1-3: Monthly average and extreme 24-hour precipitation for station #357331 (1971 through 2000).

Approximately 1.8% of the Lower South Umpqua Watershed is greater than 2,000 feet in elevation (see Map 1-8). Areas between 2,000 and 5,000 feet in elevation are known as the transient snow zone (TSZ). Rain-on-snow events, in which rain falls on accumulated snow causing it to melt with consequent high runoff, may occur in these areas.



Map 1-8: Transient snow zone in the Lower South Umpqua Watershed.¹⁰

1.2.7. Vegetation

Vegetation in the uplands of the Umpqua Interior Foothills varies. Where soil is favorable, Douglas-fir forests are common, intermixed with Pacific madrone, bigleaf maple, and oaks. Drier soils support hardwood stands dominated by Oregon white oak, California black oak, and Pacific madrone, with some conifers. Shallow slopes support scattered Oregon white oak with grasses and shrubs. Some areas are naturally treeless meadows. Invasive species such as Himalayan blackberry and Scotch broom are common.

The portions of the Lower South Umpqua Watershed within the Inland Siskiyou Ecoregion and the Mid-Coastal Sedimentary Ecoregion have similar vegetation. Douglas-fir dominates older stands with grand fir common on the northern slopes but sparse or absent on the southern slopes. Incense-cedar is often present, but western hemlock is only found on very moist slopes. Chinkapin is also common on northern slopes, while Pacific madrone is common on southern aspects. Both north and south

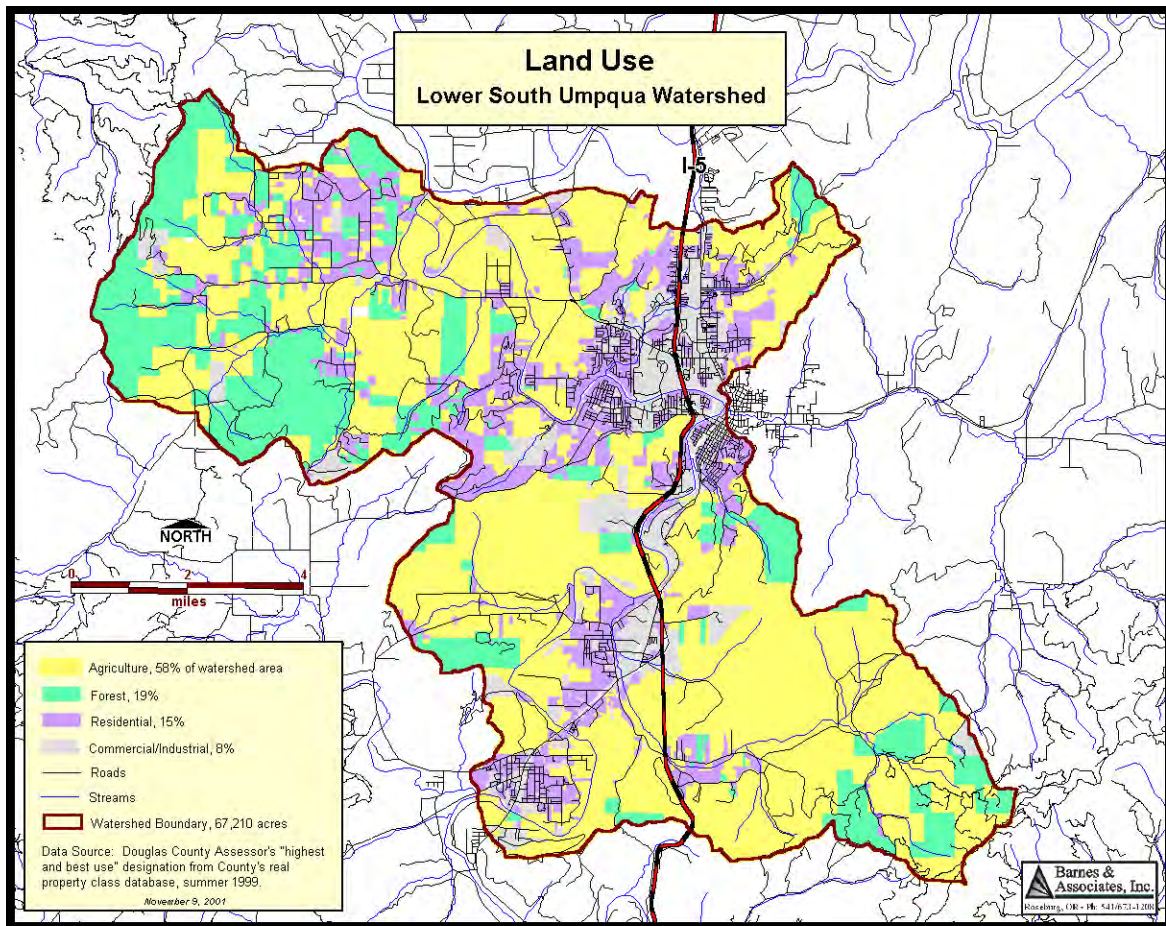
¹⁰ The highest and lowest points on this map are different than shown on Map 1-4. These differences are due to slight variations in the computer technology used to generate the maps.

slopes have shrubs and grasses. Pacific poison oak has become more common on southern aspects.

1.3. Land use, ownership, and population

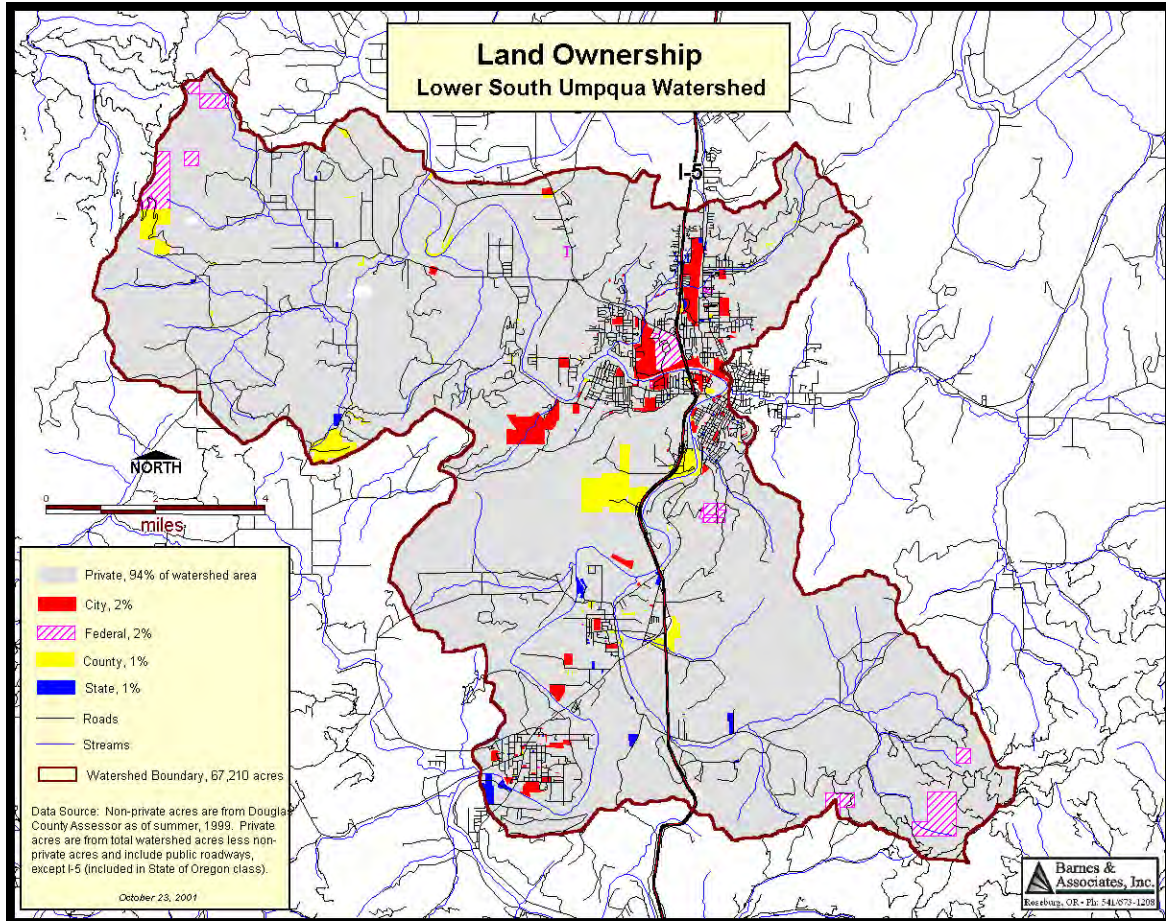
1.3.1. Land use and ownership

Over half of the land base within the Lower South Umpqua Watershed is used for agriculture (see Map 1-9). Lands used for forestry account for almost 20% of the watershed, and are mostly located in the northwest. Residential and commercial/industrial lands are found in and around the cities of Roseburg and Winston, and in Melrose, Green, and Shady. Land ownership is primarily private (94%), with public ownership evenly divided among the Bureau of Land Management, the City of Roseburg, and county and state lands (see Map 1-10).¹¹



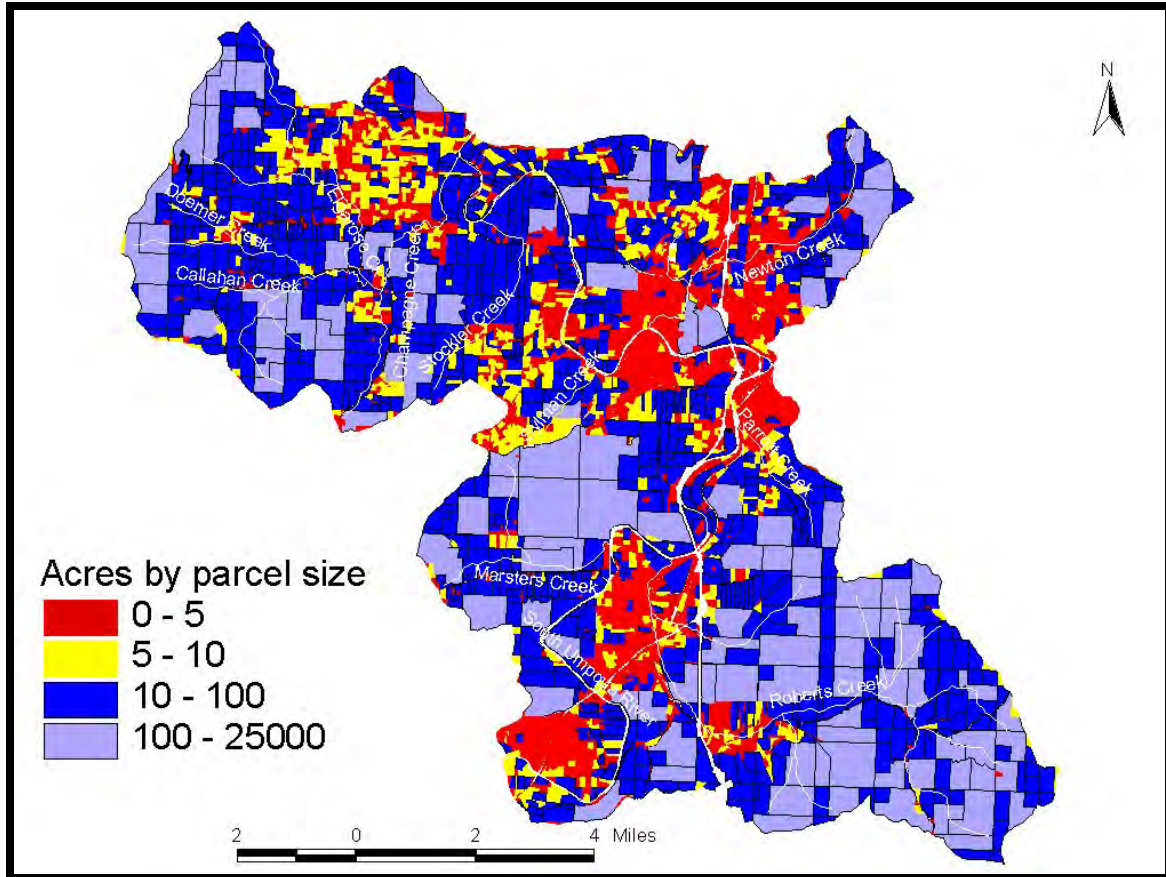
Map 1-9: Land use in the Lower South Umpqua Watershed.

¹¹ The large federal ownership within the City of Roseburg is the BLM-Roseburg district headquarters and the Veterans Administration Hospital complex.



Map 1-10: Land ownership in the Lower South Umpqua Watershed.

Map 1-11 and Table 1-3 show parcel size distribution and percent by class for the Lower South Umpqua Watershed as of 2001. Over 45% of the watershed consists of tax lot parcels that are over 100 acres. For the most part, tax lots smaller than 10 acres correspond with residential and commercial/industrial areas.



Map 1-11: Parcel size distribution for the Lower South Umpqua Watershed.

Parcel size	Percent of watershed
0-5	9.7%
5-10	6.1%
10-100	38.9%
100+	45.4%

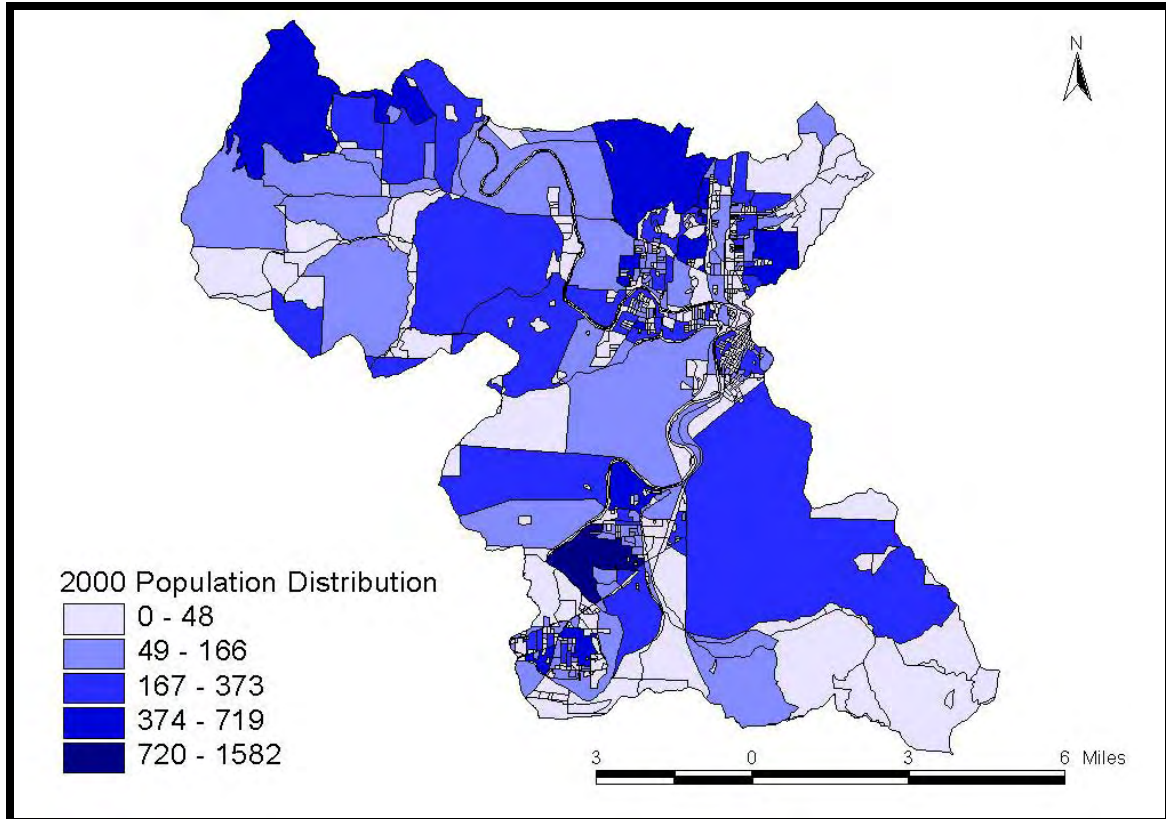
Table 1-3: Percent of landholdings by parcel size for the Lower South Umpqua Watershed.

1.3.2. Population and demographics

Population

According to the 2000 Census, the total population of the cities of Roseburg and Winston were 20,017 and 4,613, respectively. The population of the Lower South Umpqua Watershed is estimated to be no more than 38,733 people, or an average of 224.5 people per square mile.¹² The relative distribution of people in the watershed is shown in Map 1-12.

¹² US Census tracts and blocks do not follow watershed boundaries, so it is not possible to make a precise estimate of the watershed's population.



Map 1-12: 2000 population distribution within the Lower South Umpqua Watershed.

General demographic characteristics and housing

Information about general demographic characteristics and housing is available from the 2000 Census for the cities of Roseburg and Winston, the Green census division place (CDP), and the Melrose census county division (CCD).¹³ Table 1-4 provides 2000 demographic information for these areas. Appendix 2 provides location maps for the Green CDP and Melrose CCD, and provides census data for Douglas County.

As with the county, the largest racial group is white, constituting over 90% of the population, followed by Hispanic or Latino and persons of two or more races. Roseburg has a much smaller average household size and average family size than the county average. For Winston, Green, and Melrose, these parameters are comparable to the county or higher. Roseburg and Winston both have a lower percent of owner-occupied housing than the county percent, while the percents for Green and Melrose are higher.

¹³ According to the US Census Bureau (<http://factfinder.census.gov/servlet/BasicFactsServlet>), a census county division (CCD) is “a subdivision of a county that is a relatively permanent statistical area established cooperatively by the Census Bureau and state and local government authorities. Used for presenting decennial census statistics in those states that do not have well-defined and stable minor civil divisions that serve as local governments.” A CDP is “a statistical entity, defined for each decennial census according to Census Bureau guidelines, comprising a densely settled concentration of population that is not within an incorporated place, but is locally identified by a name. CDPs are delineated cooperatively by state and local officials and the Census Bureau, following Census Bureau guidelines.”

The county's percent of vacant housing is higher than all three areas; Melrose's percent vacant housing is lower than the other areas by at least 2.5%.

Parameter	Roseburg	Winston	Green	Melrose
Median age (years)	39.2	34.0	32.9	45.1
<i>Race</i>				
White	91.5%	93.2%	91.5%	93.7%
Hispanic or Latino	3.7%	2.8%	4.4%	2.6%
Asian	1.0%	0.2%	0.4%	0.5%
American Indian & Alaskan Native	1.2%	1.4%	1.2%	1.4%
Black or African American	0.3%	0.2%	0.1%	0.1%
Native Hawaiian or other Pacific islander	0.1%	0.1%	0.1%	<0.1%
Some other race	0.1%	<0.1%	<0.1%	<0.1%
Two or more races	2.2%	1.8%	2.2%	1.6%
<i>Households</i>				
Avg. household size (#)	2.32	2.61	2.79	2.67
Avg. family size (#)	2.88	2.99	3.08	2.91
Owner-occupied housing	56.5%	61.8%	86.5%	87.4%
Vacant housing units	6.8%	7.3%	6.5%	4.0%

Table 1-4: General demographic characteristics and housing from the 2000 Census for the Lower South Umpqua Watershed.

Social characteristics

Table 1-5 provides information from the 2000 Census for education, employment, and income for Roseburg, Winston, Green, and Melrose. Appendix 2 has the same information for Douglas County. The percent of people 25 years old or older that have graduated from high school is higher in Roseburg, Green, and Melrose than in the county. There is a greater percent of people with at least a four-year college degree in Roseburg and Melrose than in the county. Winston, Green, and Melrose have a greater percent of people who are 16 years or older in the labor force than does the county; Roseburg's percent is slightly lower. Percent of unemployment is lowest in Green. In all four areas, the top three occupations account for over 70% of the labor force. The top three industries employ over half of workers in Roseburg, Winston and Green. Per capita income is higher in Roseburg and Melrose than in the county. Only Winston had a lower median family income than the county. The percent of families below poverty is higher in Roseburg, Winston, and Green than in the county.

Parameter	Roseburg	Winston	Green	Melrose
<i>Education – age 25 or older</i>				
High school graduate or higher	81.6%	78.1%	83.8%	87.9%
Bachelor's degree or higher	17.0%	7.3%	9.8%	14.7%
<i>Employment- age 16 or older</i>				
In labor force	56.3%	64.3%	68.4%	59.0%
Unemployed in labor force	7.2%	7.9%	3.8%	6.2%
Top three occupations	Mgmt., professional, and related; Sales and office; Service	Production, transportation, and material moving; Service; Sales and office	Production, transportation, and material moving; Sales and office; Mgmt., professional, and related	Mgmt., professional, and related; Sales and office; Production, transportation and material moving
Top three industries	Educational, health, and social svcs; Manufacturing; Retail	Manufacturing; Educational health, and social services; Retail		Educational, health, and social svcs.; Manufacturing; Retail
<i>Income</i>				
Per capita income	\$17,082	\$13,299	\$15,208	\$20,720
Median family income	\$40,172	\$36,006	\$40,400	\$50,000
Families below poverty	11.0%	13.7%	10.2%	2.8%

Table 1-5: 2000 Census information for education, employment, and income for the Lower South Umpqua Watershed.

2. Past Conditions¹⁴

The past conditions section provides an overview of events since the early 1800s that have impacted land use, land management, population growth, and fish habitat in Douglas County and in the Lower South Umpqua Watershed. Sections 2.1, 2.2, 2.3, and 2.4, describe the history of Douglas County. Section 2.5 provides information specific to the Lower South Umpqua Watershed. Most of this chapter is based on S.D. Beckman's 1986 book *Land of the Umpqua: A History of Douglas County, Oregon*. Material obtained from other sources will be cited in the text and included in the reference list at the end of the section.

Key Questions

- What were the conditions of the Umpqua Basin watersheds before the arrival of the settlers?
- What events brought settlers to Douglas County?
- How did land management change over time and how did these changes impact fish habitat and water quality?
- What were the major socioeconomic changes in each period?
- When were laws and regulations implemented that impacted natural resource management?

2.1. Pre-settlement: Early 1800s

The pre-settlement period was a time of exploration and inspiration. In 1804 President Thomas Jefferson directed William Clark and Meriwether Lewis to “secure data on geology, botany, zoology, ethnology, cartography, and the economic potentials of the region from the Mississippi Valley to the Pacific” (Beckham, 1986, p. 49). The two men successfully completed their journey in 1806 and returned with field collections, notes and diaries. The information they collected soon became an inspiration for others to follow their path. Fur trappers came first and reached Douglas County in the 1820s. The pre-settlement period was an eye-opener for both the European explorers and the native Indians.

2.1.1. Indian lands

The Indians of Douglas County used fire to manipulate the local vegetation to improve their hunting success. George Hall, Sr., a settler of Douglas County in the 1850s, found the hills in the Oakland area with only a few large fir trees. In the draws were poison oak, small shrubs and abundant deer. “The Indians kept these hills burned off for good hunting” (Chenoweth, 1972, p. 66). In southern Douglas County early white men told of the Indian custom of burning during the late summer months. Burning stimulated the grasses and helped eliminate the undergrowth. “Reports from some of the first white men to see the Cow Creek Valley compared it to a giant wheat field” (Chandler, 1981, p. 2). Grass covering the rolling prairies often was waist high. An expedition in the fall of 1841, funded by the federal government and led by Lt. George F. Emmons, met with

¹⁴ Robin Biesecker of Barnes and Associates, Inc., contributed Chapter Two.

dense, choking smoke as they traveled through the Umpqua Valley. Indians had created the smoky conditions by burning grasslands on the hillsides and along the river.

Accounts of the native Douglas County vegetation reveal extensive prairies and large trees. In June of 1826 David Douglas crossed the Calapooya Mountains and entered Yoncalla. His purpose was to collect specimens of native vegetation for the Royal Horticultural Society of London. Douglas was searching for stands of sugar pine. In the Umpqua Valley he was fortunate to meet and, with the help of beads and tobacco, make friends with an Indian. The Indian pointed to the south after Douglas drew pictures of the sugar pine and its huge cones. The pine stand was located and Douglas later described the largest pine windfall he had found: “57 feet nine inches in circumference; 134 feet from the ground, 17 feet five inches; extreme length, 215 feet” (Lavender, 1972, p. 148). Douglas was very fortunate to live through this experience. He was shooting up into the pine trees to clip cones when eight Indians, attracted by the noise, arrived armed with bows, arrows, and knives.

Douglas cocked his gun, backed up and “as much as possible endeavored to preserve my coolness” (Lavender, 1972, p. 148). After an eight to 10 minute staredown the Indian leader requested tobacco. Douglas complied, quickly retreated to his camp and, along with his three sugar pine cones, survived the encounter.

Explorers and early settlers described the trees and other vegetation found in Douglas County. Large cedar trees were found along the South Umpqua River. In 1855 Herman and Charles Reinhart found yellow and red cedars clear of limbs for 30 to 50 feet. The Pacific Railroad Surveys passed through the Umpqua Valley in 1855. The oak groves found in the valleys were reported to grow both in groups and as single trees in the open. The oaks were described as reaching two to three foot diameters and to have a low and spreading form. Many early visitors describe the fields of camas. Hall Kelley traveled the Umpqua River in 1832. “The Umpqua raced in almost constant whitewater through prairies covered with blue camas flowers and then into dense forest” (Cantwell, 1972, p. 72). In the present day Glide area, Lavola Bakken (1970) mentions the Umpqua Indian diet of sweet camas bulbs taken from the “great fields of camas” (p. 2). The Cow Creek Indians of southern Douglas County also ate the camas bulb (Chandler, 1981).

Origin of the name “Umpqua”

Many ideas exist about the origin of “Umpqua.” An Indian chief searching for hunting grounds came to the area and said “umpqua” or “this is the place.” Other natives refer to “unca” meaning “this stream.” One full-blooded Umpqua Indian interviewed in 1960 believed the term originated when white men arrived across the river from their village and began shouting and gesturing their desire to cross. “Umpqua,” she feels means “yelling,” “calling,” or a “loud noise” (Minter, 1967, p. 16). Another Indian when asked the meaning of “Umpqua” rubbed his stomach, smiled, and said, “Uuuuuump-kwa – full tummy!” (Bakken, 1970, p. 2).

The diet of the native Indians also included fish and wildlife. The Cow Creek Indians built dams of sticks across stream channels to trap the fish. Venison was their main game meat that, prior to the use of guns, was taken with snares and bows and arrows (Chandler, 1981). Salmon was the fundamental food of the Indians along the main Umpqua River. The Lower Umpqua Indians fished with spears and by constructing barriers along the narrow channels. The large number of fish amazed a trapper working for the Hudson's Bay Company: "The immense quantities of these great fish caught might furnish all London with a breakfast" (Schlessor, 1973, p. 8). Wildlife was prevalent throughout Douglas County and included elk, deer, cougar, grizzly bear, beaver, muskrat, and coyotes.

2.1.2. European visitors

The Lewis and Clark Expedition gave glowing reports of the natural riches to be found and proved travel to Oregon was difficult but not impossible. Fur seekers, missionaries, and surveyors of the native geology, flora, and fauna were among the first European visitors to Douglas County. Methodist missionary Gustavus Hines preached to the Indians of the Umpqua in 1840. He concluded "the doom of extinction is suspended over this wretched race, and that the hand of Providence is removing them to give place to a people more worthy of this beautiful and fertile country" (Beckham, 1986, p.59).

Fur trading in Douglas County began in 1791 in the estuary of the Umpqua River. Captain James Baker traded with the Indians for about 10 days and obtained a few otter skins. The first land contact by fur traders in the Umpqua Valley was in 1818 by the Northwest Company of Canada. Trapping did not expand until Alexander Roderick McLeod – working for Hudson's Bay Company - explored the Umpqua Valley in 1826. The number of trappers steadily increased along the Umpqua River from 1828 to 1836. Hudson's Bay Company established Fort Umpqua first near the confluence of Calapooya Creek and the Umpqua in the 1820s and then, in 1836, near the present day city of Elkton. Fort Umpqua was reduced in size in 1846 and finally destroyed in a fire in 1851. By 1855, the beaver were trapped out and fur trading had ended along the Umpqua River (Schlessor, 1973).

Presettlement timeline

- 1804 Lewis & Clark Expedition - 1806
- 1810 John Jacob Astor establishes Pacific Fur Company in Astoria
- 1818 Umpqua Massacre – North West Company fur seekers kill at least 14 Indians in northern Douglas County
- 1826 David Douglas (botanist) travels Douglas County
- 1828 Smith Massacre – Jedediah Smith's party attacked by Indians at the junction of the Smith and Umpqua Rivers; 14 killed

The travel routes of the trappers and early explorers closely parallel many of Douglas County's current roads. For example, Interstate Five (I-5) is located in the vicinity of an

old trade route. The main difference is the original trail followed Calapooya Creek to its mouth and then up the Umpqua and South Umpqua rivers to Roseburg. Interstate Five uses a more direct route from Calapooya Creek to Roseburg via Winchester (Schlesser, 1973). The Umpqua Indian trails followed the major rivers and streams of the county including the main Umpqua and the North and South Umpqua Rivers, Little River, Rock Creek, and Steamboat Creek (Bakken, 1970).

The population of the Umpqua Valley is estimated to have been between 3,000 and 4,000 before the arrival of the white man (Schlesser, 1973). The Europeans brought diseases that reduced the population of Oregon Indians. Disease occurrences in Douglas County probably started between 1775 and the 1780s with the first smallpox outbreak. A smallpox or measles outbreak may have affected the far western part of the county in 1824 and 1825. The possibility of malaria in the central portion of the county occurred in 1830 through 1837. Smallpox was documented in the coastal portions of Douglas County in 1837 and 1838. Measles occurred in the western portions of the county in 1847 and 1848 (Allen, 2001). “The five bands of Athabascan speakers who lived along the Cow Creek were decreased to half their original number due to an epidemic during the severe winter of 1852-53” (Chandler, 1981, p. 9).

2.2. Settlement period: Late 1840s to the 1890s

2.2.1. Early settlement

California’s Gold Rush was one factor in the early settlement of the county. First of all, the new miners demanded goods and services. “The California Gold Rush of 1849 suddenly created a market for Oregon crops and employment for Oregonians” (Allan, 2001). Secondly, travelers on their way to the gold fields passed through Douglas County. Many of these visitors observed the great potential for farming and raising stock and, after the trip to California, returned to Douglas County to take up permanent residence

The Donation Land Act of 1850 was a further impetus for the settlement of Douglas County. This act specified married couples arriving in Oregon prior to December 1850 could claim 640 acres; a single man could obtain

<u>Settlement period timeline</u>	
1849	California Gold Rush
1850	Donation Land Act
1850s	Indian Wars; Douglas County Indians relocated to Grand Ronde Reservation
1860	Daily stages through Douglas County
1861	Flood
1870	<i>Swan</i> travels Umpqua River (Gardiner to Roseburg)
1872	Railroad to Roseburg
1873	Coos Bay Wagon Road completed
1887	Railroad connection to California
1893	Flood

320 acres. Men arriving after December 1850 were allowed to claim 320 acres if married and 160 acres if single. The patent to the land was secured with a four-year residency. The Donation Land Act was scheduled to end in December of 1853 but an extension increased this deadline to 1855. After 1855, settlers in Oregon were allowed to buy their land claims for \$1.25 per acre following a one-year residency (Allan, 2001; Patton, 1976).

Large numbers of settlers entered Douglas County between 1849 and 1855. Lands were settled along Calapooya Creek, in Garden Valley, at Lookingglass, at the mouth of Deer Creek (Roseburg), in Winchester, and along Myrtle and Cow Creeks. For example, in Cow Creek Valley almost all open lands were claimed by 1855 (Chandler, 1981). The rich bottomland of the Umpqua Valley was very attractive to the emigrants looking for farmland. As the number of settlers increased, the Indian population of the county decreased. Diseases, as mentioned previously, took a toll, as did the Indian Wars of the 1850s. Douglas County Indians were relocated to the Grand Ronde Reservation in the 1850s.

2.2.2. Gold mining

One of the earliest mines in Douglas County was the Victory Mine close to Glendale. The Roseburg Review on November 6, 1893, reported the mine consisted of 800 acres of gold bearing gravel. In order to work the Victory Mine a dam was built across a canyon with a reservoir capable of holding millions of gallons of water.

The early 1850s brought placer mining to the South Umpqua near Canyonville and Riddle. The miners worked many different branches of Cow Creek. Coffee Creek, a tributary of the South Umpqua, was one of the most important mining areas. A minor rush occurred in the Steamboat area – east of Glide - in the 1870s.

In May of 1890 construction was begun on the “China Ditch.” This ditch was to bring water from Little River to the Lower South Umpqua River area. The initial purpose was for use in hydraulic mining with future goals of floating logs and irrigating the local fruit orchards. In 1891, 200 Chinese laborers were hired, giving the ditch its name. About 18 miles of ditch were dug before the work was stopped in 1893 by a court order – employees had not been paid. The target destination of Little River was never reached (Tishendorf, 1981).

Mining techniques

Placer mining was commonly used to recover gold. Gravel deposits were washed away using water from ditches (often hand-dug) and side draws. The runoff was directed through flumes with riffles on the bottom. The gold settled out of the gravel and was collected by the riffles.

Hydraulic mining was placer mining on a large scale. A nozzle or “giant” was used to direct huge amounts of water - under pressure - at a stream bank. The soil, gravel, and, hopefully, gold was washed away and captured downstream.

Gold mining affected the fish habitat of the streams and rivers. The drainage patterns were changed when miners diverted and redirected water flow. The removal of vegetation along the stream banks increased erosion and added sediment to the waterways. Salmon spawning grounds were destroyed when the gravels were washed away and the stream bottom was coated with mud. Placer and hydraulic mining may have created spawning areas by washing new gravels into the streams.

2.2.3. Mercury mining

The Bonanza and Nonpareil mines were located about eight miles east of Sutherlin. The Nonpareil mine was discovered in 1860 but was not developed until 1878. By 1880 the smelter was capable of handling 40 tons of ore per day. The Bonanza Mine had some early production in 1887 but the large-scale development did not occur until 1935. The Elkhead Mine, southeast of Yoncalla, began mercury mining and production around 1870.

2.2.4. Nickel mining

Sheepherders discovered nickel near Riddle on Old Piney (Nickel Mountain) in 1864 or 1865. Production was infrequent until 1882 when tunnels (some 320 feet long) and shafts were dug and a series of open cuts completed. Work slowed in the late 1890s and would not increase again until the late 1940s.

2.2.5. Agriculture

The early settlers brought livestock and plant seeds to use for food and for trade. Settler livestock included cattle, sheep, hogs, and horses. The early farmers sowed cereal crops of oats, wheat, corn, rye, and barley. Gristmills – used to grind the cereal crops into flour or feed – were first established in Douglas County in the 1850s and within 20 years almost every community in the county had one. Water was diverted from nearby streams and rivers to create power for the gristmills.

The early farmers reduced the indigenous food sources and changed the natural appearance of Douglas County. Hogs ate the acorns in the oak groves. The camas lilies were nipped by the livestock and diminished in number when the bottomlands were plowed to plant cereal crops. The deer and elk herds were decreased as the settler population increased. Indians were not allowed to burn the fields and hillsides in the fall because the settlers were concerned about their newly constructed log cabins and split rail fences.

2.2.6. Commercial fishing

The bountiful trout and salmon of the Umpqua were first sold commercially in the 1870s. William Rose caught trout and salmon at the confluence of the North and South Umpqua and sold them as far north as Portland. He caught the fish at night with nets and then shipped them out early the next morning. In 1877 the *Hera* – a boat with 100 Chinese workers and canning machinery – visited the lower Umpqua River. Local fishermen used gill nets stretched from the shore into the river to capture large numbers of fish as quickly as possible. Six-foot-long sturgeons were unwelcome captives. They were clubbed and thrown back in the river to rot on the shore. Yearly visits by the *Hera* and other cannery

boats continued for three decades. Commercial fishing at a much smaller level occurred along the North Umpqua River. The fishermen constructed small dams and breakwaters. These obstructions created eddies and slow-moving water – ideal for capturing fish with gill nets.

2.2.7. Logging

The first wood product export was shipped from the Umpqua estuary in 1850. Trees were felled into the estuary, limbed, and loaded out for piling and spars on sailing ships. An additional market was found in San Francisco for piles for wharfing. The earliest sawmills in Douglas County appeared in the 1850s. The sawmills were water powered, often connected with a gristmill, and scattered throughout the county. Early sawmills were built on South Myrtle Creek, Pass Creek (north of Drain), the main Umpqua River (at Kellogg), Calapooya Creek, and in Canyonville. Dams were created to secure water to drive the mills.

Log drives were used on many of the streams and rivers of Douglas County to deliver logs to the mill.

The most common form of log drive included loading up the drainages with logs in the drier part of the year and then waiting for a winter freshet. When the rains came and the logs began to float, the “drive” would begin. Loggers would be positioned along the banks and at times would jump on and ride the logs. They used long poles to push and prod the logs downstream. Stubborn log jams would be blasted apart with dynamite. Log drives were often aided by the use of splash dams (see box). During these log drives, the stream channels were gouged, spawning gravels were removed or muddied, and fish passage was more difficult (Markers, 2000).

Splash dams

Loggers created splash dams to transport logs to the mills. A dam was built across the stream creating a large reservoir. Logs were placed in the reservoir. The dam timbers were knocked out and the surge of water started the logs on their journey downstream (Beckham, 1990).

2.2.8. Transportation

Improvements in transportation were key to the economic development and population growth during this time period. The period began with limited transportation options into and through Douglas County. Ships came into the Umpqua estuary and delivered goods destined for the gold mines of California and the remainder of Douglas County. Goods moved from the estuary inland along the Scottsburg-Camp Stuart Wagon Road. Camp Stuart was a temporary military post occupied in 1851 in the Rogue River Valley. This route passed through Winchester and then into California following the Applegate Trail. Congress funded improvements to the Scottsburg-Camp Stuart Wagon Road and to the old Oregon-California Trail (Portland to Winchester) from 1853 through 1879. These road improvements led to the beginning of stage travel from Portland to Sacramento in 1860. The Oregon and California Stage Company began offering daily stages through Douglas County in July of 1860. A daily stage came through the Cow Creek area starting in 1862 (Chandler, 1981). The Coos Bay Wagon Road opened in 1873 allowing stage travel from Roseburg to Coos Bay.

Another form of transportation was attempted in 1870. A group of hopeful investors, *Merchants and Farmers Navigation Company*, financed a small sternwheel steamer, *Swan*, to navigate the Umpqua and South Umpqua Rivers from Gardiner to Roseburg. The voyage began February 10, 1870 and became a great social event as whole communities lined the riverbanks to watch the *Swan's* progress. Witness accounts recall the slowness of the trip upriver and the swiftness of the downriver journey. The *Swan* safely arrived in Roseburg with the captain, Nicholas Haun, very optimistic about vessel travel on the Umpqua. Captain Haun thought a minor clearing of the channel would allow a ship the size of the *Swan* to pass the rapids except in periods of very low water (Minter, 1967).

The U.S. Corps of Engineers surveyed the river and reported that it could be made navigable seven months of the year. Congress appropriated money for the removal of obstructions and W.B. Clarke was awarded the job. Reports are sketchy about how much channel modification was actually carried out. One witness remembered some blasting in the Umpqua River channel near Tyee. In February, 1871, the *Enterprise* began a maiden voyage upriver but, because of low water, only reached Sawyers Rapids – downstream of Elkton. The cargo was subsequently dumped at the rapids and no further attempt was made to navigate the upper Umpqua (Minter, 1967).

River travel on the Umpqua was soon forgotten when the Oregon California Railroad reached Roseburg in 1872. Financial problems stalled the southerly extension of the railroad for 10 years. Those 10 years proved to be an economic boon for Roseburg. Travelers heading south took the train to Roseburg and then rode the stage into California. Travelers poured in and out of Roseburg creating a need for new hotels and warehouses and leading to rapid population growth. Finally, in 1887, the tracks were completed and the railroad was extended into California.

2.3. Onset of the modern era: Early 1900s to the 1960s

2.3.1. Transportation

The first automobiles arrived in Oregon in 1899 and in Douglas County in the early 1900s. After 1910 automobile travel in western Oregon became a key motivation for road construction and improvements in Douglas County. One of the first major road construction projects in the state was the Pacific Highway (Highway 99) running from Portland to Sacramento and Los Angeles. Construction began in 1915 and by 1923 Oregon had a paved highway running the entire length of the state. In Douglas County the Pacific Highway passed through Drain, Yoncalla, Oakland, Sutherlin, Roseburg, Myrtle Creek, Canyonville, and Galesville for a total length of 97.7 miles.

Other major road construction projects completed before 1925 include routes between Roseburg and Coos Bay, Dixonville to Glide, Drain to Elkton, and Elkton to Reedsport. These roads were built to meet the expanding numbers of vehicles in the state. Registered vehicles in Oregon rose from 48,632 in 1917 to 193,000 in 1924. World War II slowed the road construction projects in the early 1940s but when the soldiers returned in 1945 road construction accelerated. The most important road-building project in the

1950s was Interstate Five (I-5), a four-lane, nonstop freeway, completed in 1966. I-5 was a windfall for cities along its path – Roseburg for example – but difficult for the bypassed cities of Yoncalla, Riddle, and Glendale.

2.3.2. Logging

Logging expanded in Douglas County in the early 1900s for two main reasons: the invention of the steam donkey engine and the use of logging railroads. The steam donkey engine was a power-driven spool with a rope or cable attached for yarding logs. It could be mounted on a log sled and yard itself, as well as logs, up and down extremely steep slopes. The logs were yarded with the steam donkey engine and then hauled to the sawmill on logging railroads. In Douglas County more than 150 miles of logging railroads were used between 1905 and 1947.

Gypso loggers came into prevalence in the 1920s. These were loggers and mill owners with limited capital trying to break into the market. The term “gypso” related to the real possibility that these loggers would “gyp” or not pay their workers. Many of the gypsos operated on the edge, cutting corners and costs whenever possible. Equipment breakdowns, fuel leaks, and accidents were common occurrences. The gypso loggers searched for valuable logs, such as cedar, left after the initial logging.

Splash dams and log drives were still used in Douglas County into the 1940s (Markers, 2000). Log drives were phased out as more roads were built into the woods. In 1957 log drives in Oregon were made illegal; sports fishermen led the campaign against this form of log transport (Beckham, 1990). Waterways used to transport logs were scoured to bedrock,

1890s to the 1960s timeline

1900	Fish hatchery established near Glide
1903	Prunes major agricultural crop
1909	Flood
1923	Pacific Highway (Highway 99) completed
1927	Flood
1929	Northwest Turkey Show in Oakland (Douglas County ranked 6 th in U.S. turkey production)
1936	Kenneth Ford establishes Roseburg Lumber Company
1945	Returning soldiers (WW II) create a housing – and timber – boom
1947 - 1956	Eight dams are built in the headwaters of the North Umpqua River as part of the North Umpqua Hydroelectric Project
1950	Flood
1953	Hanna Nickel production
1955	Flood
1962	Columbus Day Storm
1964	Flood
1966	Interstate Five completed

widened, and channelized. The large woody debris was removed and fish holding pools lost. As more logging roads were built in the 1950s, fish habitat was affected. Landslides associated with logging roads added sediment to the waterways. Logging next to streams removed riparian vegetation and the possibilities for elevated summer water temperatures and stream bank erosion were increased. Fewer old growth conifers were available as a new wood source in many Douglas County streams (Oregon Department of Fish and Wildlife, 1995).

Following World War II larger sawmills with increased capacity began to operate – just in time to take advantage of the housing boom. Kenneth Ford established Roseburg Lumber Company in 1936 by taking over the operation of an existing sawmill in Roseburg. He built his own mill at Dillard in 1944.

2.3.3. Mercury mining

H.C. Wilmot purchased the Bonanza Mine, approximately eight miles east of Sutherlin, in 1935 and began extensive development. The demand for mercury (quicksilver) for war purposes (World War II) led to a surge in prices to more than \$200 a flask.¹⁵ Flasks were made of cast iron and resembled the size and shape of a fruit jar (Oberst, 1985). A vast new deposit discovered in 1939 together with the high mercury demand, resulted in a production of 5,733 flasks by 1940, second highest in the nation. Some of the mineshafts extended more than 1,000 feet deep (Libbey, 1951; Oberst, 1985).

As with many other natural resources, mercury production followed the prices received. Prices fell to \$150 per flask in 1949 and then to \$70 in 1950, causing the first shutdown since 1936. A price surge in the mid-1950s to \$300 a flask reopened the mine. The Bonanza Mine had produced 39,488 flasks by 1960, its final year of operation (Libbey, 1951; Oberst, 1985; Wyant, 1955).

Mining at the Bonanza Mine in 1955

The mine is well-equipped with modern automatic machinery. The trains of cars which bring the ore to the reduction plant, perched on the side of the hill, are powered with electric batteries.

The reduction plant, in principle, is just one giant still. Ore from the mine is fed into a long, revolving kiln, where heat from an oil-fired furnace practically melts the small bits of ore. The mercury vaporizes and is carried into a battery of 24 3-story-high condensers.

The mercury is recovered in rubber buckets at the base of the condensers. The buckets are kept beneath water as a safeguard against escaping mercury vapor which is extremely poisonous.

Dust collects in the form of mud with the mercury. The final step in the recovery process is to allow the “mud” to dry on a sloping tray. Then, the mud is stirred and chopped with a garden hoe and the mercury trickles to a lower corner where it is collected and later stored in squat, 76-pound flasks (Wyant, 1955, p. 1).

¹⁵ A flask is 76 pounds of mercury.

Other mercury mines were also active in the 1900s in Douglas County. The Elkhead Mine, southwest of Yoncalla, operated on and off into the 1960s. The Nonpareil Mine, next to the Bonanza Mine, was active from 1928 to 1932. The Tiller area had two mines, the Buena Vista and the Maud S, both active for short periods in the in the 1920s and 1930s. The Red Cloud Mine in upper Cow Creek was worked between 1908 and 1911 and then sporadically in the 1930s and 1940s.

The Oregon Department of Environmental Quality (DEQ) currently rates the Bonanza Mine as a high priority for further investigation and cleanup. High levels of mercury and arsenic have been found in the area of the old mine. Possibilities exist for movement of mercury into Foster Creek, which flows directly into Calapooya Creek. The site is a considerable risk to aquatic organisms in nearby drainages receiving runoff (Oregon Department of Environmental Quality, 2002).

2.3.4. Nickel mining / copper and zinc mining

M.A. Hanna Company obtained a lease in 1947 and contracted with U.S. government in 1953 to produce nickel. A tramway running almost to the top of Nickel Mountain was completed in 1954. By 1958, 21 million pounds of nickel had been produced. Production continued on Nickel Mountain into the 1990s.

The Formosa Mine is located about seven miles south of Riddle. This copper and zinc mine first opened in the early 1900s with the highest production occurring between 1927 and 1933. Formosa Explorations, Inc. reopened the mine in 1990 (Oregon Department of Environmental Quality, 2002).

2.3.5. Hatcheries

Douglas County's first fish hatchery was located northeast of Glide on the North Umpqua River near the mouth of Hatchery Creek. Built in 1900, the hatchery had an initial capacity for 1,000,000 eggs. In its first year of operations 200,000 salmon eggs were harvested. Another 600,000 chinook salmon eggs were brought in from a federal hatchery on Little White Salmon. These eggs produced approximately 700,000 fry that were released in the Umpqua river system. In 1901 a hatchery was constructed at the mouth of Steamboat Creek. A hatchery on Little Mill Creek at Scottsburg began operation in 1927 and operated for eight years (Bakken, 1970; Markers, 2000). The single remaining hatchery in Douglas County was established in 1937 northeast of Glide on Rock Creek.

In the 1910s large amounts of fish eggs were taken from the Umpqua river system. "In 1910 the State took four million chinook eggs from the Umpqua; the harvest mounted to seven million eggs in 1914. Over the next five years the State collected and shipped an estimated 24 million more eggs to hatcheries on other river systems" (Beckham, 1986, p. 208). The early hatcheries were focused on increasing salmon production for harvest. "Hatcheries have been essential in maintaining supplies of salmon, whose natural spawning grounds and migration routes have been severely disrupted in many areas by dams, agricultural reclamation and irrigation, and by timber operations" (Patton, 1976, p. 168). In recent years the effect of hatchery fish on the natural fish population has been

examined. Flagg et al. (2000) concluded that salmonids raised in an artificial hatchery environment do not respond the same as fish reared in a natural setting. However, they also felt current information was not sufficient to make concrete conclusions about how hatchery fish affect the survival of wild fish.

2.3.6. Agriculture

Crop irrigation was introduced to Douglas County farmers in 1928. J.C. Leady, Douglas County Agent (predecessor of County Extension Agent) gave a demonstration of ditch blasting in the 1928. In the demonstration one ditch in Melrose and one ditch in Smith River were created by blasting. The dimension of the resulting ditch was four feet deep by six feet wide. The report recommended this method of ditch creation in the low lands adjoining the Umpqua and Smith Rivers (Leady, 1929).

In 1935 Douglas County Agent J. Roland Parker introduced crop irrigation using gas and electric pumps. “The lift necessary to place irrigation water upon most land, laying along the numerous streams throughout the county, ranges from 15 to 30 feet. Only in exceptional cases will a higher lift be necessary” (Parker, 1936, p.15). Parker predicted the applications for water rights and the installation of irrigation systems would double in 1936. In his 1935 Annual Report, Parker listed 21 farms and their proposed irrigation projects. The water sources included the South Umpqua River, Calapooya Creek, Little River, North Umpqua River, Tenmile Creek, Myrtle Creek, Hubbard Creek, and Cow Creek (Parker, 1936).

The appropriation of water rights for agriculture left less water in the streams for fish, especially in the critical late months of summer. In Oregon water law follows the “prior appropriation” doctrine that is often described as “first come, first served.” The first person to obtain a water right on a stream will be the last user shut off when the streamflows are low. Junior users have water rights obtained at a later date than higher priority users. In periods of low water, the water right holder with the oldest priority date is entitled to the water specified in the senior water right regardless of the needs of junior users.¹⁶

2.4. *Modern era: 1970s to the present*

2.4.1. Logging

In 1972 the Oregon Forest Practices Act became effective. Standards were set for road construction and maintenance, reforestation, and streamside buffer strips. New rules were added in 1974 to prevent soil, silt, and petroleum products from entering streams. Starting in 1978, forest operators were required to give a 15-day notification prior to a forest operation. New rules were also added relating to stream channel changes. In 1987 riparian protection was increased – specific numbers and sizes of trees to be left in the riparian areas were specified. New rules in 1994 were added to create the desired future condition of mature streamside stands. Landowner incentives were provided for stream

¹⁶ The water rights information was obtained on January 7, 2003, from the Oregon Water Resources Department website <http://www.wrd.state.or.us/>.

enhancement and for hardwood conversion to conifer along certain streams (Oregon Department of Forestry, 2002).

In the 1970s, Roseburg Lumber's plant in Dillard became the world's largest wood products manufacturing facility. Key to the development of this facility was the availability of federal timber from both the U.S. Forest Service and the Bureau of Land Management. A housing slump in the early 1980s and a decline in federal timber in the 1990s resulted in the closure or reduced the size of many other manufacturing companies in the 1980s and 1990s (Oregon Labor Market Information System, 2002). In 2002 and 2003, increased wood products imports from foreign producers such as Canada and New Zealand resulted in a surplus of timber-based products in the US. This caused a depression in the local forest products manufacturing industry. In April, 2003, Roseburg Forest Products, the largest private employer in Douglas County, laid off approximately 400 workers.¹⁷

2.4.2. Mining

The M.A. Hanna Company permanently closed the mine and smelter on Nickel Mountain (near Riddle) in January, 1987. Nickel prices had fallen to below \$2 per pound. By March of 1988 average prices rose to between \$5 and \$6 per pound allowing Glenbrook Nickel to start production. Glenbrook Nickel closed in April, 1998. The M. A. Hanna Company followed by Glenbrook Nickel diligently strived to reclaim Nickel Mountain and to maintain good water quality from the discharge points. Walter Matschkowsky of Glenbrook Nickel Company was named Reclamationist of the Year in 1998 for his career of responsible mining and reclamation. He supervised the Thompson Creek Reclamation project and was successful in converting an area affected by mining into a green, healthy forest (Oregon Department of Geology and Mineral Industries, 2002).

Formosa Explorations Inc. was not as successful in reclamation efforts in the mine south of Riddle. Formosa reopened the Silver Butte Mine in 1990 and produced copper and zinc ore until 1993. Formosa closed the mine in 1994, completed reclamation activities,

<u>1970 to the present timeline</u>	
1971	Flood
1972	Clean Water Act
1972	Oregon Forest Practices Act
1973	Endangered Species Act
1974, 1981, 1983	Floods
1987	Hanna nickel mine in Riddle closed
1988	Glenbrook Nickel in Riddle begins production
1994	Northwest Forest Plan results in reduced federal log supplies
1996	Flood
1998	Glenbrook Nickel in Riddle closed
1999	International Paper Mill in Gardiner closed

¹⁷ This information is based on conversations between Nancy Geyer, Society of American Foresters president and president-elect Jake Gibbs and Eric Geyer, and Dick Beeby of Roseburg Forest Products.

and filed for bankruptcy. In the winter of 1995-96 acidic wastes were detected in Middle Creek and the South Fork of Middle Creek. Middle Creek is a tributary of Cow Creek. Bureau of Land Management fish surveys in the Middle Creek watershed in 1984 indicated the presence of coho salmon and steelhead. These fish have not been observed in upper Middle Creek for several years. The Oregon Department of Environmental Quality and the Bureau of Land Management are working together to clean up the site (Oregon Department of Environmental Quality, 2002).

2.4.3. Dam construction

During the late 1960s through 1980s several dams were constructed in Douglas County. The largest ones are included in Table 2-1 obtained from the Oregon Water Resources Department.

Year completed	Dam name	Creek	Storage (acre feet)
1967	Plat I Dam	Sutherlin	870
1971	Cooper Creek Dam	Cooper	3,900
1980	Berry Creek Dam	Berry	11,250
1985	Galesville Dam	Cow	42,225

Table 2-1: Name, location, and storage capacity of Umpqua Basin dams built since 1960.

Dams have both beneficial and detrimental influences on fish. Water release during periods of low flow in the late summer can assist fish survival. However, Galesville Dam and Berry Creek Dam are complete barriers to fish movement. Cooper Creek Dam and Plat I Dam may be barriers to juvenile fish.

2.4.4. Tourism

The rapid expansion of tourism in Douglas County came after World War II. The improving economy left Americans with an increased standard of living and the mobility of automobile travel. The Umpqua Valley offers scenic attractions and good access roads. Interstate Five and the connecting State Highways 38, 42, and 138, provide access to Umpqua Valley's excellent tourist areas. Tourist destination points include Crater Lake National Park, Wildlife Safari, Salmon Harbor, and the Oregon Dunes National Recreation Area. Tourism is a growing industry in Douglas County.

2.4.5. Settlement patterns and urbanization

Unlike many other Oregon counties, over 50 percent of Douglas County residents lived outside incorporated cities in 1980. The settlement pattern was mostly linear. Population density in 1980 was greatest in the central valley from Riddle to Roseburg to Sutherlin and lowest in the eastern and northwestern areas of the county (Cubic, 1987).

The population of Douglas County in 2000 was 100,399, which is an increase of almost 32,000 since 1960. Major urban areas have developed along the South Umpqua River to the confluence with the North Umpqua River and around the Umpqua estuary. Water quality along these streams gained protection with the passage of the Clean Water Act in

1972. The Clean Water Act established pollution discharge levels on point sources such as sewage treatment and wood processing plants.

2.4.6. Douglas County population growth

Figure 2-1 shows population growth data for Douglas County during the settlement period (1840s-1890s), the onset of the modern era (1900-1960s), and the modern era (1970s-present).

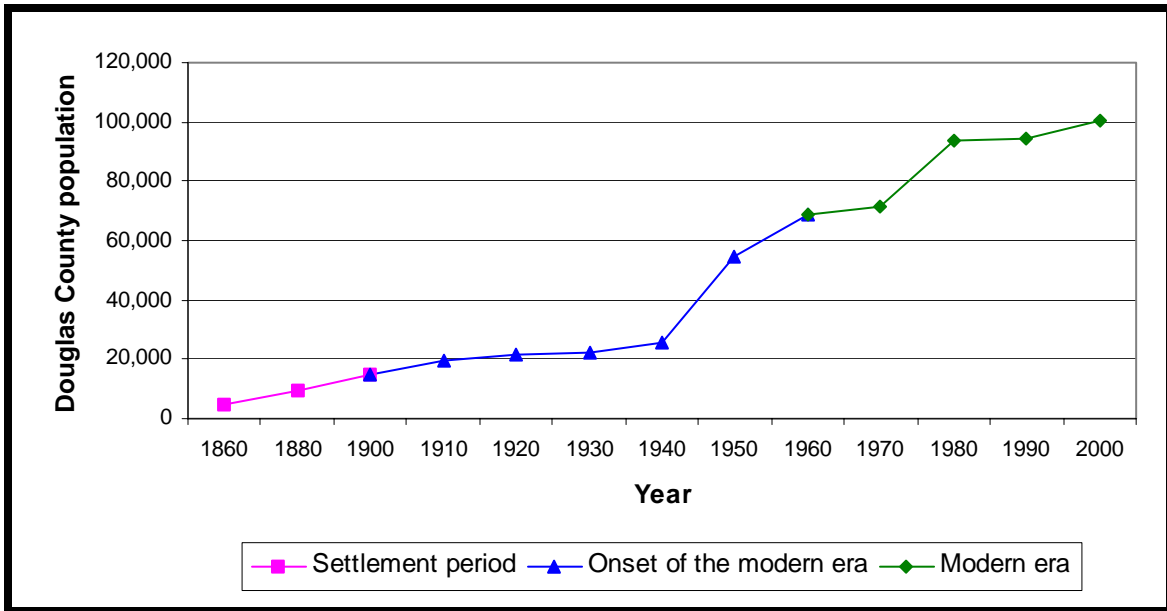


Figure 2-1: Population growth in Douglas County from 1860 through 2000.

2.5. History of the Lower South Umpqua Watershed

2.5.1. Lower South Umpqua historical timeline

Date	Event	Source
Before settlement	An Indian village existed along the South Umpqua River in the current location of the city of Roseburg. In the fall the Indians burned the grass and small trees in the valley bottoms.	(USDI Bureau of Land Management, 2000)
Late 1840s	The valleys were mainly grasslands with only a few scattered trees.	(USDI Bureau of Land Management, 2000)
1851	Aaron Rose purchased squatters rights for 640 acres that would become Roseburg – initially named Deer Creek.	(Cubic, 1982)

1852	Post Office opened at Deer Creek.	(Roseburg Area Chamber of Commerce, 2002)
1854	The county seat moved from Winchester to Deer Creek by popular vote.	(Cubic, 1982)
Mid – 1850s	Deer Creek became a major stop on the mule pack train routes and growth was stimulated.	(Roseburg Area Chamber of Commerce, 2002)
1855-56	Deer Creek was a major headquarters for volunteers fighting in the Indian Wars. Hundreds of men came to Deer Creek and supported the local businesses.	(Beckham, 1986)
1861	The city of Deer Creek was flooded. Steady rains and melting snow resulted in high waters on the South Umpqua River from late November to the flood peak on December 8.	(Pearson, 1995)
1872	Deer Creek was incorporated. The Oregon and California Railroad reached Deer Creek.	(Roseburg Area Chamber of Commerce, 2002)
Early 1880s	French Canadians linked with the Hudson’s Bay Company settled in Melrose.	(USDI Bureau of Land Management, 2000)
1894	Deer Creek officially renamed Roseburg.	(Roseburg Area Chamber of Commerce, 2002)
Late 1890s	Roads were nearly impassable in the winter in Roseburg and surrounding villages. “Teams of horses could barely drag a light wagon through the almost knee deep mud.”	(Pearson, 1995, p. 12)
1904	Sawmill built in Melrose.	(USDI Bureau of Land Management, 2000)
1910s	“Newton Creek and all creeks had trout in them at some time of the year.” “There were ducks on the South Umpqua River as well as many fish in the river. The fields abounded with pheasants and quail.”	(Weber, 1987, p. 80)

1914	The Strawberry Carnival was the biggest event of the year in Roseburg. The farmers in the Melrose area grew strawberries	(Weber, 1987)
1920	The sewage discharged at the mouth of Deer Creek and ran directly into the South Umpqua River.	(Weber, 1987)
1927	Roseburg was flooded on February 20.	(Douglas County Historical Society, 1987)
Late 1940s – 1950s	Bureau of Land Management and private forest landowners built roads to access forest lands. Travelers throughout the watershed had easier access because of the increased number of roads and the road improvements.	(USDI Bureau of Land Management, 2000)
1953	Winston incorporated as a city. Winston grew rapidly following World War II in the late 1940s and early 1950s.	(“Atlas of Oregon,” 1976)
1955	South Umpqua River flooded on December 22.	(Douglas County Oregon, 2002)
1959 The Blast	On August 7 early in the morning, a truck loaded with two tons of dynamite and 4.5 tons of Car-Prill (ammonium nitrate carbonitrate) exploded in downtown Roseburg. Fourteen people died as a result of the blast and property damage was about \$12 million. A twelve-block area of the city was destroyed. Windows as far as nine miles away were broken.	(Richards, 1974)
1964	South Umpqua River flooded on December 22 - 23.	(Douglas County Oregon, 2002)
1971	South Umpqua River flooded on January 17 - 18.	(Douglas County Oregon, 2002)
1974	South Umpqua River flooded on January 15.	(Douglas County Oregon, 2002)
Early 1980s	A nationwide recession resulted in a timber slump. The timber industry suffered job and wage losses.	(Roseburg Area Chamber of Commerce, 2002)
1981	South Umpqua River flooded on December 6.	(Douglas County Oregon, 2002)

1983	South Umpqua River flooded on December 17 - 18.	(Douglas County Oregon, 2002)
1990	The spotted owl declared an endangered species. Logging restrictions were increased.	(Roseburg Area Chamber of Commerce, 2002)
1996	South Umpqua River flooded on December 7 - 8.	(Douglas County Oregon, 2002)

2.5.2. Lower South Umpqua population

The cities of Roseburg and Winston are located within the Lower South Umpqua Watershed. The population growth for these two cities is shown in Figure 2-2. Winston was incorporated in 1953 and shows a constant growth since establishment. Roseburg incorporated in 1872 (then called Deer Creek). The population growth between 1880 and 1900 was due in part to the combining of the Roseburg and Deer Creek precincts. In 1880 the Roseburg precinct had a population of 800 and the Deer Creek precinct had a population of 834. In 1900 Roseburg more than doubled to 1,789 but Deer Creek was no longer listed as a precinct.

Roseburg grew rapidly from 1900 to 1910 and then stabilized until the late 1940s. After World War II (1945) the returning soldiers helped create a housing boom. Jobs in the timber industry brought workers and their families to Roseburg. The 1980s brought a slowdown to the timber industry and to the population growth of Roseburg.

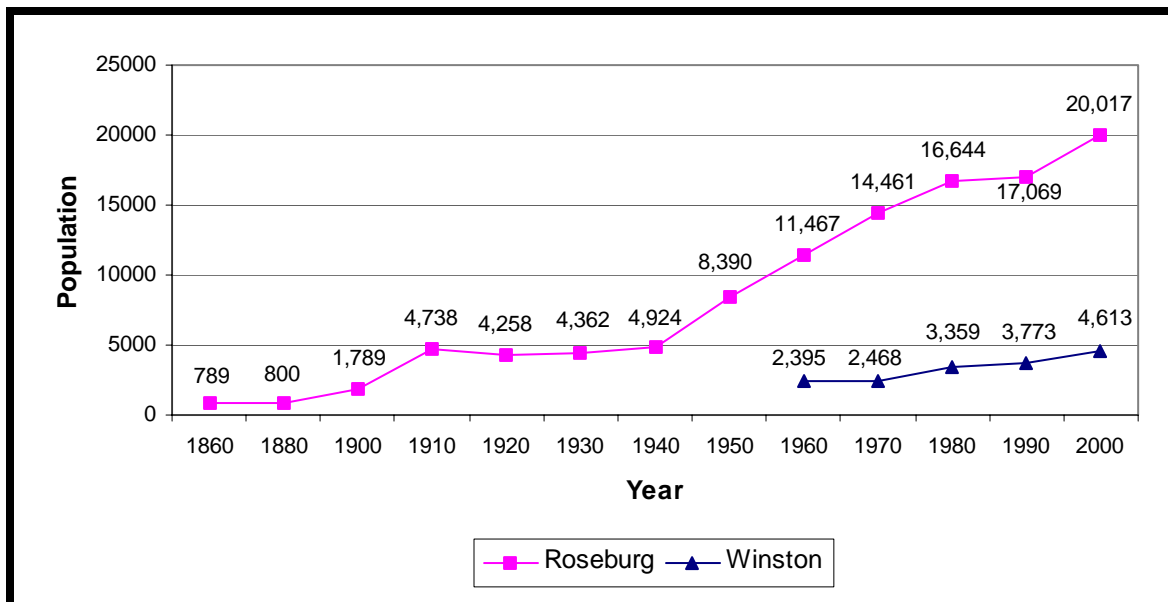
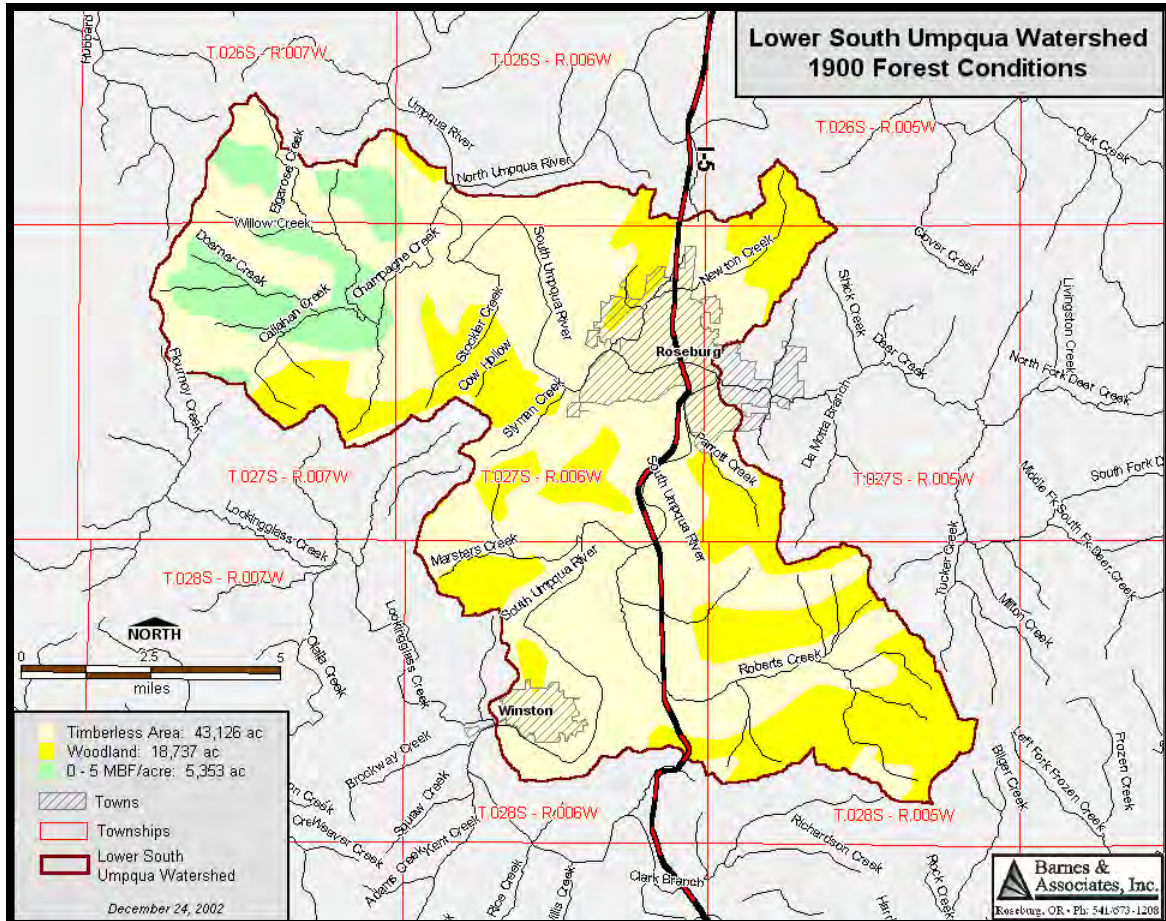


Figure 2-2: Roseburg and Winston population from 1860 through 2000.

2.5.3. 1900 forest conditions

Map 2-1 illustrates the vegetation patterns of 1900. The timberless acres include the bottomlands along the South Umpqua River, Roberts Creek, Newton Creek, and a few other waterways. Most of these lands probably were being farmed or had home sites. The woodland areas were mainly on the hillsides and upper reaches of the creeks. The west portion of the watershed shows patches of young trees or widely scattered older trees (0 – 5 MBF / acre), possibly a forest that had been recently logged or burned by wildfire.



Map 2-1: 1900 vegetation patterns for the Lower South Umpqua Watershed.

2.5.4. Historical fish use¹⁸

The Lower South Umpqua Watershed is located within the South Umpqua Basin with all streams of the watershed eventually draining into the South Umpqua River. In 1937 the Umpqua National Forest surveyed portions of the South Umpqua Basin for fish use. Numerous salmon, steelhead, and cutthroat trout were found throughout the South Umpqua River and its tributaries. The riparian zones were typically the old growth

¹⁸This section on historical fish use is based on information from the 1999 *Lower South Umpqua Watershed Analysis* completed by the Roseburg District of the USDI Bureau of Land Management.

forests found throughout the Pacific Northwest with much of the waterway shaded by tall trees.

Historically, this watershed has had naturally low streamflows and warm water temperatures but was still able to support abundant populations of chinook and coho salmon, steelhead and cutthroat trout (see Appendix 3).¹⁹ The 1937 Umpqua National Forest Survey found steelhead runs in the South Umpqua River were strongest in the winter while the chinook were most evident in late spring and summer. Cutthroat trout were observed throughout the surveyed stream segments of the Upper South Umpqua Basin. As shown in Table 2-2, the Oregon State Game Commission found coho salmon plentiful in the South Umpqua River in 1972.

Stream System	Chinook		Coho	Steelhead		Sea-run Cutthroat
	Spring	Fall		Winter	Summer	
South Umpqua River	600	1,500	4,000	10,000	0	10,000

Table 2-2: Estimated number of adult anadromous salmonids (1972).²⁰

The Umpqua system was stocked with Alsea River cutthroat from 1961 through the late 1970s. The sea-run cutthroat trout returns have been low since the stocking was eliminated. The addition of the Alsea River cutthroat may have added to the survival problems of the sea-run cutthroat trout native to the Umpqua River Basin.

Between the years of 1989 and 1993, the Umpqua National Forest did a comparative study of the streams originally surveyed in 1937. Stream widening was found in 22 of the 31 segments of streams surveyed. The widening is related to increased peak flows. Peak flows increase when stream channels are simplified – sediment fills the pools leaving a smoother channel surface. Clearing of vegetation from the riparian areas along streams has typically increased erosion along the stream banks and added sediment to the waterways. Timber harvest, road construction, and mining have all played a role in changing the stream channels and riparian zones. Stream channel simplification decreases the number and depth of the pools used for fish rearing.

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¹⁹ Some believe that water impoundments caused by beaver dams may have regulated stream flows and stream temperature.

²⁰ The information in the table was taken from Lauman et al., 1972.

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3. Current Conditions

This chapter explores the current conditions of the Lower South Umpqua Watershed in terms of instream, riparian, and wetland habitats, water quality, water quantity, and fish populations. Background information for this chapter was compiled from the following sources: the *Oregon Watershed Assessment Manual* (Watershed Professionals Network, 1999), the *Watershed Stewardship Handbook* (Oregon State University Extension Service, 2002), and the *Fish Passage Short Course Handbook* (Oregon State University Extension Service, 2000). Additional information and data are from the following groups' documents, websites, and specialists: the USDI Bureau of Land Management, the Oregon Department of Environmental Quality, the Oregon Department of Fish and Wildlife, the Douglas Soil and Water Conservation District, the US Geological Survey, and the Oregon Water Resources Department.

Key Questions

- In general how are the streams, riparian areas, and wetlands within the Lower South Umpqua Watershed functioning?
- How is water quality in terms of temperature, surface water pH, dissolved oxygen, and other parameters?
- What are the consumptive uses and instream water rights in the watershed, and what are their impacts on water availability?
- What are the flood trends within the watershed?
- What is the distribution and abundance of various fish species, what are the habitat conditions, and where are fish passage barriers?

3.1. Stream function

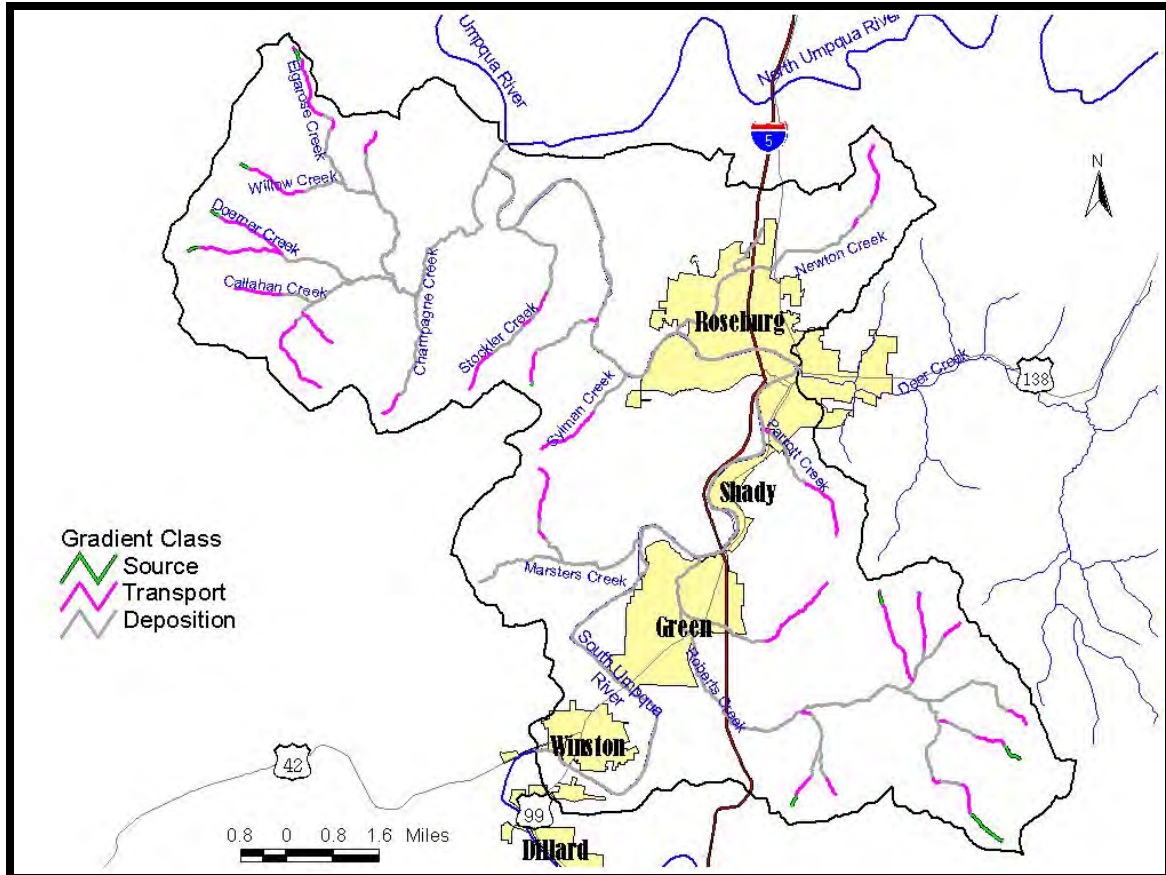
3.1.1. Stream morphology

Channel morphology²¹

The Watershed Assessment Manual was used for classifying streams within the Lower South Umpqua Watershed. In general, streams were classified according to channel habitat types based on stream gradient, valley confinement, and stream size. The Oregon Watershed Enhancement Board's (OWEB) manual further classifies and defines streams as source, transport, or depositional streams. Source streams are defined as steep (>16%), confined, mountain streams that are void of a floodplain. These channels are thought to be high-energy streams that carry wood and sediment to the lower reaches. Transport streams generally have a moderate gradient (3% to 16%) and are confined to narrow valleys. These streams may have small floodplains and temporarily store wood and sediment. However, these streams will transport wood and sediment to the downstream reaches during higher flow events. Depositional streams are defined as low gradient streams (<3%); they are low-energy streams that store wood and sediment for long periods of time. These streams are found in valley bottoms and have large

²¹ Jenny Allen, Tim Grubert, and John Runyon of BioSystems, Inc., provided the text and Table 3-2 for this section.

floodplains (Ellis-Sugai and Godwin, 2002). This classification scheme is based on the widely held assumption that stream channels possess specific physical characteristics resulting from the interaction of geologic, climatic, and vegetative inputs. Map 3-1 and Table 3-1 show the total stream miles and percent of streams within each gradient class.



Map 3-1: Stream gradients in the Lower South Umpqua Watershed.

Gradient class	Stream miles in the watershed	% Total
Source	2.1	2.1
Transport	23.7	23.7
Deposition	74.3	74.2
Total	100.1	100.0

Table 3-1: Lower South Umpqua Watershed stream miles within each gradient class.

The Lower South Umpqua Watershed has source streams located in the mountain headwaters of the upper reaches. Some of the tributaries to Roberts Creek and Newton, have steep gradients (>16%) and narrow channels confined by adjacent steep hill slopes with little or no floodplain. Given the steep gradients of these channels, they have a

tremendous amount of energy to deliver wood and sediment to the downstream reaches, often in the form of landslides and debris torrents. Given the high-energy, steep gradients, and lack of floodplains, these streams are generally not responsive to habitat projects. Often these streams do not provide high quality aquatic habitat because the channels are dynamic and are always in a state of transition. Many times these tributaries are located above the anadromous fish zone, eliminating quality fish habitat. The best approach to managing these types of systems may be through the careful monitoring and limiting of human activities such as cattle grazing and road building. Such activities can increase sediment loads into these systems that subsequently impact water quality of the lower reaches.

The middle portions of the Lower South Umpqua Watershed consist of transport streams such as Parrott and Sylman Creeks that feed directly into the main stem of the South Umpqua. These channels have moderate gradients (3% to 12%) with unconfined to moderately confined valleys and small floodplains. Many are still considered high-energy streams capable of carrying wood and sediment downstream during high flows. However, wood and sediments may temporarily be stored in these systems, providing cover and shade, promoting pool formations, and helping to dissipate stream energy. Restoration projects within these channels should be carefully considered before implementation due to their wide range of responses. The success of the project will depend greatly on channel gradient, size of floodplain, sediment load from upper reaches, and amount of energy associated with high flows. Goals should be carefully matched to the individual channels for success of restoration projects.

The main stem of the South Umpqua and several of its tributaries, such as Champagne and Marsters Creeks, are low gradient streams (1% to 3%) associated with medium to large floodplains. Sediment and large wood are deposited into these systems for long periods of time providing complex aquatic habitats within the stream network. The large wood and coarse sediments contribute to several processes that affect aquatic habitat, such as pool formation, bar formations, and development of side-channels. These tributary streams with large floodplains and low gradients are good candidates for restoration projects. Floodplains provide an important function for the stream. During high flows, the floodplain allows stream energy to be dissipated and slowly released as floodwaters recede. By slowing the stream energy during high flows, control structures like large wood often remain and continue to provide habitat. Furthermore, sediments have time to settle along the floodplains rather than filling pools and causing increased turbidity. The additions of control structures like boulders and large wood can improve fish habitat in several ways, such as increasing pool frequency and depth, promoting side-channel development, and dissipating stream energy during high flows. If stream shade and bank stability are issues, activities such as riparian plantings and removal of livestock through fencing are effective means to mitigate this problem. Table 3-2 lists the channel habitat types that are found in the area along with examples of streams that fall into each category within the watershed and restoration enhancement opportunities

Channel Habitat Type	Example within watershed	Restoration opportunities
Low gradient large floodplain	South Umpqua River	Because of the migrating nature of these channels, restoration opportunities such as riparian planting projects, on small side channels may be the best option for improvement.
Low gradient medium floodplain	Marsters Creek	Because of the migrating nature of these channels, restoration opportunities such as riparian plantings on small side channels may be the best option for improvement.
Low gradient small floodplain	Roberts Creek	Because of the migrating nature of these channels, restoration efforts may be challenging. However, because of their small size, projects such as, riparian plantings might at some locations be successful.
Low gradient moderately confined	Champagne Creek	These channels can be very responsive to restoration efforts. Adding roughness in forested areas may improve fish habitat, while stabilizing stream banks in non-forested areas and may decrease erosion.
Low gradient confined	Stockler Creek	Though these channels are not often responsive, shade and bank stability projects such as, riparian plantings may improve water temperature and erosion issues.
Moderate gradient moderately confined	Sylman Creek	These channels are among the most responsive to restoration projects. Adding large wood in forested areas may improve fish habitat and decrease erosion.
Moderate gradient confined	Parrott Creek	Though these channels are not often responsive, riparian planting projects may improve water temperature and erosion issues.
Moderate gradient headwater	Roberts Creek Headwaters	These channels are often moderately responsive to restoration. Riparian planting projects may improve water temperature and erosion issues.

Table 3-2: Channel habitat type examples for the Lower South Umpqua Watershed.

Stream habitat surveys

Since 1992, the Oregon Department of Fish and Wildlife (ODFW) has conducted stream habitat surveys throughout the Umpqua Basin. The purpose of these surveys is to gather basic data about Umpqua Basin streams and to compare current stream conditions to the habitat needs of salmonids and other fish. UBWC watershed assessments include nine surveyed variables grouped into four categories: pools, riffles, riparian areas, and large instream woody material. Table 3-3 provides the variables included in each category, and the standards used to rate a stream as “good,” “fair,” or “poor” for each category.

In the Lower South Umpqua Watershed, Newton Creek is the only stream that has been surveyed (see Map 1-7 on page 18). Newton Creek’s pools are fair, while its riffles,

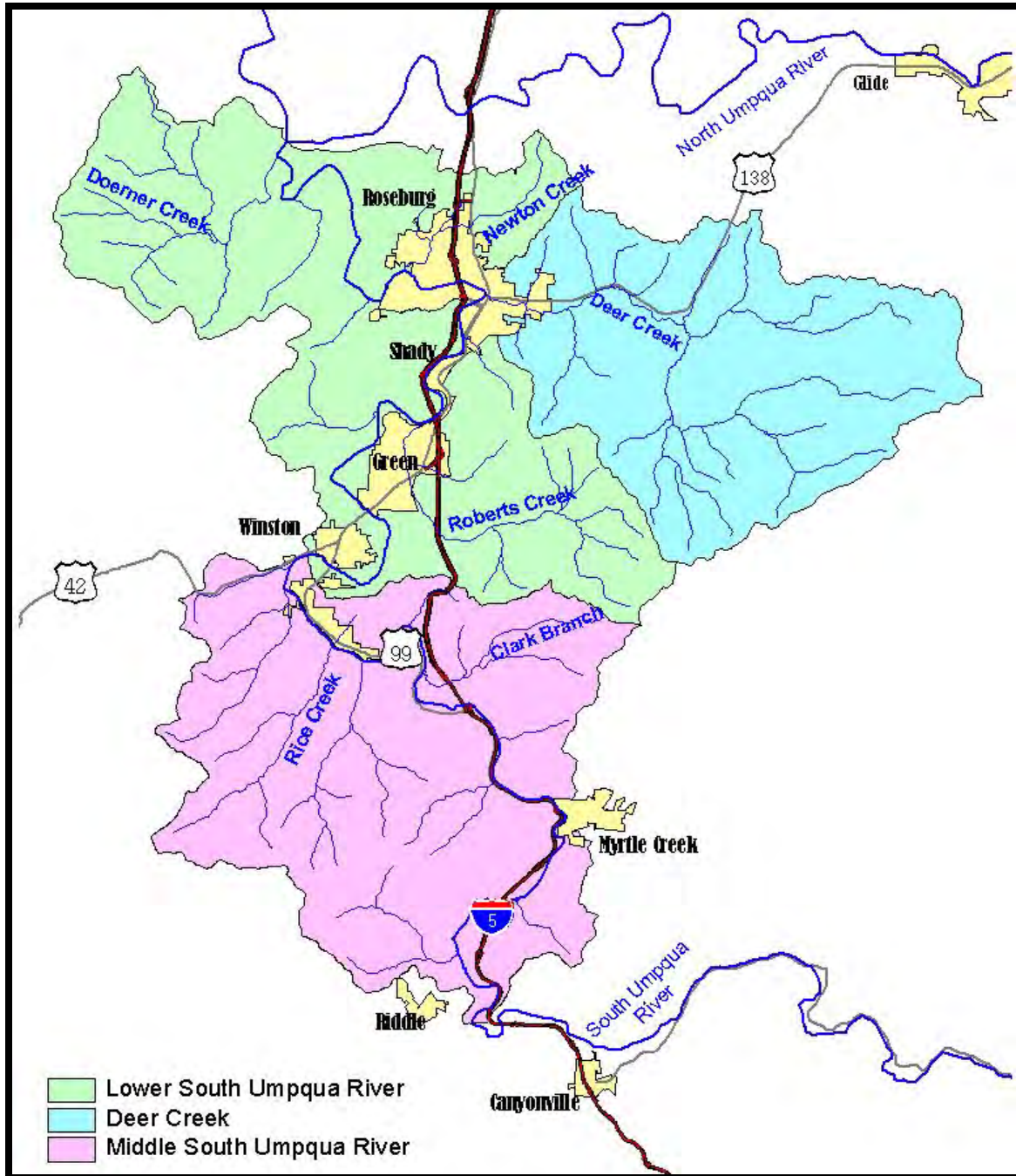
riparian areas, and large woody material levels are poor. No conclusions can be made about watershed-wide stream habitat conditions based on these data.

Habitat characteristic	Measurements used for rating habitat quality	Benchmark values		
		Good	Fair	Poor
Pools	1. Percent area in pools: percentage of the creek area that has pools 2. Residual pool depth: depth of the pool (m), from the bottom of the pool to the bottom of the streambed below the pool a) small streams b) large streams	1. > 30 2a. > 0.5 2b. > 0.8	1. 16-30 2a. 0.5 - 0.3 2b. 0.8 - 0.5	1. <16 2a. < 0.3 2b. < 0.5
Riffles	1. Width to depth ratio: width of the active stream channel divided by the depth at that width 2. Percent gravel in the riffles: percentage of creek substrate in the riffle sections of the stream that are gravel 3. Percent sediments (silt, sand, and organics) in the riffles: percentage of creek substrate in the riffle sections of the stream that are sediments	1. ≤ 20.4 2. ≥ 30 3. ≤ 7	1. 20.5-29.4 2. 16-29 3. 8-14	1. ≥ 29.5 2. ≤ 15 3. ≥ 15
Riparian	1. Dominant riparian species: hardwoods or conifers 2. Percent of the creek that is shaded a) for a stream with width < 12m (39 feet) b) for a stream with width > 12m	1. large diameter conifers 2a. > 70 2b. > 60	1. medium diameter conifers & hardwoods 2a. 60 – 70 2b. 50 – 60	1. small diameter hardwoods 2a. < 60 2b. < 50
Large Woody Material in the Creek	1. Number of wood pieces²² per 100m (328 feet) of stream length 2. Volume of wood (cubic meters) per 100m of stream length	1. > 19.5 2. > 29.5	1. 10.5-19.5 2. 20.5-29.5	1. < 10.5 2. < 20.5

Table 3-3: Stream habitat survey benchmarks.

²² Minimum size is six-inch diameter by 10 ft length or a root wad that has a diameter of six inches or more.

It is probable that the conditions of other streams in the Lower South Umpqua Watershed are similar to the neighboring Middle South Umpqua and Deer Creek Watersheds (see Map 3-2). In the Middle South Umpqua Watershed, stream habitat surveys suggest that lack of adequate large woody material, poor quality pools, and poor riparian tree composition limit fish habitat in tributaries. In the Deer Creek Watershed, inadequate large woody debris levels and poor riparian areas are the primary limiting factors.



Map 3-2: Locations of the Middle South Umpqua and Deer Creek Watersheds.

3.1.2. Stream connectivity

Stream connectivity refers to the ability of resident and anadromous fish, as well as other aquatic organisms, to navigate the stream network. The stream system becomes disconnected when natural and human-made structures such as waterfalls, log jams, and dams, inhibit fish passage. Although some stream disconnect is normal, a high degree of disconnect can reduce the amount of suitable spawning habitat available to salmonids. This, in turn, reduces the stream system's salmonid productivity potential. Lack of stream connectivity can also increase juvenile and resident fish mortality by blocking access to other critical habitat, such as rearing grounds and cool tributaries during the summer months.²³

For this assessment, fish passage barriers are structures that completely block all fish passage. A juvenile fish passage barrier permits adult passage but blocks all young fish. Structures that allow some adults or some juvenile fish to pass are referred to as obstacles. Although a single obstacle does not prevent passage, when there are multiple obstacles, fish can expend so much energy in their passage efforts that they may die or be unable to spawn or feed. This assessment reviews the known distribution and abundance of three common human-made fish passage barriers and obstacles: irrigation ditches, dams, and culverts.

Irrigation ditches

Irrigation ditches without fish wheel screens are primarily a problem for juvenile fish.²⁴ When the water diversion is in place, young fish swim into the ditches in search of food. When the diversion to the ditch is removed, the young fish left in the ditch cannot return to the stream network and will eventually die. At the writing of this assessment, no unscreened irrigation ditches in the Lower South Umpqua Watershed had been identified as significant juvenile fish passage barriers.

Dams

In the central Umpqua Basin, most dams on larger streams are push-up dams used to create pools to pump irrigation water.²⁵ These dams are only used during the summer months, and pose no passage barrier to fish during the winter. Dams can be barriers or obstacles to fish passage if the distance from the downstream water surface to the top of the dam is too far for fish to jump.

Whether or not a fish can overcome this distance depends on three factors: the size of the fish, the height of the drop, and the size of the pool at the base of the dam, which is where fish gain momentum to jump. If the pool is two feet deep, it is generally believed that adult fish can surmount a two-foot high dam or less, while juvenile fish can overcome a height of 0.5 feet or less. As pool depth decreases or height increases, fish have difficulty jumping high enough to pass over. According to the Oregon Water Resources

²³ See section 3.3.2 for more information about stream temperature.

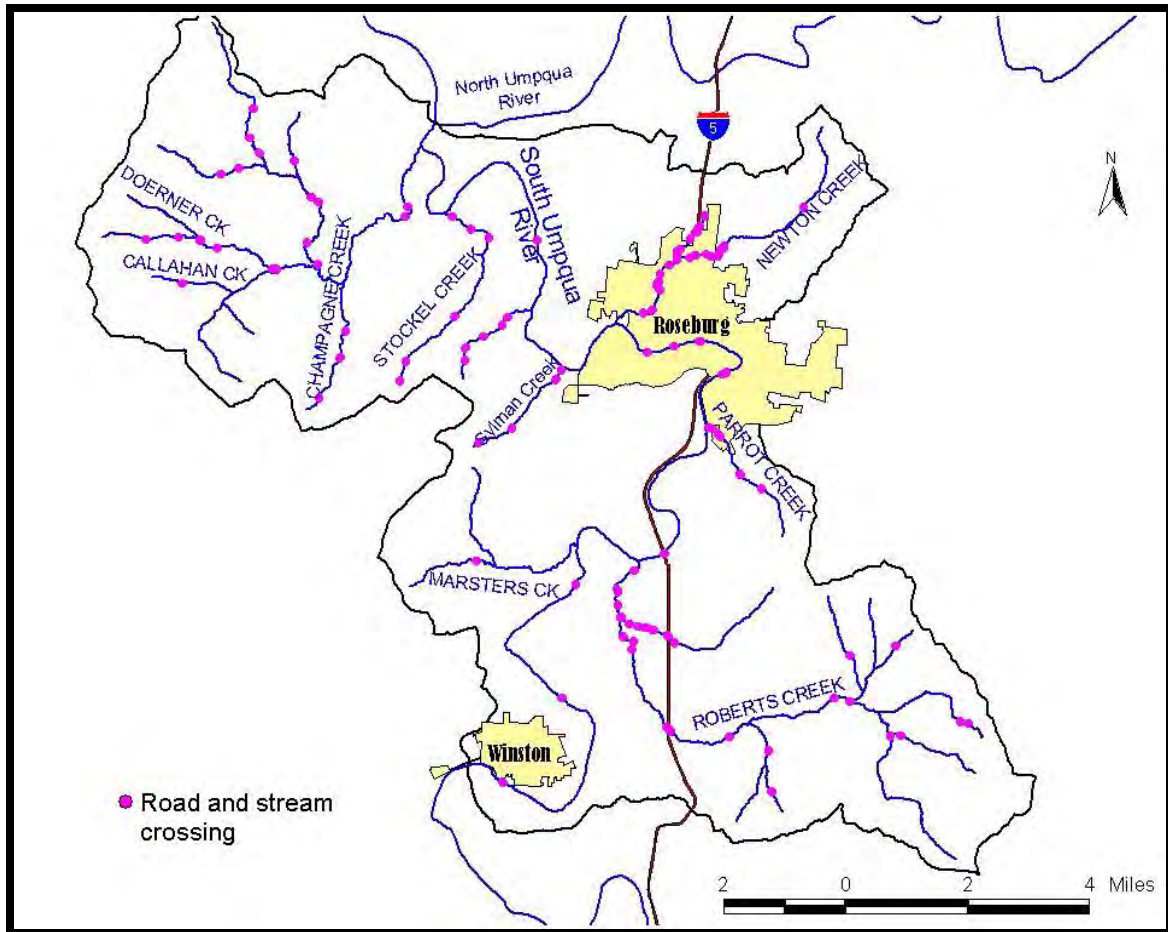
²⁴ Fish wheel screens are self-cleaning screens that prevent fish from entering an irrigation ditch while passing floating debris that may prevent water flow.

²⁵ Some landowners may have dams on small tributaries to provide water for wildfire control, provide water for livestock, or for landscape aesthetics.

Department, there are small agricultural dams on Champagne Creek, Elgarose Creek, and Stockler Creek. It is unknown at this time the extent to which these dams may be barriers to fish passage.

Culverts

Culverts pose the greatest problem for fish passage. Culverts are the most common method of crossing a road over a stream. There are at least 163 road and stream crossings in the Lower South Umpqua Watershed (see Map 3-3). Many of these are most likely culverts, but it's unknown at this time how many of the culverts are fish passage barriers or obstacles (see The Umpqua Basin Fish Access Team subsection below).



Map 3-3: Road and stream crossings in the Lower South Umpqua Watershed.

Culverts can be a barrier or obstacle to fish passage if the distance from the downstream water surface to the culvert outfall (or “drop”) is too far for fish to jump. Just as with dams, it is generally believed that adult fish can reach a culvert outlet that is two feet or less from the downstream water, while juvenile fish overcome a height of 0.5 feet or less, if there is a two-foot deep pool at the outfall.

Unlike dams, water velocity within the culvert poses another potential fish passage barrier. In natural stream systems, fish are able to navigate high velocity waters by periodically resting behind rocks and logs or in pools. Smooth-bottomed culverts offer no such protection, and water velocities can prevent some or all fish from passing through the pipe. Fish may face additional velocity barriers at the upstream end of a culvert if it has been placed so that the stream flows sharply downward into the culvert entrance. In general, smooth-bottomed culverts at a 1% gradient or more are obstacles to fish passage. Culverts that are partially buried underground or built to mimic a natural streambed provide greater protection and allow fish passage at steeper gradients and higher water velocities.

It is important to note that culverts may be fish passage obstacles or barriers for only part of the year. As water levels change, so do pool depth, drop distance, and water velocity. A culvert with a five-foot drop in the summer may be easily navigated in the winter. High winter water flows can increase pool size and reduce jumping distance. However, high flows can also increase water velocities, making culverts impassible.

The Umpqua Basin Fish Access Team

Currently, the Umpqua Basin Fish Access Team (UBFAT) is working on identifying and prioritizing fish passage-limiting culverts, as well as other fish passage barriers and obstacles, on public and private land throughout the Umpqua Basin. This project is in the information gathering stage and does not yet have a list of fish passage-limiting culverts in the Umpqua Basin. Future prioritization will focus on identifying the fish passage barriers that will give the highest cost-to-benefit ratio, such as culverts blocking fish access near the mouths of streams that are within the distribution of salmonids.²⁶ A document summarizing the results of this project will be available in late 2003.

3.1.3. Channel modification²⁷

For the purpose of this assessment, “channel modification” is defined as any human activity designed to alter a stream’s flow or its movement within the floodplain, such as building riprap, dredging, or vegetative bank stabilization. Although placing structures like boulders or logs in a stream alters the channel, this type of work is done to improve aquatic habitat conditions and is not intended to alter the stream’s path. As such, instream structure placement projects are not considered channel modification activities for this assessment.

In Oregon, the state has the authority to regulate all activities that modify a stream’s active channel. The active channel is all the area along a stream that is submerged during high waters. Even if the entire stream is within a landowner’s property, the active channel, like the water within it, is regulated by public agencies, and channel

²⁶ See section 3.5.2 for information about anadromous and resident salmonid distribution within the Lower South Umpqua Watershed.

²⁷ Information in section 3.1.3 is primarily from interviews by the author with Douglas Soil and Water Conservation District staff.

modification projects can only be done with a permit.²⁸ History has shown that channel modification activities are often detrimental to aquatic ecosystems and to other reaches of the same stream. Streams naturally meander, and attempts to halt meandering can alter aquatic habitats in localized areas and cause serious erosion or sedimentation problems further downstream. Although channel modification projects can still be done with a permit, obtaining a permit is a lengthy process.

Historical channel modification projects

Quantifying historical channel modification activities is difficult because no permits were issued and the evidence is hidden or non-existent. The majority of past channel modification activities were removing gravel bars from the stream and bank stabilization. Property owners removed gravel bars to sell the gravel as aggregate, to reduce water velocities, and “to put the creek where it belongs.” Gravel bars are not stationary, and during every flood event gravel is washed away and replaced by upstream materials.²⁹ Consequently, a gravel bar in the same location was often removed every year. According to landowners, there used to be many small aggregate mining businesses along the South Umpqua River, which have been replaced by a few large companies.

Bank stabilization concerns any material added to the stream’s bank to prevent erosion and stream meandering. The term “riprap” refers to bank stabilization done with any handy material including tires, car bodies, railroad ties, rocks, and cement. Other bank stabilization projects involve engineered structures, such as bank “barbs,” which are large rocks strategically placed to divert the flow of water away from the bank. Frequently, riprap and engineered structures become buried by sediment only to be exposed years later when a stream alters its path. During the 1996 Douglas County area floods, many past bank stabilization projects were exposed as sediment was washed away. In some cases, entire car bodies used for riprap were found stranded in the middle of streams that had drastically changed course.

Current channel modification projects

There are only a handful of permitted channel modification activities that have been done within the Lower South Umpqua Watershed in recent times. Rock riprap was placed at Singleton Park in the early 1990s to stabilize the South Umpqua River’s bank. Upstream of Stockler Creek, a bank barb project was completed in 1997 along 1,900 feet of the South Umpqua River. There is on-going aggregate mining along the South Umpqua River. Riprap was placed in Callahan Creek to stabilize a bridge. In 1987, a grade stabilization project on Marsters Creek involved adding a rock dam to the stream.

Landowners and stream restoration professionals report that non-permitted channel modification activities still occur throughout the Umpqua Basin. In many cases, the

²⁸ Under the Oregon Removal/Fill Law (ORS 196.800-196.990), removing, filling, or altering 50 cubic yards or more of material within the bed or banks of the waters of the state or any amount of material within essential habitat streams or state scenic waterways requires a permit from the Division of State Lands. Waters of the state include the Pacific Ocean, rivers, lakes, most ponds and wetlands, and other natural bodies of water. Tree planting in the active stream channel, and timber harvesting in some circumstances, can be done without a permit.

²⁹ In general, a gravel bar that has no grass or other vegetation is unstable.

people involved are unaware of the regulations and fines associated with non-permitted channel modification projects and the effects on aquatic systems.

3.1.4. Stream function key findings and action recommendations

Stream morphology key findings

- The majority of streams within the Lower South Umpqua Watershed have low gradients with few stream miles in source areas, where most large woody material is recruited into the stream system. This may limit instream large woody material abundance.
- Newton Creek is the only stream that has been surveyed by ODFW in the Lower South Umpqua Watershed. No conclusions can be made about watershed-wide stream habitat conditions based on these data.
- Surveys in the neighboring Deer Creek and Middle South Umpqua Watersheds suggest that lack of adequate large woody material, poor quality pools, and poor riparian tree composition limit fish habitat in these areas; these may be limiting factors in the Lower South Umpqua Watershed as well.

Stream connectivity key findings

- Culverts and, to some degree, dams, reduce stream connectivity, which affects anadromous and resident fish productivity in the Lower South Umpqua Watershed. More information about fish passage barriers will be available from UBFAT in 2003.

Channel modification key findings

- Many landowners may not understand the detrimental impacts of channel modification activities or may be unaware of active stream channel regulations.

Stream function action recommendations

- Through public education and outreach, recruit community participation in the ODFW stream habitat surveys.
- Where appropriate, improve pools, collect gravel, and increase the amount of large woody material by placing large wood and/or boulders in streams with channel types that are responsive to restoration activities and have an active channel less than 30 feet wide.³⁰
- In areas with inadequate riparian conditions, encourage land use practices that enhance or protect riparian areas:
 - Protect riparian areas from livestock-caused browsing and bank erosion by providing stock water systems and shade trees outside of the stream channel and riparian zones. Fence riparian areas as appropriate.
 - Plant native riparian trees, shrubs, and understory vegetation in areas with poor or fair riparian areas.
 - Manage riparian zones for uneven-aged stands with large diameter trees and younger understory trees.
- Maintain areas with good native riparian vegetation.

³⁰ Thirty feet is the maximum stream width for which instream log and boulder placement projects are permitted.

- Encourage landowner participation in restoring stream connectivity by eliminating barriers and obstacles to fish passage. Restoration projects should focus on barriers that, when removed or repaired, create access to the greatest amount of fish habitat.
- Increase landowner awareness and understanding of the effects and implications of channel modification activities through public outreach and education.

3.2. *Riparian zones and wetlands*

3.2.1. Riparian zones

The vegetation immediately adjacent to a stream is the stream's riparian zone. Riparian zones influence stream conditions in many ways. Above-ground vegetation can provide shade, reduce flood velocities, and add nutrients to the stream. Roots help prevent bank erosion and stream meandering. Trees and limbs that fall into streams can increase fish habitat complexity and can create pools. Insects that thrive in streamside vegetation are an important food source for fish.

What constitutes a "healthy" riparian area, however, is dependent on many factors. Although many large diameter conifers and hardwoods provide the greatest amount of shade and woody debris, many streams flow through areas that don't support large trees or forests. In some areas, current land uses may not permit the growth of "ideal" vegetation types. Conclusions about stream riparian zone conditions should take into consideration location, known historical conditions, and current land uses. Therefore, this assessment's riparian zone findings should be viewed as a guide for interpretation and further investigation and not as an attempt to qualify riparian conditions.

Riparian zone classification methodology

Digitized aerial photographs were used to determine riparian composition of the Lower South Umpqua Watershed. Creek banks are classified separately since conditions on one side of a stream are not necessarily indicative of conditions on the opposite bank. Stream banks are labeled as "left" or "right" from the perspective of standing in the middle of the creek looking downstream. The miles of riparian zone are the combined total of both the left and right banks. This assessment evaluated a total of 50.4 miles of South Umpqua River riparian zones and a total of 149.8 miles of tributary riparian zones.

Each side of the stream was divided into reaches based on changes in vegetation type and vegetation width. The reaches were measured and classified using three vegetation composition parameters: dominant vegetation or feature, buffer width, and cover. Table 3-4 outlines the classifications for each parameter. Findings for each parameter for the South Umpqua River and tributaries within the watershed are discussed below.

Appendix 4, Appendix 5, and Appendix 6 have data by percent for Champagne Creek, Elgarose Creek, Roberts Creek, Sylman Creek, Marsters Creek, Newton Creek, and Stockler Creek.³¹

³¹ Combined tributary data include these streams and others.

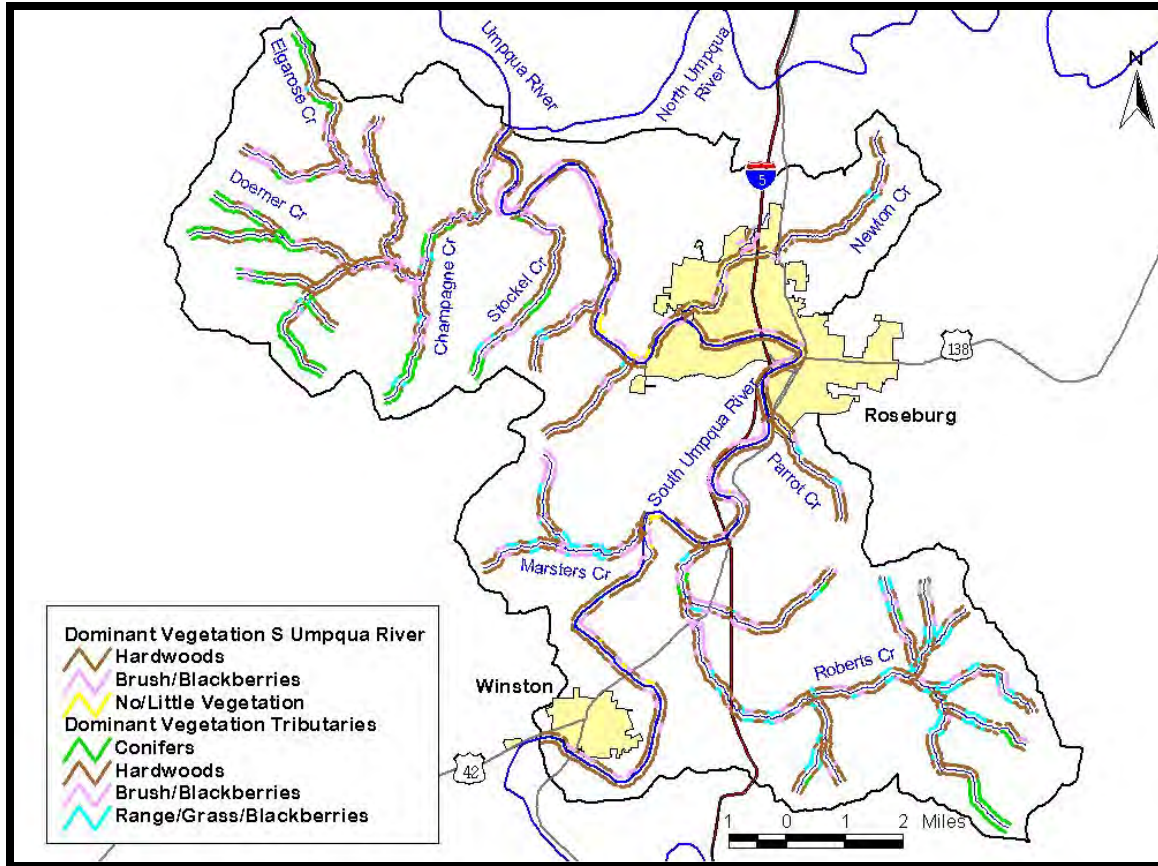
Riparian zone parameters	Parameter attributes Stream reaches are classified by the most dominant (>50% cover) characteristic
Dominant vegetation or feature	<ul style="list-style-type: none"> • Conifer trees • Hardwood trees • Brush/blackberries • Range/grass/blackberries • No vegetation (roads, bare ground, etc.) • Infrastructure (bridges and culverts)
Buffer width	<ul style="list-style-type: none"> • No trees • 1 tree width • 2+ tree width
Cover	<ul style="list-style-type: none"> • No cover • <50% cover • >50% cover

Table 3-4: Riparian zone classification for the Lower South Umpqua Watershed.

Dominant vegetation or feature

The dominant streamside vegetation or features affect ecological functions by providing different levels of shade and bank stability as well as different types of nutrients and wildlife habitat. For this assessment, the dominant vegetation or feature was evaluated using six attributes. Trees were split into two groups, conifers and hardwoods. Although all tree types provide shade and large woody debris, large conifers decompose very slowly and are less likely than hardwoods to wash downstream. Brush and blackberries constitute short broad plants. Blackberries were not given a separate category because they are frequently intertwined with other shrubs and difficult to differentiate. Range and grass includes blackberries because in most cases a predominantly range or grass riparian zone has a thin strip of blackberries close to the stream bank. Areas of no vegetation include streamside roads and railroads and non-road related bare ground and rock. Infrastructure indicates areas where the stream passes under a bridge or culvert. Map 3-4 shows the three most common vegetation types for Lower South Umpqua Watershed streams. Appendix 4 has the percent of all vegetation or features for the South Umpqua River, combined tributaries, and specific tributaries.

Hardwoods dominate the riparian zones for both the South Umpqua River (66.6%, 33.6 miles) and for all tributaries (58.0%, 86.8 miles). After hardwoods, brush/blackberry is the most predominant vegetation type for both the South Umpqua River (23.1%, 11.7 miles) and for tributaries (17.7%, 26.6 miles). No/little vegetation is the third most prevalent condition for the South Umpqua River (5.5%, 2.8 miles). For the tributaries, conifers (11.7%, 17.6 miles) and range/grass/blackberries (10.2%, 15.2 miles) are the third and fourth most common vegetation types.

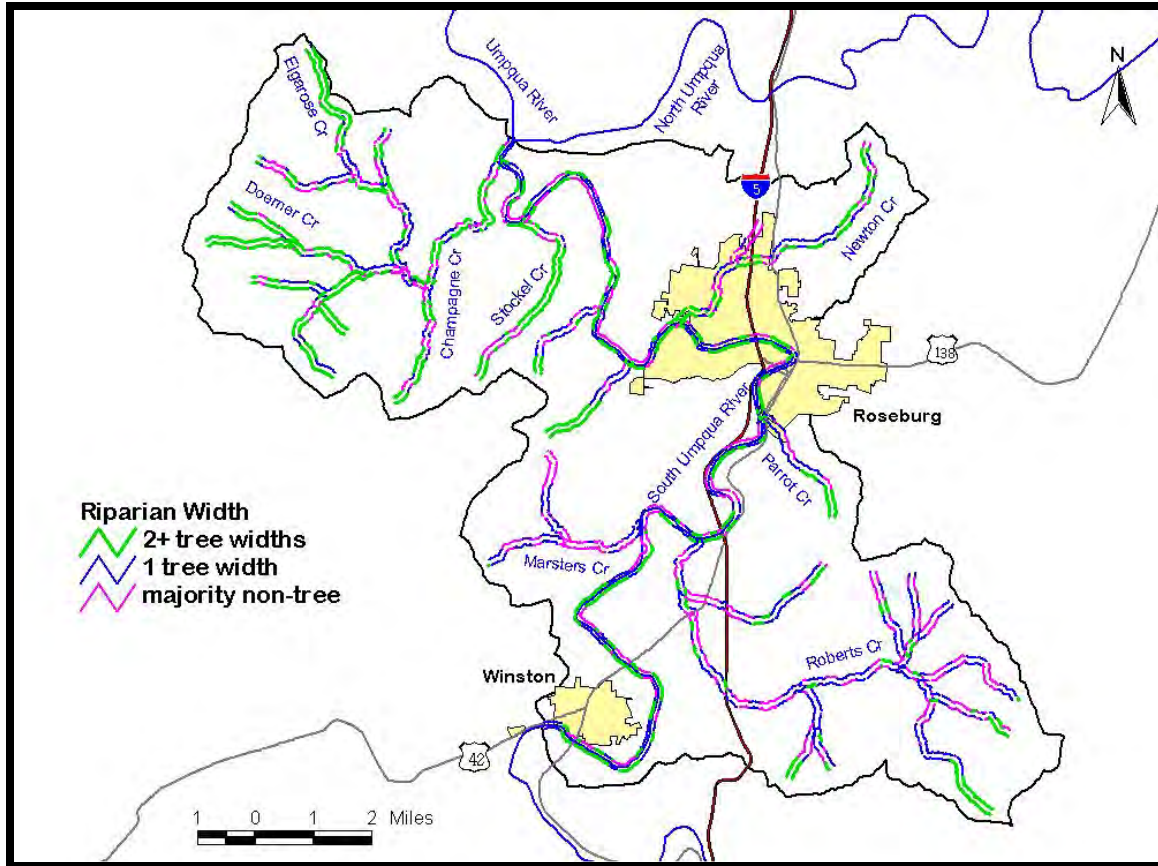


Map 3-4: Dominant riparian vegetation or feature for the Lower South Umpqua Watershed.

Buffer width

Riparian areas with a wide band of trees provide habitat and migration corridors for wildlife. As the number of trees in proximity to the stream increases, so does the likelihood that some trees will fall into the stream, creating fish habitat and forming pools. Wide tree buffers also increase stream shading, creating a microclimate with cooler temperatures compared to other reaches of the same stream. Buffer width was classified as having no trees, one tree width, or a width of two or more trees. Map 3-5 shows buffer width findings for the South Umpqua River and combined tributaries. Appendix 5 provides percents by width for the South Umpqua River, combined tributaries, and specific tributaries.

For both the South Umpqua River and its tributaries, riparian areas are fairly evenly divided among no trees, one tree width, and two or more trees. The South Umpqua River has 40.2% (20.3 miles) of riparian zones with two or more trees, while tributaries have 33.9% (50.8 miles). The South Umpqua River and tributaries have similar percentages of riparian zones with no trees: 31.4% (15.8 miles) and 30.3% (45.4 miles), respectively. As shown in Appendix 5, there is tremendous variation among tributaries. Whereas over two-thirds of Stockler Creek's riparian zone is two trees wide, almost half of Marsters Creek has no trees.



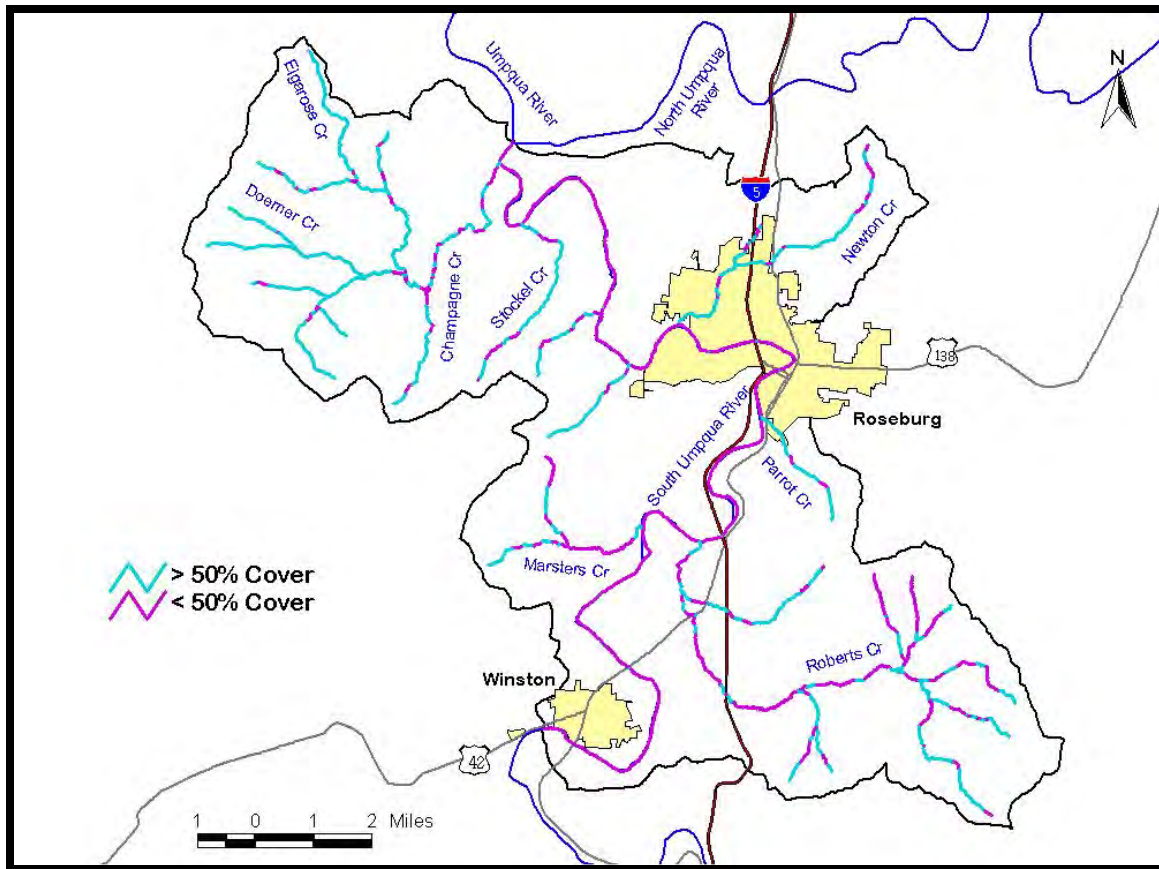
Map 3-5: Riparian buffer widths for the Lower South Umpqua Watershed.

Cover

The ultimate source of stream heat is the sun, either by direct solar radiation or by ambient air and ground temperature around the stream.³² Blocking the amount of direct solar energy reaching the stream surface reduces warming rates. Streams with complete cover receive the least direct solar radiation, and are therefore favored in the Umpqua Basin, where many streams are 303(d) listed for high temperature.³³ Cover is dependent on stream width and riparian vegetation. Shrubs and grasses can provide substantial cover for small, narrow streams. Larger streams can be partially shaded by vegetation and completely shaded by infrastructure. In very wide streams, only bridges provide complete coverage. This assessment looks at the percent of the total stream width that is covered by trees or infrastructure. Map 3-6 shows the stream reaches that have greater than 50% cover and less than 50% cover. Appendix 6 shows the percent cover for the South Umpqua River and for tributaries.

³² See section 3.3.2 for more information about stream temperature.

³³ See section 3.3.1 and Table 3-6 for more information about 303(d) listed streams.



Map 3-6: Percent cover for the Lower South Umpqua Watershed.

Due to the great width of the South Umpqua River, 99.5% of the river is less than half covered by vegetation or infrastructure (47.2 miles). The areas that are mostly covered are under bridges. Two-thirds of tributaries (100.6 miles) are more than half covered by vegetation or infrastructure. There are 46.5 miles (31.0%) of tributaries that are less than half covered. Only 2.7 miles (1.8%) of tributaries are completely exposed. As shown in Appendix 6, there is much variation among tributaries; almost 90% of Elgarose Creek is mostly covered, while over 50% of Roberts Creek is mostly exposed.

3.2.2. Wetlands³⁴

Overview

The purpose of this analysis is to identify and evaluate historical and current wetlands associated with streams, wetlands surrounded by uplands, identify present and potential impacts or alterations to these wetlands, and to examine potential strategic restoration areas located within the Lower South Umpqua Watershed. General wetland functions such as wildlife habitat, water quality improvement, and hydrologic control were evaluated, including more specific functions related to each general function.

³⁴ Brad Livingston and Loren Waldron from Land and Water Environmental Services, Inc. contributed all of section 3.2.2.

Wetlands provide several functions within their respective watersheds that are essential to healthy water resources. Many of the functions can be categorized under the general functions of wildlife habitat, water quality improvement, and hydrologic control. Wetlands provide habitat for terrestrial wildlife, birds, and aquatic wildlife, provide feeding opportunities, refuge areas, and nesting sites. Wetlands improve water quality by trapping sediments, removing nitrogen, retaining phosphorous, and regulating stream temperatures. Hydrologic control functions reduce peak flows from high water events by retaining high volumes of surface water, and slowly releasing water during lower flows. Wetlands may also contribute to groundwater recharge.

Wetlands are defined as:

Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.³⁵

Review of the U.S. Fish and Wildlife Service National Wetland Inventory (NWI) maps for the Lower South Umpqua Watershed indicates significant wetland resources. The two dominant wetland types are riverine and palustrine. Palustrine wetlands include wetland prairies, slope wetlands, and marshy areas with persistent vegetation. Palustrine wetlands may contain trees, shrubs, and/or herbaceous vegetation. Riverine wetlands may or may not contain vegetation and are defined as:

[Wetlands] that are closely associated with a channel or floodplain, including the active two year floodplain, sloughs, and riparian areas. Riverine wetlands should include any channel to a depth of 6.5 feet, scoured floodplains, wetlands that comprise entire islands within channels, some ditches, sloughs connected to main channels, river alcoves with seasonally stagnant conditions, and depressions or temporarily ponded areas within active biennial floodplains.³⁶

Wetland prairies are flat areas dominated by wetland grasses and other herbaceous hydrophytic vegetation. Wetland prairies are mostly precipitation driven, poorly drained, seasonal in nature, and typically contain a hummocky microtopography. The Happy Valley area near Winston contains a significant amount of area occupied by wetland prairies.

Slope wetlands are also found within the upland portions of the watershed. Slope wetlands receive water from surface water flowing downhill, or from lateral subsurface flow. Some slope wetlands may depend on a seep or spring for water. Hydrophytic trees, shrubs, and herbaceous vegetation may be associated with a slope wetland.

³⁵ Environmental Laboratory, 1987, p. 13.

³⁶ Adamus, P.R., 2001, p. 2.

Historical wetlands

Historical wetlands within the Lower South Umpqua Watershed contained mixed conifer and hardwood forests of various seral stages interspersed with wetland prairies and scrub/shrub wetlands. Palustrine wetlands associated with streams were often seasonal and contained maple, ash, oak, fir, alder, and vine maple. Low lying valleys and floodplains were described as being ideal for grains and vegetables while upland areas were described as ideal for pasture, which indicates a change of ecotype.³⁷

Valleys formed by the South Umpqua River contained mixed coniferous and hardwood temperate forests. Riparian areas and forested riverine wetlands primarily contained hardwood tree species. Wetland and riparian forests provided woody debris and instream structure, shaded streams, and provided habitat for a variety of fish and wildlife. Lowland valleys within the Lower South Umpqua Watershed were often dominated by open oak savannahs; however, riparian areas and riverine wetlands provided conditions that allowed a mixture of forest seral stages, scrub/shrub, and emergent wetlands to develop.

Bigleaf maple (*Acer macrophyllum*), Oregon white oak (*Quercus garryana*), black cottonwood (*Populus balsamifera*), red alder (*Alnus rubra*), Oregon ash (*Fraxinus latifolia*), and Douglas-fir (*Pseudotsuga manziesii*) dominated forested wetlands and riparian zones. These forested wetland areas provided flood control, storm surge desynchronization, streambank stability, and high water retention.

Prior to widespread fire suppression policies, wildfires were a regularly occurring phenomenon caused by lightning strikes or set by Native Americans. Wildfires would burn uplands and low lands, including wetland prairies. Wetland prairies become very dry in late summer, making them susceptible to wildfires. Once wetland prairies became dry in late summer, wildfires would often invade due to optimal conditions. Wildfires have helped to maintain wetland prairies by burning shrubs and trees before they become established. Wildfires had less effect on wetlands that remained wet throughout the summer, such as riverine wetlands and emergent wetlands.

Current wetland status

Wetlands that are hydrologically driven by precipitation, lateral subsurface flow, seeps and springs, or surface water runoff from slopes are typically identified as palustrine emergent wetlands with varying water regimes and special modifiers. These palustrine wetlands may include wetland prairies, slope wetlands, or seep and spring-fed wetlands. Seasonal wetland prairies are abundant in low lying areas with poorly drained soils.

Riverine wetlands associated with the active channel of the South Umpqua River include seasonally exposed stream beds that contain sparse or no vegetation, permanent open water riverine wetlands, gravel beds and beaches, intermittently flooded scrub/shrub wetlands, and wetlands among meander scars and seasonal over-flow channels. There are few forested wetlands identified within the Lower South Umpqua Watershed.

³⁷ 1853 County Surveyors Record, Douglas County, OR.

Tributaries to the South Umpqua River contain wetlands mostly confined to active channels. These wetlands include seasonally saturated hardwood forested areas, permanent diked/impounded wetlands containing open water, seasonal scrub-shrub/emergent wetlands, and seasonally saturated hardwood forested/emergent wetlands. Many of the wetlands are seasonal.

Palustrine wetlands include much of the wetland areas within the Lower South Umpqua Watershed. Most palustrine wetlands are identified as wetland prairies or slope wetlands. Wetland prairies and slope wetlands occur in low lying areas containing poorly drained soil. Wetland hydrology is typically provided by precipitation, subsurface flow, sheet flow, and seep. Wetland grasses and forbs typically dominate wetland prairies. Slope wetlands are often dominated by sedges, rushes, forbs, and may contain wetland grasses as well. Happy Valley contains a significant amount of palustrine wetlands due to the relatively level landscape and the presence of poorly drained soils.

One of the most well known wetlands within the Lower South Umpqua Watershed is located in Roseburg off Stewart Parkway. The new pond located in Stewart Park is part of a wetland mitigation project that includes the re-alignment of Newton Creek, and a created wetland prairie area located adjacent to Stewart Parkway. The wetland mitigation project is designed to compensate for wetland impacts resulting from development activities. The mitigation areas provide green space and wildlife habitat within the urban growth boundary of Roseburg, as well as several wetland functional attributes that provide hydrologic control and water quality improvements. The presence of wetlands in populated areas provides aesthetic values as green space, helps provide hydrologic control, improves water quality, and provides habitat for songbirds and other wildlife. Wetlands also help filter surface water runoff by trapping sediments and nutrients.

The establishment of Roseburg, Green, and Winston has altered and eliminated all types of wetlands that were historically present in the area. Development at the bases of slopes, in low-lying areas with poorly drained soils, and within the floodplain of streams has drained and eliminated wetland areas. The end result is that wetlands are often confined to the active channel of streams, or are located in somewhat isolated and/or disturbed areas where their functional attributes have been diminished. The present state of wetlands within the watershed is the result of a variety of impacts. Urban development creates the most substantial and persistent alteration of wetlands.

Potential sources of impacts

Wetlands within the Lower South Umpqua Watershed have been eliminated or heavily impacted for several years by various activities. Wetlands were altered by the placement of fill material, the construction of dikes and berms, clearing of native vegetation, erosion, the physical alteration of stream morphology, and the removal of aggregate resources.

Development typically includes an increase of impervious surface area, and the replacement or clearing of native vegetation. Development located adjacent to the Lower South Umpqua River, and within the 100 year floodplain, reduces the effectiveness of

riparian buffers, increases impervious surfaces, reduces water storage capacity, and impacts wildlife habitat.

Roads are often located adjacent to streams within the interior valleys. Roads built parallel to a waterway alter natural drainage patterns and restrict terrestrial wildlife access. Roads can create a hydrologic obstacle, and can lead to a reduction of slope stability. Culverts and drainage ditches are often necessary for the installation of roads, contributing to rapid draining and altered drainage patterns.

Urban development within the Lower South Umpqua Watershed, primarily associated with the City of Roseburg, Winston, and the Green District, causes long term modifications to natural water regimes, removes vegetation, eliminates wildlife habitat, and deposits potentially water quality limiting substances into wetlands. Buildings, roads, sewers and other urban structures create long-term impacts to wetlands. The result of urban development is often a loss of wetland areas.

Aggregate removal operations may impact spawning beds and juvenile rearing habitat, can cause migration blockages, may contribute to a loss of channel stability, can increase turbidity, and may remove large woody debris from aquatic habitats and wetlands. The loss of substrate can cause channels to deepen, reducing flow velocity and white water riffles. The loss of riffles can result in a decrease in dissolved oxygen, which is essential to aquatic life.

Impacts derived from disturbances near the headwaters of tributaries to the Lower South Umpqua River are primarily related to land clearing and road construction. Storm surges and peak flows are intensified due to the removal of vegetation and other wetland attributes contributing to water storage. The reduced ability of wetlands to perform hydrologic control during high flow events can lead to property damage, and the degradation of water resources and wetlands downstream from the degraded wetland.

Losses of the water storage capacity of wetlands have contributed to the rapid draining of the watershed during summer months. Rapid draining occurs as a result of clearing vegetation, increasing impervious surface areas, and ditching or channelizing wetlands. Combining the loss of water storage capacity with water uses such as irrigation, drinking water, and sewage systems leads to significantly low flow volumes during summer months.

Potential restoration opportunities

Restoration opportunities exist where a loss of wetland functions has occurred. Restoration of the most severely degraded wetlands will provide the most significant increase in overall functions.

Removing undesirable vegetation, and establishing wetland vegetation and hydrology can improve wetland functions. Restored wetlands improve water quality by trapping sediments and nutrients from surface water runoff, provide wildlife habitat, and may contribute to ground water recharge. Borrow pits or various aggregate removal sites,

lumber yards, log ponds, or decommissioned industrial sites may be restored to wetland prairies, as long as suitable conditions exist.

Wetland restoration opportunities include protecting existing wetlands located near the headwaters of tributaries, enhancing any stream-associated wetlands by simply planting more native trees such as Oregon ash (*Fraxinus latifolia*), black cottonwood (*Populus balsamifera*), red alder (*Alnus rubra*), and various willow species (*Salix spp.*), stabilizing eroding stream banks using biotechnical erosion control methods or reducing slope severity by excavating, eliminating livestock access to streams by fencing riparian areas, and using off-channel stock watering systems. Restoration of wetlands located in urban areas can be beneficial, although opportunities are limited. The cost of land in urban areas often reduces the chance of wetland restoration projects. Wetlands need time to develop and should be protected for long time periods to maximize functionality.

Specific restoration opportunities exist throughout Happy Valley. Happy Valley is an ideal location for wetland restoration activities due to the amount of small streams and tributaries located within the lowland valley. Restoration and enhancement activities might include the conversion of cleared lands to wetland prairie by plugging drainage ditches and eliminating livestock access. After wetland hydrology is restored and impacts are minimized or eliminated, wetland functions will begin to develop.

Benefits of wetland restoration projects are not limited to physical project boundaries. Improved water quality has a positive effect on downstream areas as well, and hydrologic control can help reduce impacts of flooding downstream. Wetland restoration is most beneficial when a large area can be restored and protected in perpetuity, although smaller-scale projects provide undeniable benefits if they are protected. Regular monitoring and maintenance activities are essential to the long-term success of restoration sites.

Wetland references

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Guard, J.G. 1995. Wetland Plants of Oregon and Washington. Lone Pine Publishing, Vancouver, British Columbia.

3.2.3. Riparian zones and wetlands key findings and action recommendations

Riparian zones key findings

- For both the South Umpqua River and tributaries within the watershed, hardwoods are the dominant vegetation type. Brush/blackberry is the second most common vegetation type. Over 10% of tributaries have riparian areas dominated by range/grass/blackberry.
- For both the South Umpqua River and its tributaries, approximately 60% of riparian zones are dominated by treeless buffers and buffers that are one tree wide.
- Almost a third of tributaries are mostly exposed to direct sunlight.

Wetlands key findings³⁸

- Historical wetlands within the Lower South Umpqua Watershed contained mixed conifer and hardwood forests of various ages and sizes interspersed with wetland prairies and scrub/shrub wetlands.
- The most common wetland types found within the watershed are riverine wetlands confined to active channels and palustrine wetlands located within low-lying areas.
- Riverine wetlands within the Lower South Umpqua Watershed are often unvegetated.
- Many wetlands within the watershed are seasonal, and are mostly dry in summer months without persistent hydrologic sources. Seasonal wetland prairies benefit from wildfires that reduce competition from woody vegetation.

Riparian zones and wetlands action recommendations

- Where canopy cover is less than 50%, establish wide buffers of native trees (preferably conifers) and/or shrubs, depending upon local conditions. Priority areas are fish-bearing streams for which more than 50% canopy cover is possible.
- Identify riparian zones dominated by blackberries and convert these areas to native trees (preferably conifers) and/or shrubs, depending on local conditions.
- Investigate methods of controlling blackberries.
- Where riparian buffers are one tree wide or less, encourage buffer expansion by planting native trees (preferably conifers) and/or shrubs, depending on local conditions.
- Maintain riparian zones that are two or more trees wide and, along tributaries, provide more than 50% cover.
- Enhance riverine and palustrine wetlands through high-density planting and seeding in locations with appropriate conditions.
- Educate policy makers, landowners, and community members on the importance of maintaining wetlands for healthy watersheds, and their educational, recreational, and aesthetic values for the local community.

³⁸ Brad Livingston and Loren Waldron of Land and Water Environmental Services, Inc., contributed the wetlands key findings and action recommendations.

- Opportunities for wetland restoration are limited in urban areas due to the higher cost of land. Wetlands established in urban areas provide several benefits, and should be protected for the long term to maximize their potential.

3.3. *Water quality*

3.3.1. Stream beneficial uses and water quality impairments

The Oregon Water Resources Department (OWRD) has established a list of designated beneficial uses for surface waters, including streams, rivers, ponds, and lakes. Beneficial uses are based on human, fish, and wildlife activities associated with water. This assessment focuses on the designated beneficial uses for flowing water, i.e. streams and rivers. Table 3-5 lists all beneficial uses for streams and rivers within the Umpqua Basin.

Beneficial uses	
Public domestic water supply	Private domestic water supply
Industrial water supply	Irrigation
Livestock watering	Boating
Aesthetic quality	Anadromous fish passage
Commercial navigation and transportation	Resident fish and aquatic life
Salmonid fish spawning	Salmonid fish rearing
Wildlife and hunting	Fishing
Water contact recreation	Hydroelectric power

Table 3-5: Beneficial uses for surface water in the Umpqua Basin.

The beneficial uses of a stream determine its water quality standards. In a stream where “salmonid fish rearing” is a beneficial use, stream temperature is a concern because salmonids need cool water to survive. In a stream where people swim (a water contact recreation), the level of human disease-causing toxins or bacteria would be a concern.

The Oregon Department of Environmental Quality (ODEQ) has established water quality standards for the designated beneficial uses. These standards determine the acceptable levels or ranges for water quality standards, including temperature, dissolved oxygen, and pH. Water quality standards set by ODEQ are reviewed and updated every three years. ODEQ monitors streams and stream reaches throughout Oregon, and streams or reaches that are not within the standards are listed as “water quality impaired.”³⁹ The list of impaired streams is called the “303(d) list,” after section 303(d) of the Clean Water Act. For each stream on the 303(d) list, ODEQ is required to determine the total maximum daily load (TMDL) allowable for each parameter.⁴⁰ Streams can be de-listed once TMDL plans are complete, when monitoring shows that the stream is meeting water quality standards, or if evidence suggests that a 303(d) listing was in error.

³⁹ ODEQ can also use data collected by other agencies and organizations to evaluate water quality.

⁴⁰ Total maximum daily loads are limits on pollution developed when streams and other water bodies do not meet water quality standards. TMDL plans consider both human-related and natural pollution sources.

Table 3-6 shows the Lower South Umpqua Watershed streams and stream segments included in the 2002 draft 303(d) list that require TMDL plans.⁴¹ This table is not a comprehensive evaluation of all water quality concerns in the Lower South Umpqua Watershed. There are many streams and stream segments that have not been monitored by ODEQ, or for which additional information is needed to make a listing determination.

Stream	Parameter(s)	Year listed	Stream miles listed ⁴²	Season
Callahan Creek	Temperature	1998	0 – 6.2	Summer
South Umpqua River	Temperature	1998	0 – 15.9	Summer
		2002	0 – 15.9	Sept. 15 – May 31
			15.9 – 57.7	Sept. 15 – May 31
		1998	0 – 15.9 & 15.9 – 57.7	Winter/spring/fall
	Fecal coliform	1998	15.9 – 57.7	Summer
	Biological criteria	1998	0 – 15.9 & 15.9 – 57.7	Not listed
	Phosphorus	1998	0 – 15.9	Summer
	pH	1998	0 – 15.9	Summer/fall
			15.9 – 57.7	Summer
		2002	0 - 5	Winter/spring/fall
	Aquatic weeds or algae	1998	0 – 15.9 & 15.9 – 57.7	Summer
	Chlorine	1998	0 - 51	All year
	Arsenic	2002	0 – 15.9	All year
	Cadmium	2002	0 – 15.9	All year
	Dissolved oxygen	2002	5 – 15.9	Sept. 15 – May 31

Table 3-6: ODEQ water quality-limited streams in the Lower South Umpqua Watershed.

To evaluate water quality in the Lower South Umpqua Watershed, this assessment explores seven water quality parameters that may be of concern within the watershed. These parameters are temperature, pH, dissolved oxygen, nutrients, bacteria, sedimentation and turbidity, and toxics. ODEQ monitoring data was used and evaluated using ODEQ or OWEB water quality standards.

3.3.2. Temperature

Importance of stream temperature

Aquatic life is temperature-sensitive and requires water that is within certain temperature ranges. The Umpqua Basin provides important habitat for many cold-water species, including salmonids. When temperature exceeds tolerance levels, cold-water organisms

⁴¹ Streams that are water quality-limited for habitat modification and flow modification do not require TMDL plans. In the Lower South Umpqua Watershed, these streams are: Callahan Creek (habitat), Champagne Creek (flow), Roberts Creek (flow), and the South Umpqua River (habitat and flow).

⁴² Stream mile zero is the mouth of the stream.

such as salmonids become physically stressed and have difficulty obtaining enough oxygen.⁴³ Stressed fish are more susceptible to predation, disease, and competition by temperature tolerant species, which in the case of salmonids might be bass. For all aquatic life, prolonged exposure to temperatures outside tolerance ranges will cause death. Therefore, the beneficial uses affected by temperature are resident fish and aquatic life, and salmonid spawning and rearing.

Temperature limits vary depending upon species and life cycle stage. Salmonids are among the most sensitive fish, so ODEQ standards have been set based on salmonid temperature tolerance levels. From the time of spawning until fry emerge, 55°F (12.8°C) is the maximum temperature criterion. For all other life stages, the criterion is set at 64°F (17.8°C). Temperatures 77°F (25°C) or higher are considered lethal.

Stream temperature fluctuates by time of year and time of day. In general, water temperature during the winter and most of spring (between November and May) is well below both the 55°F and 64°F standards, and is not an issue. In the summer and fall months, water temperature can exceed the 64°F standard and cause streams to be water quality-limited. Over six miles of Callahan Creek and all of the South Umpqua River in the Lower South Umpqua Watershed are 303(d) listed for temperature at various times of year (see Table 3-6).⁴⁴

In 1999, the Umpqua Basin Watershed Council (UBWC) undertook a study on water temperature for the entire South Umpqua River sub-basin to determine temperature trends for the South Umpqua River and its tributaries, including streams in the Lower South Umpqua Watershed (the Smith report).⁴⁵ Continuously sampling sensors were placed at 119 locations within the South Umpqua River sub-basin, of which 11 were within the Lower South Umpqua Watershed. Sensors were placed at sites between June 24 and June 30, 1999, and removed between September 9 and September 15, 1999.

Figure 3-1 and Figure 3-2 show the seven-day moving average maximum temperatures for the South Umpqua River and tributaries within the Lower South Umpqua Watershed.⁴⁶ Table 3-7 has the number of days and percent of days for which average maximum temperature exceeds 64°F. Results of the study show that throughout the Lower South Umpqua Watershed, seasonal seven-day moving average maximum temperatures exceed water quality standards. Every monitoring day, the South Umpqua River had maximum temperatures exceeding the 64°F. During the study period, no sites were below 64°F every day.

⁴³ Cold water holds more oxygen than warm water; as water becomes warmer, the concentration of oxygen decreases.

⁴⁴ There are 102.2 total South Umpqua River miles that are 303(d) listed for temperature.

⁴⁵ Copies of this study “South Umpqua Watershed Temperature Study, 1999” (January, 2000) by Kent Smith are available at the UBWC office.

⁴⁶ The seven-day moving average maximum temperature is an average of the maximum temperatures of a given day, the three preceding days, and the three days that follow.

Throughout the South Umpqua fourth-field watershed study area, tributaries tend to be 10°F cooler than the South Umpqua River. Charting data with respect to distance shows that maximum temperatures of the coldest streams tend to increase 0.58°F per downstream mile. It also appears that many tributaries that are the same size have the potential to be at cooler temperatures.

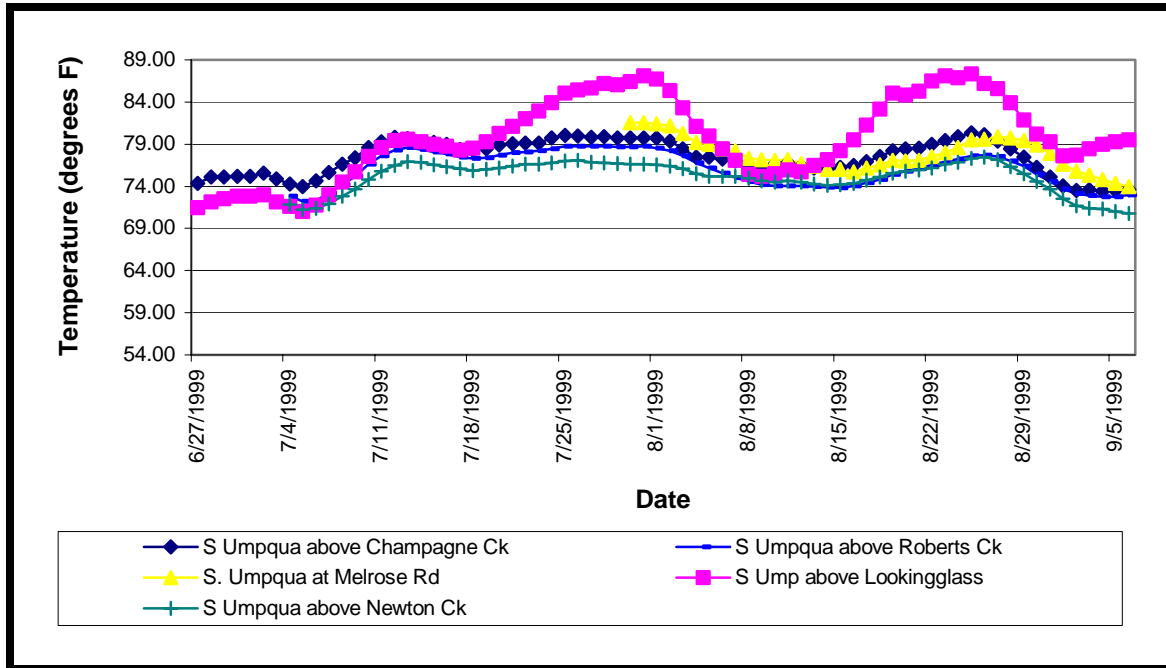


Figure 3-1: Seven-day moving average maximum temperature trends for the South Umpqua River within the Lower South Umpqua Watershed.

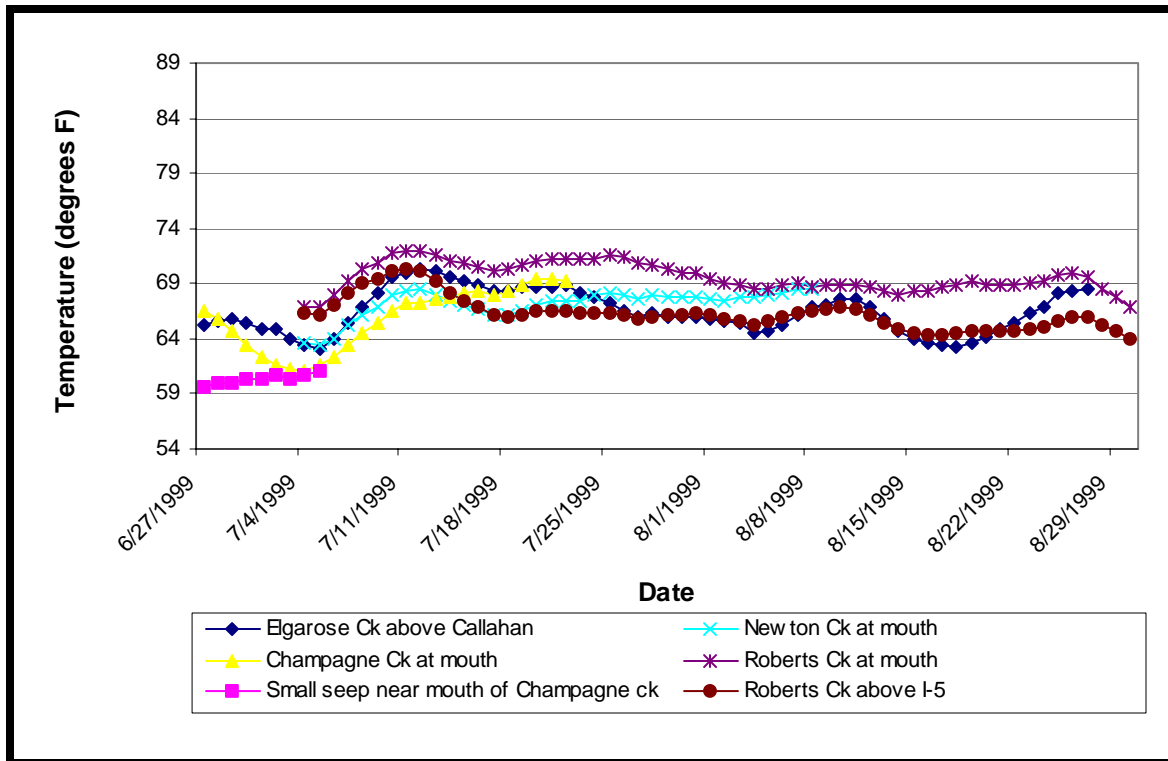


Figure 3-2: Seven-day moving average maximum temperature trends for Lower South Umpqua tributaries.

Sample Site	# days >64°F	# days monitored	% >64°F
South Umpqua above Champagne Creek	78	78	100%
South Umpqua at Melrose Road	45	45	100%
South Umpqua above Newton Creek	72	72	100%
South Umpqua above Roberts Creek	72	72	100%
South Umpqua above Lookingglass	79	79	100%
Roberts Creek at Mouth	66	72	92%
Newton Creek at mouth	38	42	90%
Roberts Creek above I-5	56	64	88%
Elgarose Creek above Callahan	51	68	75%
Champagne Creek at mouth	24	32	75%
Small seep near mouth of Champagne Creek	1	15	7%

Table 3-7: Number of days and percent of days for which seven-day average maximum temperatures exceeded 64°F in the Lower South Umpqua Watershed.

Influences on stream temperature

The ultimate source of stream heat is the sun, either by direct solar radiation or by ambient air and ground temperature around the stream, which are also a result of solar

energy.⁴⁷ Groundwater has the least exposure to solar energy, and therefore is at the coolest temperature (52°F in the Umpqua Basin). Since groundwater accounts for a large proportion of a stream's flow at the headwaters, streamflow is generally coolest at the headwaters. When groundwater enters a stream and become surface water, it is exposed to solar energy and will become warmer until it reaches equilibrium with ambient temperatures and direct solar radiation levels. As solar energy inputs change, such as at night, so do the ambient and stream temperatures.

If solar energy were the only influence on stream warming, it would be expected that stream temperature would increase at a smooth and steady rate until the stream was in equilibrium with solar energy inputs. However, stream temperature at a given location is influenced by two factors: the temperature of the upstream flow and local conditions. As upstream flow reaches a given stream location, factors such as stream morphology and riparian buffer conditions can affect warming rates. For example, the Smith report indicates that when upstream flow enters a reach that is highly exposed to direct solar radiation, the flow in that reach is usually warmer than would be expected from the upstream flow's temperature.

Localized groundwater influx and tributary flow can reduce stream temperatures. As stated earlier, groundwater in the Umpqua Basin is typically 52°F. When groundwater enters a stream, it mixes with the warmer upstream surface flow until temperature equilibrium is reached. As the proportion of groundwater increases, so will the cooling effect. Groundwater has the greatest influence on small and medium-sized streams. This is partially because groundwater constitutes a greater proportion of small streams' flow. As a result, cooler flow from small tributaries entering larger streams can, like groundwater influx, reduce stream temperature at that location.

In some cases, this may also occur when a tributary is practically dry. Evidence from the Smith report suggests that in some cases tributaries with gravel-dominated streambeds permit cooler subsurface water to pass into the main stem, even when the stream has no surface flow. Smith suggests that the lower reaches and mouths of small and medium-sized tributaries, and reaches within warm streams that have high groundwater influx and shade, may provide important shelter for fish during the summer months.

Management implications

An important implication of Smith's studies is that prevailing stream temperatures on small streams can be strongly influence by local conditions. Local stream temperature management restoration projects may be very effective in improving stream temperature conditions in many small streams in the Umpqua Basin.⁴⁸

3.3.3. Surface water pH

The hydrogen ion concentration of a liquid, which determines acidity or alkalinity, is expressed using pH. A logarithmic scale that ranges from one to 14 measures pH. On

⁴⁷ Friction adds a very small amount of heat to streams. Geothermal heat is a minor factor in the Umpqua Basin.

⁴⁸ From Kent Smith's "Thermal Transition in Small Streams under Low Flow Conditions," 2002.

this scale, a pH of seven is neutral, more than seven is alkaline, and less than seven is acidic.

The beneficial uses affected by high or low pH levels are resident fish and aquatic life, and water contact recreation. When pH levels are outside the stream's normal range, water can dissolve the protective mucous layer on aquatic organisms such as fish, amphibians, and mollusks. Without a healthy protective layer, fish and other animals become more susceptible to diseases. Also, pH affects nutrients, toxics, and metals within the stream. Changes in pH can alter the chemical form and affect availability of nutrients and toxic chemicals, which can harm resident aquatic life and be a human health risk. In mining areas, there is the potential for both low pH levels and the presence of heavy metals. This is an issue because metal ions, which can be toxic to humans, fish and wildlife, shift to more soluble forms in acidic water, and are more easily ingested.

Many physical and biological factors cause surface and groundwater pH to vary outside the normal pH range. The chemical composition of rocks and rainfall will influence pH. Respiration and photosynthesis are metabolic processes of aquatic organisms that change pH. Carbon dioxide (CO₂) is produced during respiration and used for photosynthesis. The level of dissolved CO₂ in a stream raises and lowers pH. Normally, there is a balance between instream metabolic processes and a natural chemical buffering system that prevents streams from becoming too acidic or alkaline from CO₂. However, stream inputs that increase or decrease respiration and photosynthesis by aquatic organisms can indirectly shift pH by changing CO₂ levels. For example, nitrogen and phosphorus from organic matter such as feces and urine, or from inorganic chemicals such as fertilizers, encourage algae growth in the summer and can result in algae "blooms." When a stream's algae population grows, so does the overall consumption of dissolved CO₂. As CO₂ levels drop, pH elevates and can reach detrimental levels.⁴⁹

In an attempt to differentiate between the natural variability of surface water pH and the changes caused by other nitrogen and phosphorus sources, the Oregon Water Quality Standards established a range of acceptable pH levels for river basins or for specific bodies of water. In the Umpqua Basin, the acceptable pH range is 6.5 to 8.5. When 10% or more of pH measurements from the same stream are outside of the 6.5 to 8.5 range, the stream is designated water quality-limited.

Between 1959 and 2001, the South Umpqua River within the Lower South Umpqua Watershed was sampled 589 times. Of these samples, 84 (14.3%) were outside the 6.5 to 8.5 range. Figure 3-3 shows the pH range for samples taken from the mouth to stream mile 15.9 (the mouth of Roberts Creek) from June 1 to October 31. Fifty-seven out of 119 samples (47.9%) exceeded water quality standards.⁵⁰ Within the Lower South Umpqua Watershed, all of the South Umpqua River is 303(d) listed for pH during the

⁴⁹ Increased nutrient levels in the winter have a smaller effect on pH because cold temperatures inhibit algae growth.

⁵⁰ Data are from ODEQ's Laboratory Analytical Storage and Retrieval (LASAR) database. All ODEQ data are available via the website www.deq.state.or.us. Select "water quality" and "Laboratory Analytical Storage and Retrieval Database – Monitoring Data."

summer.⁵¹ Other portions are listed during the winter, spring, and fall (see Table 3-6 on page 74).

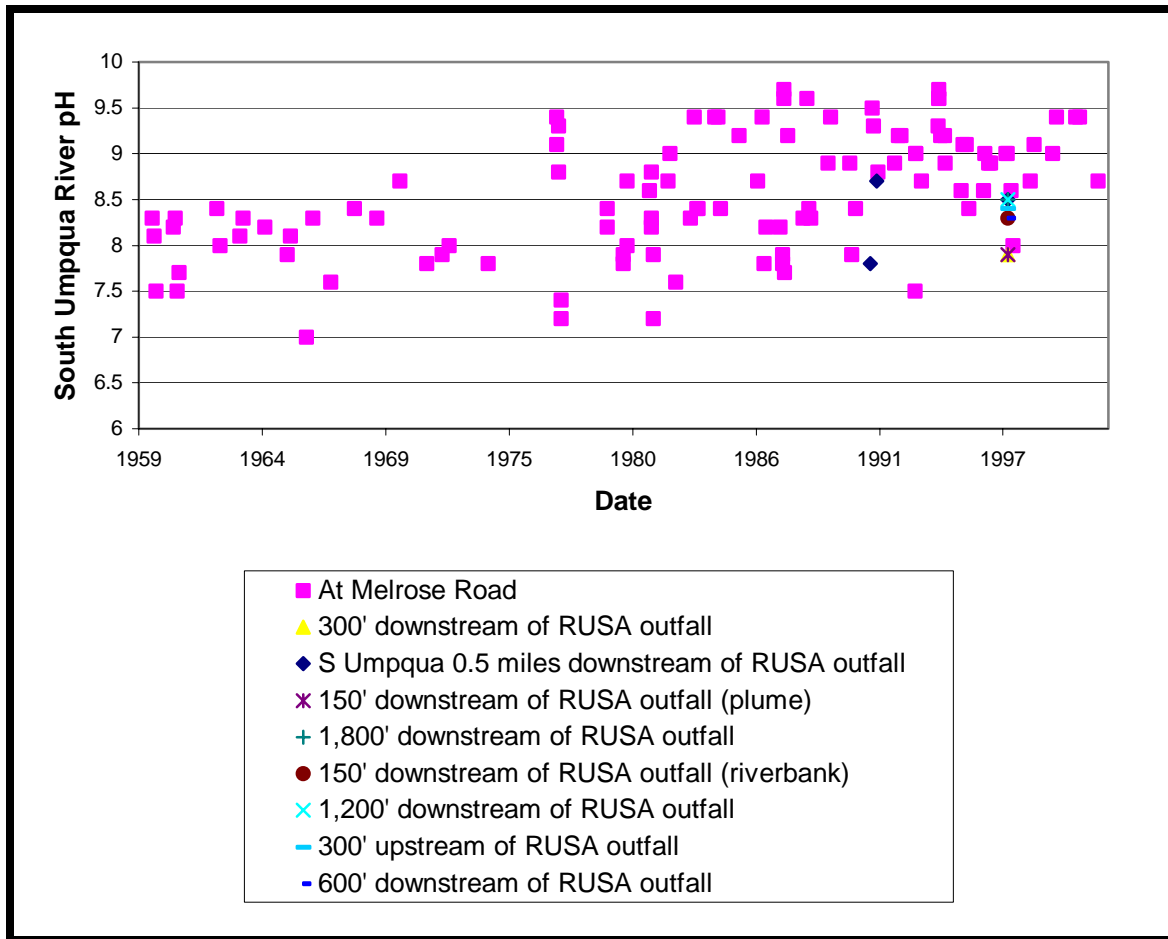


Figure 3-3: pH levels for monitoring sites in the South Umpqua River from stream mile zero to 15.9 between June 1 and October 31.⁵²

3.3.4. Dissolved oxygen

In the Umpqua Basin, cold-water aquatic organisms are adapted to waters with high amounts of dissolved oxygen. Salmonid eggs and smolts are especially sensitive to dissolved oxygen levels. If levels drop too low for even a short period of time, eggs, smolts, and other aquatic organisms will die. Therefore, the beneficial uses most affected by dissolved oxygen are resident fish and aquatic life, salmonid fish spawning, and salmonid fish rearing.

The amount of oxygen that is dissolved in water will vary depending upon temperature, barometric pressure, flow, and time of day. Cold water dissolves more oxygen than warm water. As barometric pressure increases, so does the amount of oxygen that can

⁵¹ There are at total of 102.2 South Umpqua River miles 303(d) listed for pH.

⁵² RUSA is the Roseburg Urban Sanitary Authority.

dissolve in water. Flowing water has more dissolved oxygen than still water.⁵³ Aquatic organisms produce oxygen through photosynthesis and use oxygen during respiration. As a result, dissolved oxygen levels tend to be highest in the afternoon when algal photosynthesis is at a peak, and lowest before dawn after organisms have used oxygen for respiration.

Since oxygen content varies depending on many factors, Oregon Water Quality Standards have many dissolved oxygen criteria. The standards specify oxygen content during different stages of salmonid life and for gravel beds. Standards change based on differences in elevation and stream temperature. During months when salmon are spawning, 11 mg/l is the dissolved oxygen standard for the South Umpqua River. For the rest of the year, the standard is eight mg/l.

From September 15 to May 31, the South Umpqua River is 303(d) listed for dissolved oxygen from river mile five to 15.9 (the confluence with Roberts Creek). Figure 3-4 shows the dissolved oxygen content from 1956 through 2001 at three South Umpqua River sampling sites within the Lower South Umpqua Watershed. Out of 408 samples taken between September and May, 159 (39%) were less than 11 mg/l.⁵⁴

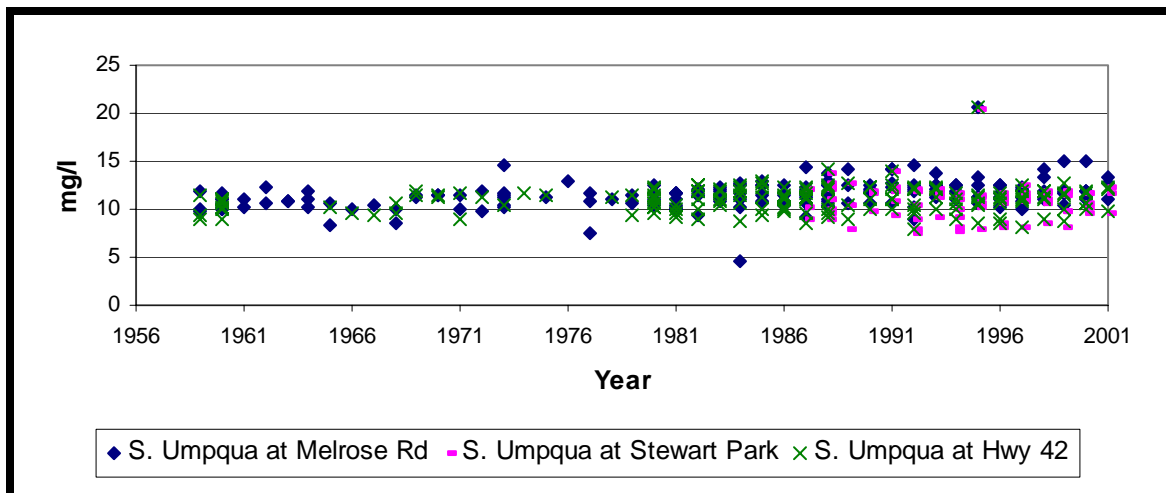


Figure 3-4: Dissolved oxygen levels for the South Umpqua River from May through September.

3.3.5. Nutrients

There are many sources of phosphorus and nitrate in streams. Aquatic organisms produce nutrient-rich wastes. Decomposition of organic material also adds nutrients to the stream. Industrial and home fertilizers, wastewater treatment plant effluent, and fecal matter from wildlife, domestic animals, and septic systems, can increase stream nutrient levels.

⁵³ As water churns and moves, it makes contact with atmospheric oxygen, some of which dissolves in the water until the stream is saturated.

⁵⁴ Data are from ODEQ's Laboratory Analytical Storage and Retrieval (LASAR) database.

The beneficial uses affected by nutrients are aesthetics or “uses identified under related parameters.”⁵⁵ This means that a stream may be considered water quality-limited for nutrients if nutrient levels adversely affect related parameters, such as dissolved oxygen, that then negatively impact one or more beneficial uses, such as resident fish and aquatic life. As stated earlier, high nutrient levels encourage the growth of algae and aquatic plants. Excessive algal and vegetative growth can result in little or no dissolved oxygen, and interfere with water contact recreation such as swimming. Also, certain algae types produce by-products that are toxic to humans, wildlife, and livestock, as seen in Diamond Lake in the summer of 2002.⁵⁶

Currently, there are no Umpqua Basin-based ODEQ values for acceptable stream nutrient levels. Therefore, this assessment used the OWEB standards for evaluating nutrient levels in the watersheds. The Oregon Watershed Enhancement Board recommends limits of 0.05 mg/l for total phosphorus, and 0.3 mg/l for total nitrate (including nitrites and nitrates).

Figure 3-5 show nitrate levels for South Umpqua River monitoring sites within the Lower South Umpqua Watershed from 1976 through 2000. Nitrate levels have been low for most sites, except the South Umpqua River at Melrose Road. At this site, 20 out of 175 samples (11%) exceeded the 0.3 mg/l recommended standard. All sites monitored for phosphorus had samples exceeding the 0.05 mg/l recommended standard.⁵⁷

Table 3-8 shows the number and percent of Lower South Umpqua Watershed sites that were sampled more than once and exceeded OWEB’s recommended phosphorus standard. All of these monitoring sites had a least 25% of samples exceeding 0.05 mg/l. Therefore, the South Umpqua River is 303(d) listed for phosphorus from the mouth to stream mile 15.9 (the confluence with Roberts Creek).

⁵⁵ From ODEQ’s *Oregon’s Approved 1998 303(d) Decision Matrix*.

⁵⁶ Diamond Lake is within the Umpqua National Forest in the extreme eastern portion of the Umpqua Basin.

⁵⁷ Data are from ODEQ’s Laboratory Analytical Storage and Retrieval (LASAR) database.

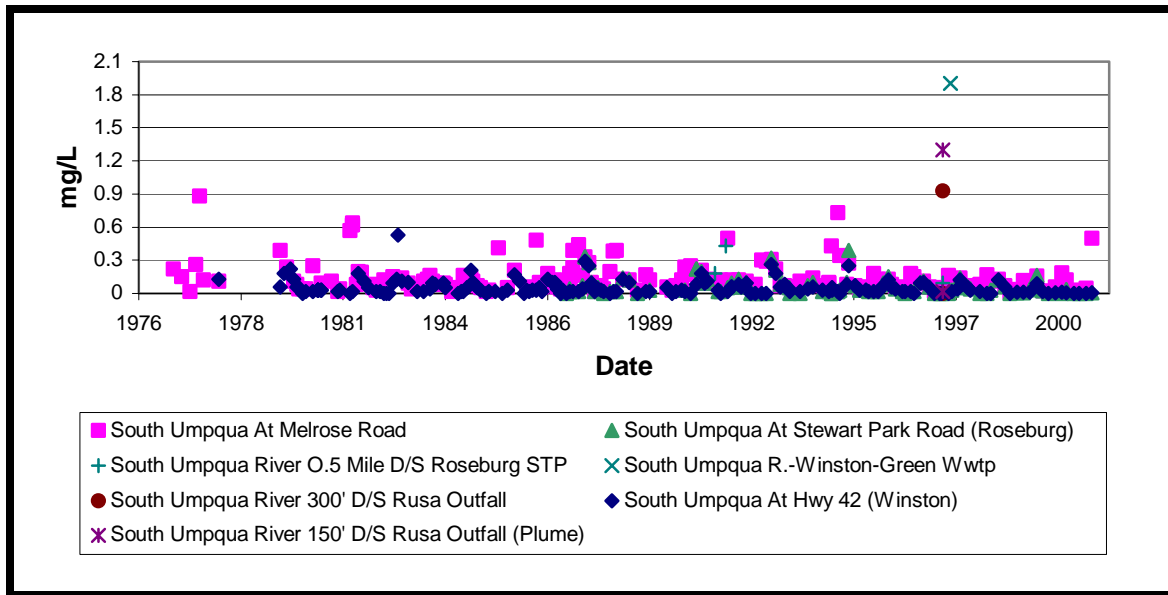


Figure 3-5: Nitrate/nitrite levels for monitoring sites in the Lower South Umpqua Watershed.

South Umpqua River monitoring location	Total # samples	# samples >0.05 mg/l	% of samples
Hwy 42 (Winston)	172	43	25%
Stewart Park Road (Roseburg)	104	28	27%
Melrose Road	174	149	86%
Winston/Green Wastewater treatment plant	8	5	63%
300 feet downstream from RUSA outfall ⁵⁸	3	3	100%

Table 3-8: Number and percent of Lower South Umpqua Watershed phosphorus samples exceeding 0.05 mg/l.

3.3.6. Bacteria

Bacteria are present in all surface water. In general, resident bacteria are not harmful to the overall aquatic environment or to most human uses. However, ingestion of fecal bacteria such as *Escherichia coli* (*E. coli*) can cause serious illness or death in humans. The presence of fecal bacteria indicates a potential vector for other serious human diseases, such as cholera and typhoid. Water contact recreation is the beneficial use most affected by bacteria. Private and public drinking water supplies are not affected because water filtration systems are able to remove harmful microorganisms.

There are many possible sources of *E. coli* and other fecal bacteria in water. These can be divided into “point sources” and “non-point sources.” The legal definition of a point

⁵⁸ RUSA is the Roseburg Urban Sanitary Authority.

source is one for which there is an operational permit, such as the outlet for a wastewater treatment plant. Stream contamination can also come from non-point sources, or ones for which there is no operational permit, such as animal waste. Although septic systems require an installation permit, there is no annual operational permit. These sources are considered non-point even if it is clear that, for example, a single failing septic field adjacent to a stream is causing high fecal bacteria levels. Upland areas with concentrated fecal waste can be non-point sources that contribute significantly to bacteria levels because bacteria are washed down into streams during rain events.

According to the Oregon Water Quality Standards, a stream is considered water quality-limited for bacteria when one of two events occurs: 1) 10% of two or more samples taken from the same stream have *E. coli* concentrations exceeding 406 bacteria per 100 ml of water; and 2) the average *E. coli* concentration of five samples taken within a 30-day period exceeds 126 bacteria per 100 ml of water.

Figure 3-6 shows the most probable number (MPN) of bacteria taken from various locations along the South Umpqua River within the Lower South Umpqua Watershed. Twenty out of 130 samples (15%) exceed 126 bacteria per 100 ml. Five samples (3.8%) exceed 406 bacteria per 100 ml. The South Umpqua River from the mouth to stream mile 15.9 (the confluence with Roberts Creek) is 303(d) listed for fecal coliform in the fall, winter, and spring. From stream mile 15.9 to 57.7 (the confluence with Days Creek), the South Umpqua River is 303(d) listed all year.⁵⁹ Additional monitoring is necessary to determine if Lower South Umpqua Watershed tributaries have water quality-limiting levels of bacteria.

⁵⁹ Data are from ODEQ's Laboratory Analytical Storage and Retrieval (LASAR) database.

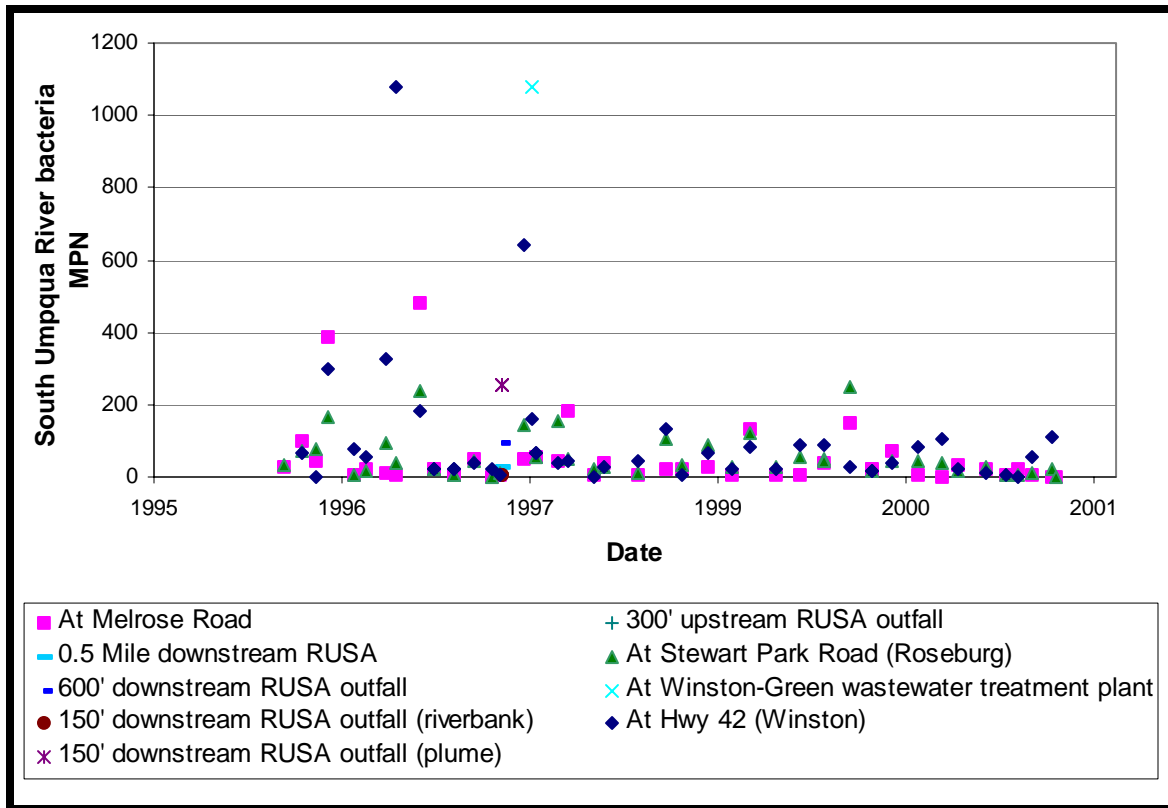


Figure 3-6: South Umpqua River bacteria levels within the Lower South Umpqua Watershed.

3.3.7. Sedimentation and turbidity

Sediment is any organic or inorganic material that enters the stream and settles to the bottom. When considering water quality, this assessment is specifically referring to very fine particles of organic or inorganic material that have the potential of forming streambed “sludge.” The beneficial uses affected by sedimentation are resident fish and aquatic life, and salmonid fish spawning and rearing. Salmonids need gravel beds for spawning. Eggs are laid in a gravel-covered nest called a “redd.” Water is able to circulate through the gravel, bringing oxygen to the eggs. The sludge layer resulting from stream sedimentation does not allow water circulation through redds and will suffocate salmonid eggs. Although there are many aquatic organisms that require gravel beds, others, such as the larvae of the Pacific and western brook lamprey, thrive in sludgy streams.

Turbidity is closely related to sediment because it is a measurement of water clarity. In many cases, high turbidity indicates a large amount of suspended sediment in a stream.⁶⁰ Small particles such as silt and clay will stay suspended in solution for the longest amount of time. Therefore, areas with soils comprised of silt and clay are more likely to be turbid than streams in areas with coarser soil types. Also, turbidity levels can rise during a storm. This is because rapidly moving water has greater energy than slower

⁶⁰ Suspended particles are not chemically mixed with water and will eventually settle to the stream bottom.

water. During storms, upland material is washed into the stream from surface flow, which adds sediment to the system.

The beneficial uses affected by turbidity are resident fish and aquatic life, public and private domestic water supply, and aesthetic quality. As turbidity increases, it becomes more difficult for sight-feeding aquatic organisms to see, impacting their ability to search for food. High levels of suspended sediment can clog water filters and the respiratory structures in fish and other aquatic life. According to the Oregon Watershed Assessment Manual, suspended sediment is a carrier of other pollutants, such as bacteria and toxins, which is a concern for water quality in general. Finally, clear water is simply more pleasant than cloudy water for outdoor recreation and enjoyment.

Sediment limits water quality when beneficial uses are impaired. ODEQ determines impairment by monitoring changes in aquatic communities (especially macroinvertebrates, such as insects), changes in fish populations, or by using information from non-ODEQ documents that use standardized protocols for evaluating aquatic habitat and fish population data. Currently, ODEQ monitors streams for total suspended solids, which indicates sedimentation. At the writing of this assessment, neither ODEQ nor OWEB has established criteria for these data. There are currently no streams in the Lower South Umpqua Watershed 303(d) listed for sedimentation. More data are needed to determine if sedimentation is a problem in the watershed.

Turbidity is measured by passing a light beam through a water sample. As suspended sediment increases, less light penetrates the water. Turbidity is recorded in NTUs (nephelometric turbidity units), and high NTU values reflect high turbidity. According to the Oregon Water Quality Standards, turbidity is water quality limiting when NTU levels have increased by more than 10% due to an on-going operation or activity, such as dam releases or irrigation. To date, there are no streams in the Lower South Umpqua Watershed that are 303(d) listed for turbidity.

The Oregon Watershed Assessment Manual recommends using 50 NTUs as the turbidity evaluation criteria for watershed assessments. At this level, turbidity interferes with sight-feeding aquatic organisms and provides an indication of the biological effect of suspended sediment. Seven out of 454 (1.5%) South Umpqua River turbidity samples exceeded 50 NTUs.⁶¹ Additional monitoring is necessary to determine if turbidity levels are of concern in tributaries.

Sediment delivery processes⁶²

Sediment delivery to streams from adjacent floodplains and slopes is a natural process for watersheds. The amount of sediment delivered to the streams will vary over time, with the bulk of sediment delivered during high flows. Streams have an inherent ability to dissipate energy and carry sediments. Aquatic organisms within these systems have also adapted to deal with these natural sediment loads. Problems arise when sediment

⁶¹ Data are from ODEQ's Laboratory Analytical Storage and Retrieval (LASAR) database.

⁶² Jenny Allen, Tim Grubert, and John Runyon of BioSystems, Inc., contributed the introductory text for the sediment delivery processes section.

delivered to the streams exceed natural levels. For instance, human activity, such as runoff from towns, can significantly inflate natural sediment loads within stream networks. If erosion and runoff increase within the watershed, sediments also increase and then overwhelm a stream's ability to transport the additional build up. In turn, the sediments may decrease the quality of fish habitat by raising the elevation of the streambed, filling in pools, burying cobbles, boulders, and logs, and contributing to accelerated erosion of stream banks through the formation or addition of gravel bars. This changes the dynamics of the stream and its ability to dissipate energy and has a domino effect by causing more erosion downstream.

Distinguishing between human-induced erosion and a stream's natural rate of erosion can prove challenging due to the variable nature of natural erosion patterns in addition to the timing and spatial pattern of human-induced erosion. In general, aquatic organisms will be affected by an increase in sediment for reasons previously mentioned. Increased human use of the watershed may be apparent during times of high sediment loads, causing increased turbidity and accelerated rates of bank erosion within normally stable streams. These factors are indicators of increased sediment moving through the system. Furthermore, human caused changes within the watershed can often be narrowed to a few locations that experience high-use or that pass through developed areas. The Oregon Watershed Assessment Manual is a valuable resource for determining such problem areas within the watershed. It provides the steps necessary to inventory and address increased sediment loads and erosion.

Without further field verification and analysis using GIS, a more in-depth and detailed report on sediment processes within the assessment area is beyond the scope of this screening-level assessment. This assessment reviews five potential sources of stream sedimentation and turbidity in the watershed: roads and culverts, debris flow potential, soil type, urban drainage, and burns.

Roads and culverts

As is the case in many watersheds, sediment delivery from dirt and gravel roads is a leading cause of increased sediment in stream systems. Road sediment production and delivery involves many factors and processes such as road surface type, ditch infeed lengths, proximity to nearest stream channel, condition of road, and level and type of use the road system receives. Since complete road data for the watershed are not available, specific values for sediment delivery from the road system are not included in this assessment. Rather, this assessment looks at the current state of road types, road to stream proximity and slope, and culverts.⁶³

Roads can be divided into two types: surfaced and unsurfaced. Surfaced roads are ones that have been paved or rocked. Unsurfaced roads are dirt roads. Unsurfaced roads are much more likely to erode and fail than surfaced roads. There are 674.8 miles of roads in the Lower South Umpqua Watershed. These are broken into nine classes (see Table 3-9).

⁶³ Tim Grubert and John Runyon of BioSystems, Inc., contributed this paragraph.

Surface type	Road miles	% total
Surfaced		
• Federal roads (paved)	52.1	7.7%
• State roads (paved)	10.4	1.5%
• County/other (paved)	313.8	46.5%
• Major gravel	172.7	25.6%
• Minor gravel or spur	95.0	14.1%
Total surfaced	644.0	95.4%
Unsurfaced		
• Major dirt road	15.4	2.3%
• Minor dirt road	5.4	0.8%
Total unsurfaced	20.8	3.1%
Other		
• Unknown	2.8	0.4%
• Closed	7.2	1.1%
Total other	10.0	1.5%

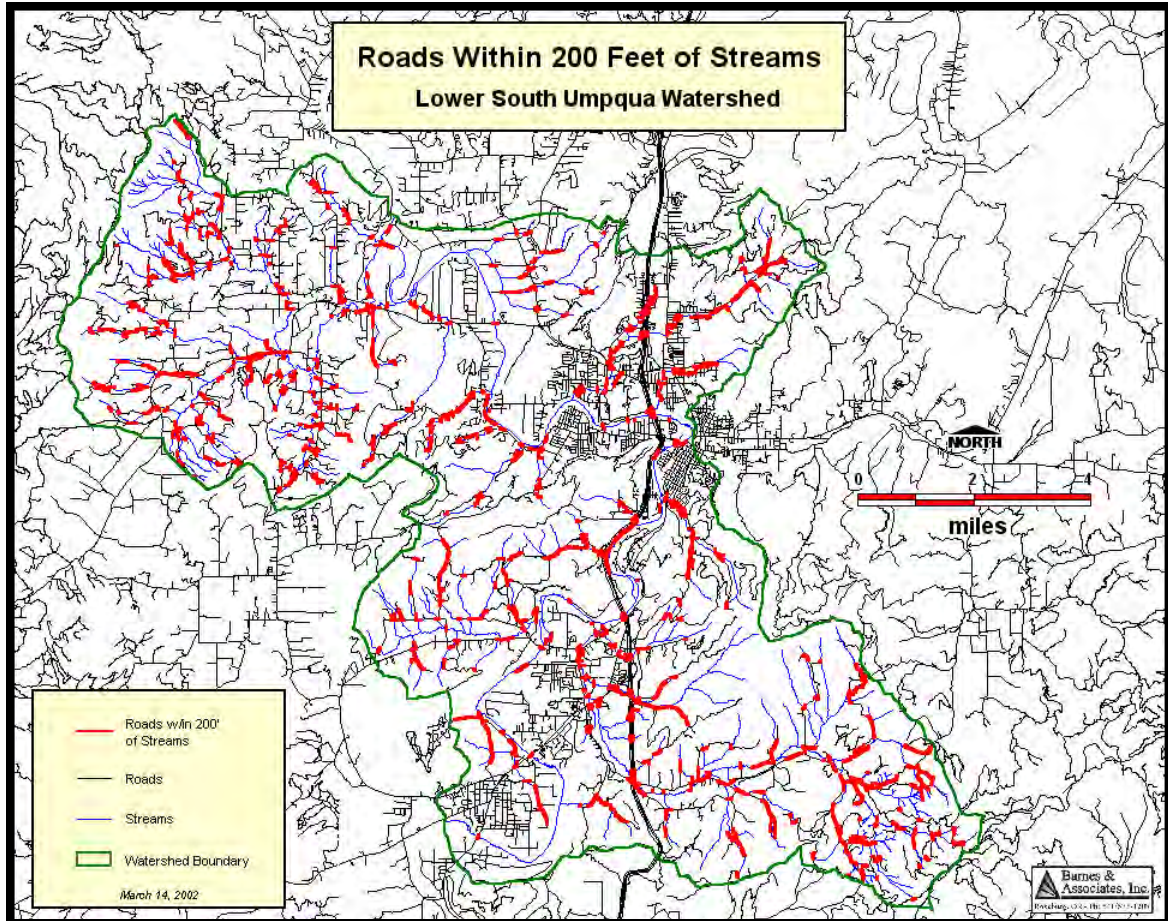
Table 3-9: Miles and percent of Lower South Umpqua Watershed roads by class.

The closer a road is to a stream, the greater the likelihood that road-related runoff contributes to sedimentation. In the Lower South Umpqua Watershed, there are 95 miles of roads (14% of 675 total miles) within 200 feet of streams (see Map 3-7). Of these, approximately 89 miles (94%) are surfaced roads, three miles (3%) are unsurfaced roads, and three miles (3%) are unknown or closed.

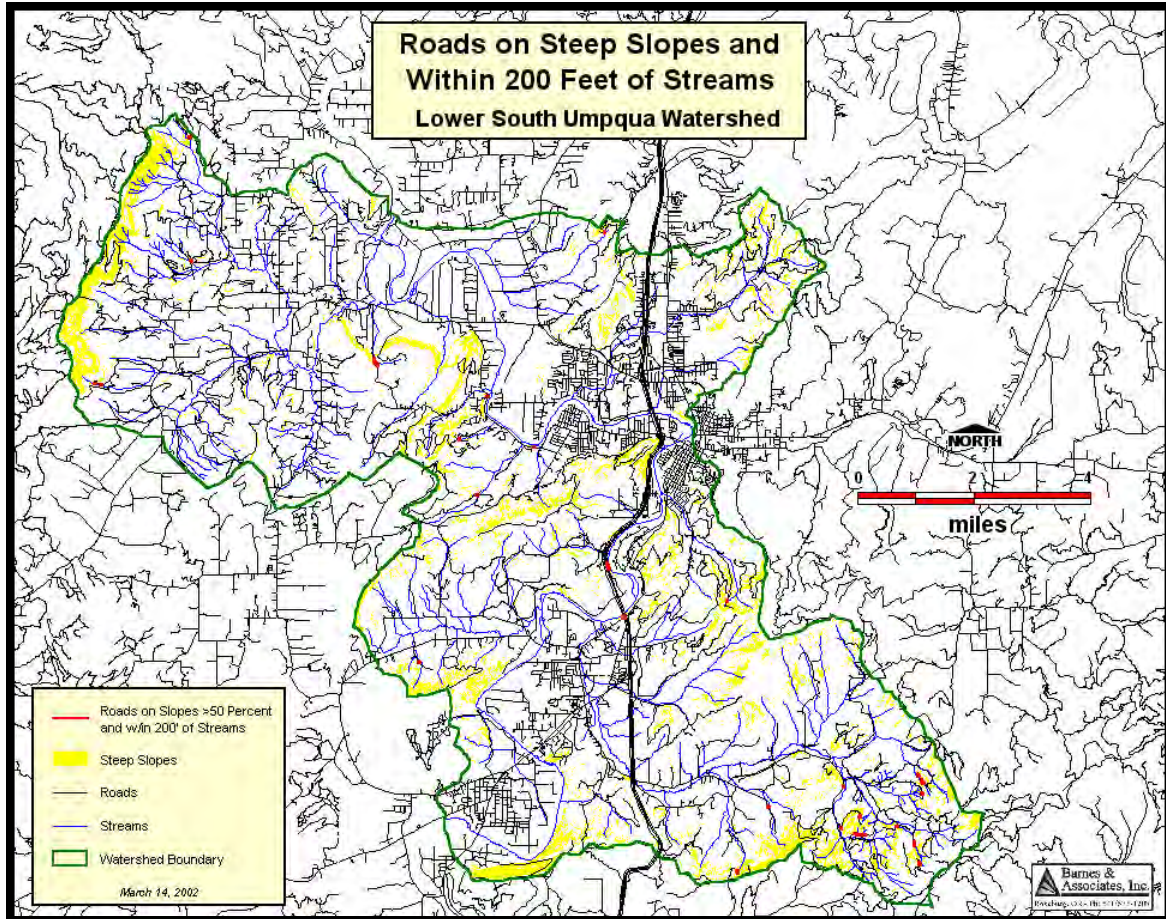
Roads on steep slopes have a greater potential for erosion and/or failure than roads on level ground. There are approximately 1.1 miles of roads (0.2% of 675 total miles) located on a 50% or greater slope and within 200 feet of a stream (see Map 3-8). Of these roads on steep slopes, 0.65 miles (61.3%) are surfaced, 0.1 miles (9.4%) are unsurfaced, and 0.3 miles (28.3%) are closed or unknown. An analysis of road conditions near streams is necessary to determine how much stream sedimentation is attributable to road conditions.

Like roads, culverts can contribute to stream sedimentation when they are failing. Culverts often fail when the pipe is too narrow to accommodate high stream flows, or when the pipe is placed too high or too low in relation to the surface of a stream. In the latter cases, the amount of flow overwhelms the culvert's drainage capacity, and water floods around and over the culvert, eroding the culvert fill, road, and streambank. There are at least 163 stream crossings in the Lower South Umpqua Watershed. At this time, it is unknown how many of these crossing are culverts and how many culverts are failing.⁶⁴

⁶⁴ See section 3.1.2 for a discussion of current culvert identification and restoration efforts in the Umpqua Basin.



Map 3-7: Locations of Lower South Umpqua Watershed roads within 200 feet of a stream.



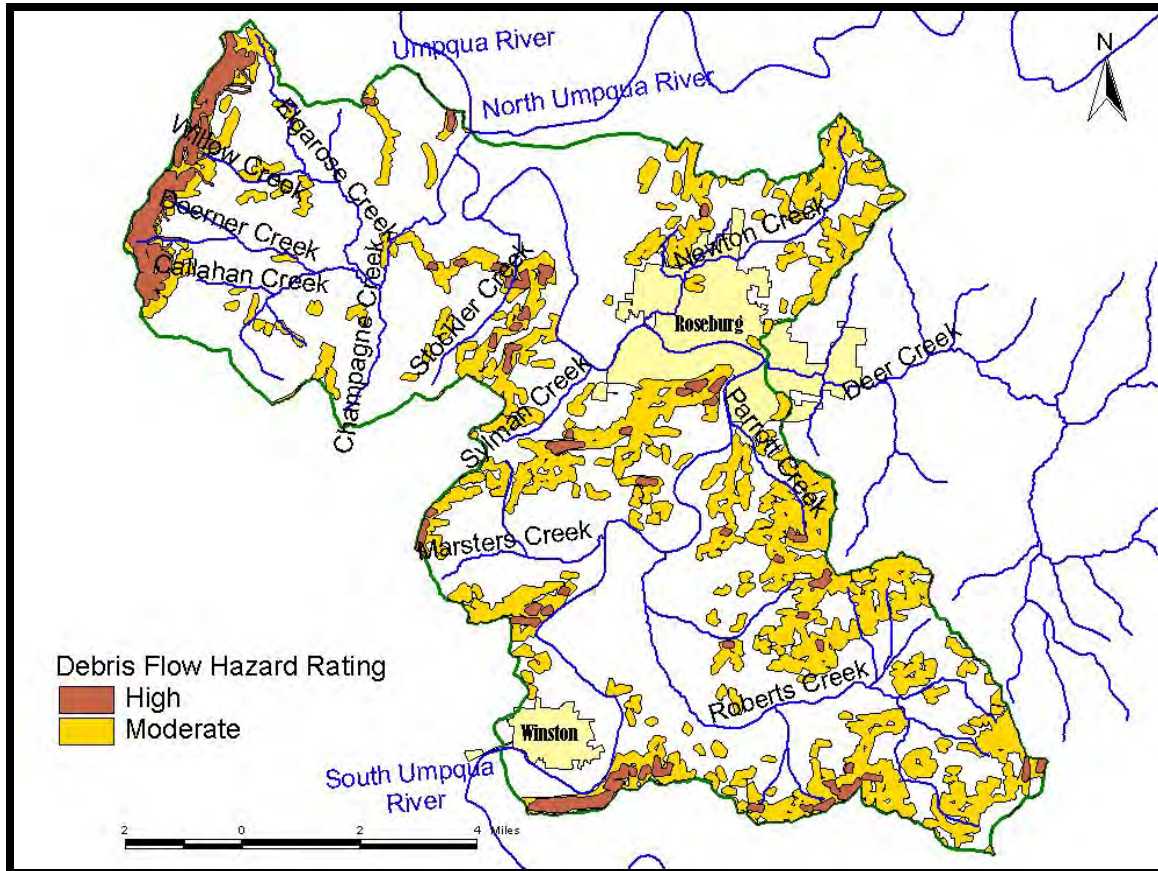
Map 3-8: Locations of Lower South Umpqua Watershed roads within 200 feet of a stream and on slopes that are greater than 50%.

Slope instability

In 2000, the Oregon Department of Forestry (ODF) published a debris flow hazard study that is geographically categorized by counties. These data sets were developed by evaluating slope steepness, geologic units, stream channel confinement, fan shaped geomorphology, historical information on debris flow occurrence, and the “ODF Storm Impacts and Landslides of 1996” study. This can be a useful tool for the watershed council to use when evaluating sediment delivery to streams and determining areas at risk for landslides and mass failures. However, this is a coarse scale study that was primarily designed to assist land managers in locating areas that are naturally prone to debris flows. This model should not be used to make decisions without further investigation of the areas mapped as high risk. The debris flow hazard model for the Lower South Umpqua Watershed is shown in Map 3-9. An organization known as Nature of the Northwest is in the process of publishing a similar landslide study that is more refined. The new study has incorporated more variables into the model and refined the scale to make it a more realistic management tool with which land managers can make decisions.⁶⁵

⁶⁵ Jenny Allen, Tim Grubert, and John Runyon of BioSystems, Inc., contributed this paragraph.

Of the 67,329 acres within the Lower South Umpqua Watershed, 16,252 acres (24%) are considered moderate for debris flow potential, and 2,661 acres (4.0%) are classified as high. There are no areas within the watershed classified as having extreme debris flow potential. Of the 100.1 miles of streams included in Map 3-9, approximately seven miles (7%) are within areas of moderate landslide potential, and one mile (1%) is within an area of high landslide potential. Although landslides can contribute significant amounts of stream sediment, they are periodic events and are difficult to predict. At this time, it is unknown how much stream sediment is a result of landslides in the Lower South Umpqua Watershed.



Map 3-9: Debris flow potential within the Lower South Umpqua Watershed.

Hydrologic soil groups⁶⁶

The Natural Resources Conservation Service (NRCS) classifies soil into four hydrologic soil groups that are based on the soil's runoff potential given similar storm and groundcover conditions. Soil texture, depth to water table, structure, and permeability influence the soil's runoff potential. The hydrologic soil groups are categorized as A through D, with A having the lowest runoff potential and D having the highest runoff potential. Please refer to Table 3-10 for more details about the soil groups.

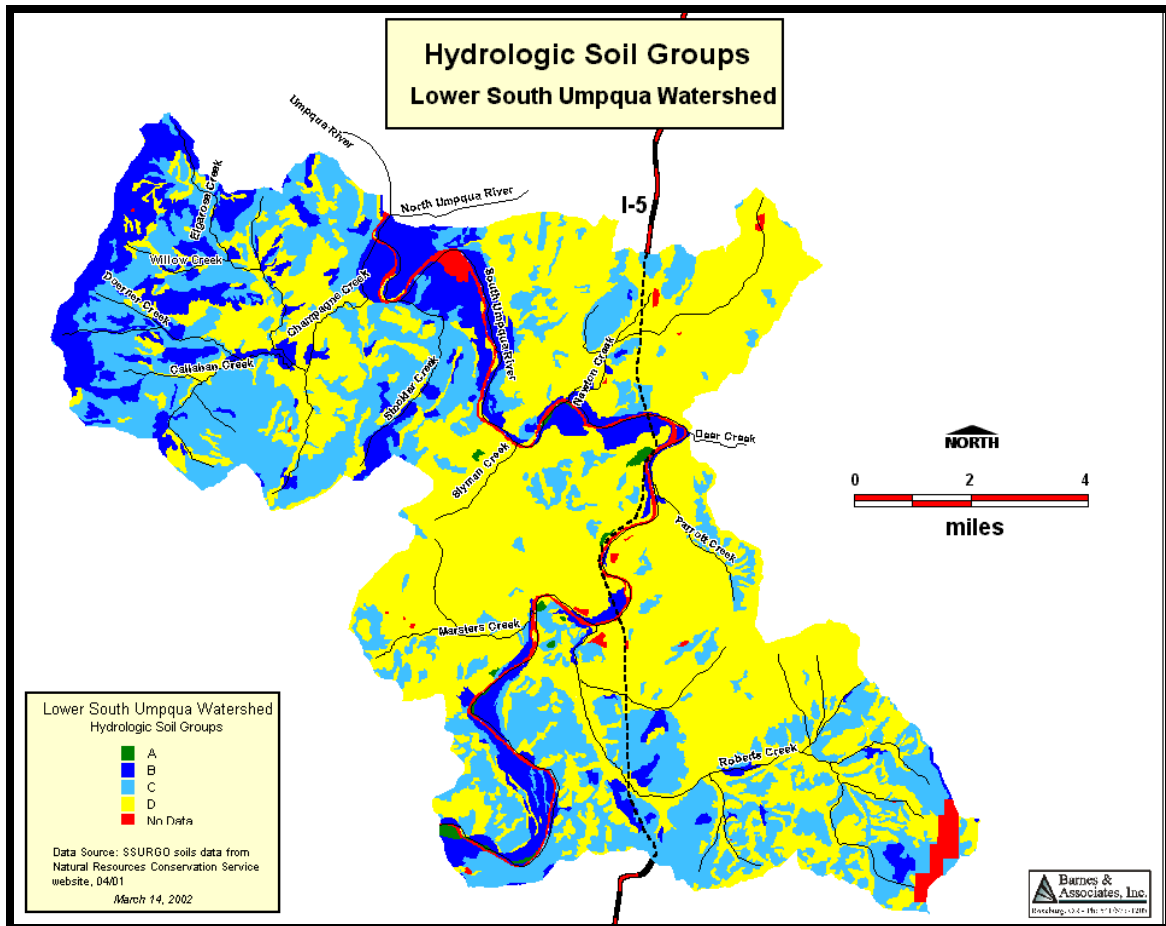
⁶⁶ Jenny Allen, Tim Grubert, and John Runyon of BioSystems, Inc., contributed this subsection.

HSG	Soil Description
A	These soils can be sand, loamy sand, or sandy loam. These soils have low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sands or gravels and have a high rate of water transmission.
B	This soil type is silt loam or loam. These soils have moderate infiltration rates when thoroughly wetted and consist chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures.
C	This soil type is sandy clay loam. These soils have a low infiltration rate when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately-fine to fine structure.
D	This soil type is clay loam, silty clay loam, sandy clay, silty clay, or clay. This hydrologic soil group has the highest runoff potential. These soils have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface and shallow soils over nearly impervious material.

Table 3-10: Hydrologic soil groups.⁶⁷

The Lower South Umpqua Watershed includes soil from all of the hydrologic soil groups (see Map 3-10). However, 2% to 5% of the soils in the watershed are currently unclassified. Approximately 1% of the area is categorized as having type A soils. These soils are adjacent to the main stem of the South Umpqua River, scattered in small patches south of Deer Creek to the southern watershed boundary. Group B soils comprise 10% to 15% of the watershed and can be found throughout the region. However, they are concentrated in the watershed's upper northwest portion and along the main stem of the South Umpqua; beginning at the South Umpqua River's junction with the Umpqua River and continuing downstream to the tributary junction with Deer Creek. Group B soils are also found adjacent to the stream from the tributary junction of Marsters Creek south to the southern watershed boundary. These soils are found atop the coastal marine and deep alluvial deposits of the Coast Range and Klamath Mountain provinces. Group C soils cover approximately 20% to 25% of the watershed and are predominately located in the watershed's midsection. These soils have formed atop marine, alluvial, and sedimentary deposits. Group D soils comprise more than half of the watershed. As noted in Table 3-10, these soils have a low infiltration rate and high runoff potential. This group is concentrated in the mid- to lower portions of the watershed, adjacent to the lower gradient streams.

⁶⁷ Source: SSURGO soils data from the NRCS website.



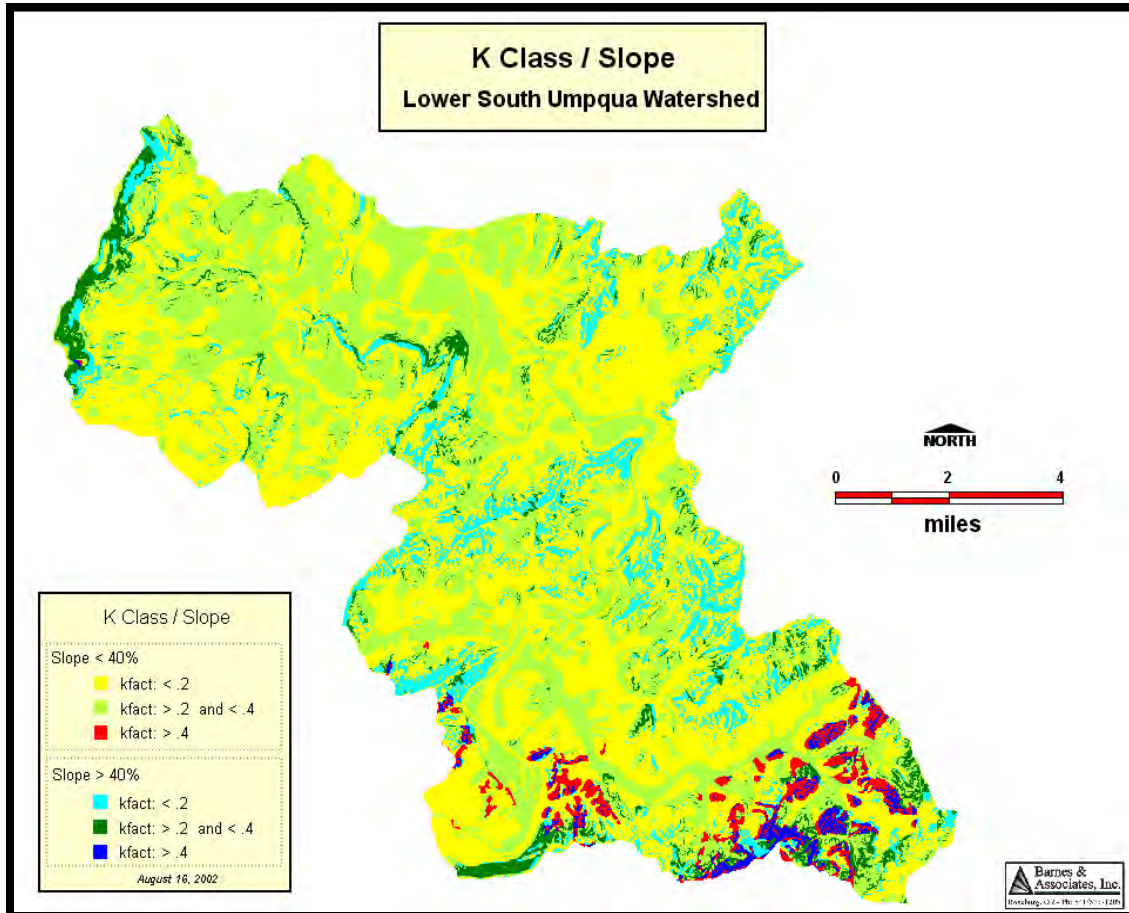
Map 3-10: Hydrologic soils map of the Lower South Umpqua Watershed.

Soil K-factor⁶⁸

Erodibility generally refers to a soil's susceptibility to the erosive force of water running over land and is expressed as a value known as the K-factor. The two major factors that define K-factor are the soil's infiltration capacity and its structural stability. Major influences of a soil's infiltration capacity and structural stability include characteristics such as: the amount of organic matter, soil texture, the kind and amount of swelling clays, soil depth, the presence of impervious soil layers, and the tendency of the soil to crust. K-factor is generally expressed as a value between zero and 0.6. Soils with a K-factor of less than 0.2 are classified as well-drained, sandy soils with high infiltration rates; soils with a K-factor in the range of 0.2 to 0.4 are considered to have moderate infiltration capacities; and K-factors greater than 0.4 are assigned to soils with low infiltration rates and a high susceptibility to erosion. Slope also influences erosion. Since steep slopes are more prone to the erosive force of water, slopes can adversely affect soils that have moderate infiltration rates and levels of erosion potential. On steep slopes, areas with moderate K-factors may still be prone to a high risk of erosion. In general, the steeper the slope, the more likely it is to fail; however, some geologic material is more stable than

⁶⁸ Jenny Allen, Tim Grubert, and John Runyon of BioSystems, Inc., contributed this subsection.

others on varying gradients. For instance, tuffs, breccias, and sediments such as marine deposits, are more prone to erosive forces than harder material such as granite, which is better able to support steep slopes.⁶⁹ Map 3-11 illustrates the K-factor and slope distribution of the area.



Map 3-11: K-class distribution within the Lower South Umpqua Watershed.

Much of the watershed has been categorized as having a low to moderate K-factor with slopes less than 40%. Roughly 10% to 15% of the area is mapped on slopes greater than 40%. Of this area, about 10% has been categorized as having a low K-factor of less than 0.2 with the remainder having a moderate K-factor that ranges between 0.2 and 0.4. As mentioned above, it is important to pay attention to the portions of the watershed that have been classified as having a K-factor greater than 0.2 and less than 0.4 on slopes greater than 40%. These are found to some degree throughout the watershed, but are concentrated in the watershed's northwestern portion. This area has also formed from marine deposits that are generally less stable than harder materials. Concentrated near the southern boundary of the watershed are areas with a high K-factor with slopes greater than 40%. Since these areas are naturally more prone to erosion, development

⁶⁹ Section 1.2.4 and Appendix 1 provide more information on geologic units within the Lower South Umpqua Watershed.

activities should be limited in these areas as they may be slower to recover from disturbance. This area is also mapped on potentially less stable geologic units that consist of sedimentary deposits (KJds, Jop) and old landslide debris deposits (Qls).

Urban drainage

In cities and towns, most sediment enters streams from storm water systems. Urban development results in high amounts of impervious surfaces concentrated in a small area.⁷⁰ As a result, rainfall is no longer absorbed by the soil or stored in wetlands, leading to heightened peak streamflows and shortened lag times (time from rainfall to peak streamflow) following rain events. To prevent flooding, cities have extensive storm water systems that convey runoff from streets and other paved areas to nearby rivers, streams, and/or lakes.

Different types of land within an urban setting produce different amounts of sediment. Residential neighborhoods produce the least amount of sediment per square mile. Commercial areas produce moderate loads of sediment, and heavy industrial areas produce even higher amounts. The highest amounts occur in areas that are actively being developed. Earth disturbances and bared surfaces usually makes sediment production the highest within a town, albeit the sediment production usually decreases once the construction is complete (Oregon Watershed Assessment Manual, p. VI-27).

Table 3-11 shows the dominant land use and estimated percent of total impervious surfaces for seven cities in the central Umpqua Basin. “Residential” is the dominant land use for all seven cities. In the Lower South Umpqua Watershed, the City of Roseburg has the highest estimated amount of impervious area. Compared to the other six cities, Winston has a low estimated percent impervious area. More research is needed to determine the degree to which these cities contribute to stream sediment.

Urban Growth Boundary	% of area commercial, industrial or residential	Dominant type of land use	Estimate of % total impervious area
Drain	76	Residential	36
Myrtle Creek	74	Residential	34
Oakland	88	Residential	38
Roseburg	75	Residential	42
Sutherlin	76	Residential	38
Winston	39	Residential	18
Yoncalla	93	Residential	48

⁷⁰ Impervious surfaces are ones that do not permit water infiltration, such as roads, roofs, and compacted soil.

Table 3-11: Dominant land use and estimated percent impervious area for seven cities in the central Umpqua Basin.⁷¹**Burns**

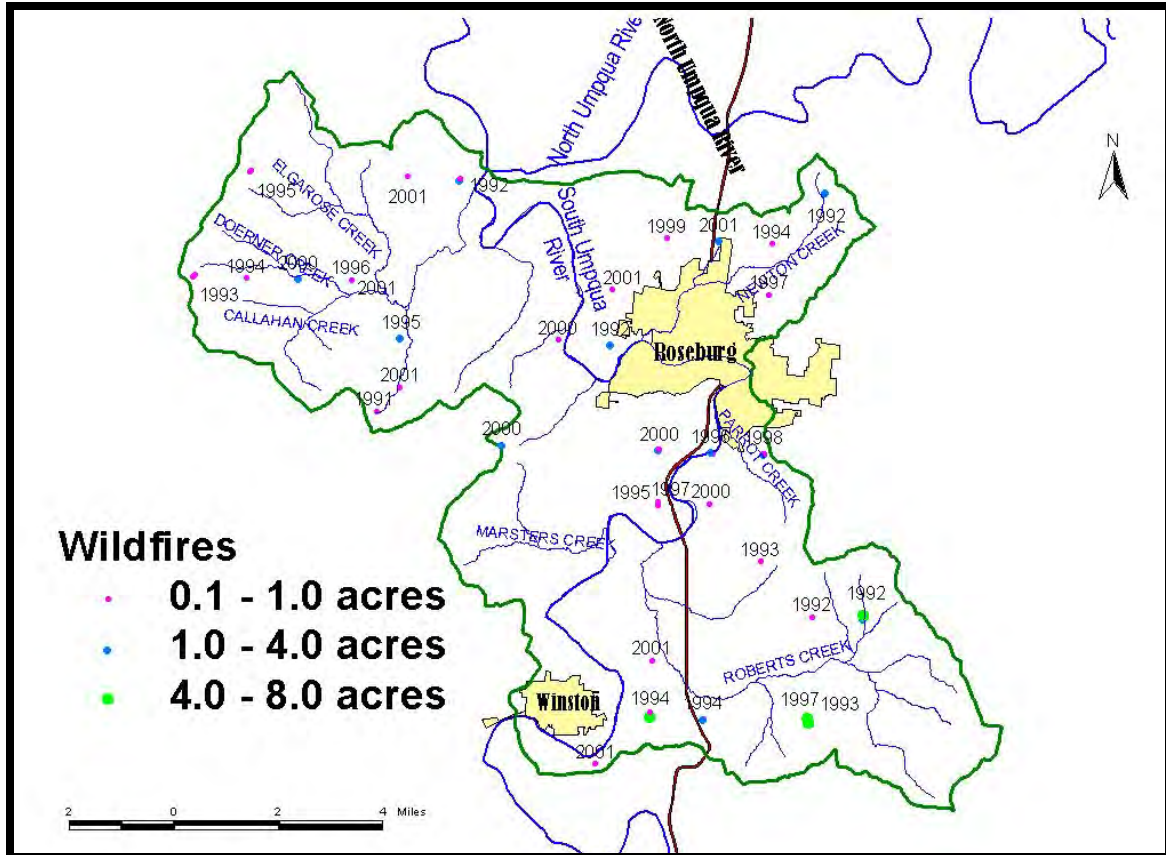
Burned areas erode more easily than unburned areas because of the lack of vegetative cover and an abundance of ash and charred material. In the Lower South Umpqua Watershed, the Douglas Forest Protective Association (DFPA) is responsible for issuing burn permits.

Table 3-12 shows the number of acres and piles for which burn permits were issued by DFPA from 1998 through 2001. Map 3-12 shows the location, years, and size of non-permitted (accidental) fires in the Lower South Umpqua Watershed from 1991 through 2001. The UBWC was unable to locate quantitative data on burns/stream proximity and cannot evaluate the potential for stream sedimentation from burns.

Year	Field acres	Debris piles
1998	922	15
1999	979	10
2000	468	11
2001	147	31
Total	2,516	67

Table 3-12: Number of acres and burn piles for which permits were issued from 1998 through 2001 in the Lower South Umpqua Watershed.

⁷¹ Barnes and Associates, Inc., provided the data in Table 3-11.



Map 3-12: Wildfire location, year, and size in the Lower South Umpqua Watershed.

3.3.8. Toxics

Toxics are a concern for residential fish and aquatic life and for drinking water. A variety of substances can be toxic, including metals, organic chemicals, and inorganic chemicals. Toxics are not defined by substance type, but rather by their effects on humans, fish, wildlife, and the environment. According to the ODEQ:

Toxic substances shall not be introduced above natural background levels in the waters of the state in amounts, concentrations, or combinations [that] may be harmful, may chemically change to harmful forms in the environment, or may accumulate in sediments or bioaccumulate in aquatic life or wildlife to levels that adversely affect public health, safety, or welfare, [or are detrimental to] aquatic life, wildlife, or other designated beneficial uses (p. 22).⁷²

As shown in Table 3-6 on page 74, three toxics have resulted in the 303(d) stream listings within the Lower South Umpqua Watershed: chlorine, arsenic, and cadmium.⁷³

⁷² From the *Oregon's Approved 1998 303(d) Decision Matrix*.

⁷³ Toxics listing criteria and data are from the ODEQ website <http://www.deq.state.or.us>. Select "water quality," "303(d)" list," "review the final 2002 303(d) list," and "search 303(d) list by waterbody name, parameter, and/or list date." Query the database by waterbody, parameter, listing status, and listing date.

Ammonia is listed as a potential concern. Monitoring in the 1970s and 1980s detected six organic compounds. A general description of these toxics and ODEQ's water quality monitoring findings are provided below.

Chlorine

The South Umpqua River was listed for chlorine in 1998. According to ODEQ, TMDL development for the river showed chlorine toxicity associated with major discharges from Canyonville to the mouth of the river. The beneficial uses affected by this toxicity are resident fish and aquatic life, anadromous fish passage, and drinking water. The Hach Corporation, which develops products for testing water quality, also provides educational information about various chemicals. Below is a description of chlorine from the Hach Corporation website:⁷⁴

Chlorine is a greenish-yellow gas that dissolves easily in water. It has a pungent, noxious odor that some people can smell at concentrations above 0.3 parts per million. Because chlorine is an excellent disinfectant, it is commonly added to most drinking water supplies in the US...Chlorine is also used as a disinfectant in wastewater treatment plants and swimming pools. It is widely used as a bleaching agent in textile factories and paper mills, and it's an important ingredient in many laundry bleaches.

As shown in Table 3-13, chlorine is toxic to fish and aquatic life in very small concentrations. Chlorine becomes more toxic in low pH levels and in combination with other toxics, such as cyanide and ammonia.

Amount of total chlorine (mg/l)	Effects on fish and aquatic life
0.006	Kills trout fry in two days.
0.01	Recommended maximum for all fish and aquatic life.
0.01	Kills chinook salmon and coho salmon.
0.01-0.05	Oysters have difficulty pumping water through their bodies.
0.02	Maximum brook and brown trout can withstand.
0.05	Maximum amount that can be tolerated by young Pacific salmon in the ocean.
0.1	Kills most marine plankton.
0.25	Only the hardiest fish can survive.
0.37	Maximum fish can tolerate.
1.0	Kills oysters.

Table 3-13: Effects of chlorine on fish and aquatic life.⁷⁵

⁷⁴ Available at <http://www.hach.com>. Select "visit H2OU," and then "educator resources," and "important water quality factors."

⁷⁵ From the Hach Corporation web site.

Arsenic

The South Umpqua River was 303(d) listed for arsenic in 2002 because two out of 13 US Geological Survey samples (15.4%) exceeded 0.0022 µg/l.⁷⁶ The beneficial uses affected by arsenic are fishing and drinking water. Arsenic is a metal element that is naturally found in Oregon soils, volcanic rocks, and geothermic water sources. The non-profit, Canada-based Environmental Bureau of Investigation (EBI) summarizes the environmental toxicology of various chemicals. Below is EBI's description of arsenic.⁷⁷

Arsenic is highly reactive and can easily undergo many chemical transformations. Most arsenic compounds can dissolve in water. Arsenic is easily adsorbed by iron and manganese and reacts with clay particles, which explains why it is often found in sediments. Some fish and shellfish can accumulate arsenic in their tissues, but mostly in a form non-toxic to humans.

Arsenic is acutely toxic to animals and may cause death. In animals, the effects of chronic exposure may include shortened life expectancy, decrease in reproduction, and behavioral effects. Arsenic appears to be more toxic to aquatic species than land animals. Studies in animals show that doses of arsenic that are large enough to cause illness in pregnant females may cause low birth weight, fetal malformations, or even fetal death.

Cadmium

The South Umpqua River is listed for cadmium because three out of 15 samples exceeded 0.66 µg/l. The beneficial uses affected by cadmium are resident fish and aquatic life. According to the Kentucky Department of Natural Resources' River Assessment Monitoring Project:

Cadmium is a non-essential element and it diminishes plant growth. It is considered a potential carcinogen. It also has been shown to cause toxic effects to the kidneys, bone defects, high blood pressure, and reproductive effects.⁷⁸

EBI summarizes the sources of cadmium in the environment.

Cadmium, in its elemental form, occurs naturally in the earth's crust. Pure cadmium is a soft, silver-white metal; however cadmium is not usually found in the environment as a metal but as a mineral combined with other elements such as oxygen (cadmium oxide), chlorine (cadmium chloride), or sulfur (cadmium sulfate, cadmium sulfide). These solid compounds are soluble in water. Cadmium has no definite odor or taste. Most cadmium is

⁷⁶ "µg/l" = micrograms per liter. A microgram is one millionth of a gram.

⁷⁷ From EBI's website <http://www.e-b-i.net/ebi/index.cfm>; select "index" and "arsenic."

⁷⁸ From the website <http://water.nr.state.ky.us/ww/ramp/default.htm>. Select "what we are testing for" and "cadmium."

extracted during the production of other metals such as zinc, lead, or copper.

The largest source of cadmium release to the general environment is the burning of fossil fuels (such as coal or oil) or the incineration of municipal waste materials. Cadmium may also escape into the air from zinc, lead, or copper smelters. It can enter water from disposal of wastewater from households or industries. Fertilizers often contain some cadmium.⁷⁹

Ammonia

As with chlorine, ODEQ TMDL development showed possible ammonia toxicity in the South Umpqua River associated with major discharges from Canyonville to the mouth. Ammonia can come from numerous sources. In nature, ammonia is formed by the action of bacteria on proteins and urea. The Kentucky Department of Natural Resources' River Assessment Monitoring Project summarizes ammonia sources and environmental impacts.

About three-fourths of the ammonia produced in the United States is used in fertilizers either as the compound itself or as ammonium salts such as sulfate and nitrate. Large quantities of ammonia are used in the production of nitric acid, urea, and nitrogen compounds. It is used in the production of ice and in refrigerating plants. "Household ammonia" is an aqueous solution of ammonia. It is used to remove carbonate from hard water. Since ammonia is a decomposition product from urea and protein, it is found in domestic wastewater. Aquatic life and fish also contribute to ammonia levels in a stream.

NH₃ is the principal form of toxic ammonia. It has been reported toxic to fresh water organisms at concentrations ranging from 0.53 to 22.8 mg/l. Plants are more tolerant of ammonia than animals, and invertebrates are more tolerant than fish. Hatching and growth rates of fishes may be affected. In the structural development, changes in tissues of gills, liver, and kidneys may also occur.⁸⁰

Like nitrates, ammonia may result in excessive plant growth, which in turn depletes oxygen levels. The danger ammonia poses for fish depends on the water temperature and pH along with the dissolved oxygen and carbon dioxide levels. In general, ammonia becomes more toxic as pH increases or water becomes warmer.

Organic compounds

From 1970 through 1980, the US Geological Survey sampled the South Umpqua River for organic compounds below the Roseburg Urban Sanitary Authority (RUSA) wastewater treatment plant. Organic compounds refer to carbon-based chemicals, which

⁷⁹ From EBI's website <http://www.e-b-i.net/ebi/index.cfm>; select "index" and "cadmium."

⁸⁰ From the website <http://water.nr.state.ky.us/www/ramp/default.htm>. Select "what we are testing for" and "ammonia."

include herbicides, fungicides, and insecticides. In the past, these chemicals persisted in natural systems and sometimes impacted non-target plants, animals, and humans; DDT is an example.

Organic compound monitoring in the South Umpqua River was discontinued due to lack of funding for the high cost of chemical analysis. During the sampling period, six organic compounds were detected in the South Umpqua River: [2,4-dichlorophenoxy] acetic acid (2,4-D); gamma-1,2,3,4,5,6-hexachlorocyclohexane (lindane); 2,4,5-trichlorophenoxypropionic acid (silvex); dieldrin; 2,4,5-trichlorophenoxyacetic acid (2,4,5-T); and polychlorinated biphenyls (PCBs). None of these chemicals was found at levels considered hazardous to human health. Little is known about the non-lethal affects of these residual toxics in the watershed.⁸¹

Lindane and 2,4-D are still in use; the rest have been banned. Lindane is an ingredient in fungicides and insecticides, including lotions, creams, and shampoos used to control lice and mites (scabies) in humans. 2,4-D is an herbicide used to control many types of broadleaf weeds. It is used in cultivated agriculture, pasture and rangeland applications, forest management, domestic homes and gardens, and to control aquatic vegetation.⁸²

3.3.9. Water quality key findings and action recommendations

Temperature key findings

- Monitoring locations within the watershed indicate that streams within the Lower South Umpqua Watershed frequently have seven-day moving average maximum temperatures exceeding the 64°F water quality standard during the summer. High stream temperatures would limit salmonid rearing in these reaches.
- Warmer sites often lack shade. Increasing shade on small and medium-sized streams may improve overall stream temperature.
- Groundwater and tributary flows can contribute to stream cooling. Gravel-dominated tributaries may permit cooler subsurface flows when surface flows are low.
- Fish may find shelter from high summer temperatures in the lower reaches and mouths of small and medium-sized tributaries and in reaches within warm streams that have proportionately high groundwater influx and shade.

Surface water pH, dissolved oxygen, nutrients, bacteria, and toxics key findings

- Temperature and the levels of pH, nutrients, and dissolved oxygen are interrelated. In the South Umpqua River during the summer, pH, nutrients, and dissolved oxygen exceed water quality standards. This condition is detrimental to resident fish, aquatic life, and human contact recreation. It is unknown if these parameters are concerns for other locations within the watershed
- In the South Umpqua River, bacteria levels exceed water quality standards all year, decidedly a human health concern. Additional monitoring is necessary to determine if other locations in the watershed have high bacteria levels.

⁸¹ From Chauncey Anderson, a hydrologist with the US Geological Survey.

⁸² From the Extension Toxicology Network website <http://ace.orst.edu/info/extoxnet/>

- In the South Umpqua River, chlorine, arsenic, and cadmium levels exceed water quality standards and are a concern for resident fish and aquatic life, salmonid fish, drinking water, and fishing. Toxics may be a concern for other Lower South Umpqua streams.
- Organic compounds have been detected within the South Umpqua River, although not at levels considered hazardous to human health.

Sedimentation and turbidity key findings

- Turbidity data indicate that usual turbidity levels in the South Umpqua River do not impair sight-feeding fish like salmonids.
- Soils prone to high rates of erosion due to low infiltration and high runoff rates are located throughout the watershed but are concentrated in the northern and eastern portions of the watershed.
- The southern watershed boundary has areas that may be sensitive to disturbance due to their high K-factor values, especially along Roberts Creek and its tributaries.
- Developed areas within the watershed may impact water quality (i.e. runoff from roads and roofs). Improperly drained roads and poor land management practices can increase sediment loads to streams. In the Umpqua Basin, more studies are needed to determine the impacts of roads, culverts, landslides, burns, soil type, and urban conditions on sedimentation and turbidity.

Water quality action recommendations

- Continue monitoring the Lower South Umpqua Watershed for all water quality conditions. Expand monitoring efforts to include tributaries.
- Identify stream reaches that may serve as “oases” for fish during the summer months, such as at the mouth of small or medium-sized tributaries. Protect or enhance these streams’ riparian buffers and, if needed, improve instream conditions by placing logs and boulders within the active stream channel to create pools and collect gravel.
- In very warm streams, increase shade by encouraging wide riparian buffers and managing for full canopies.
- Identify and monitor sources of bacteria and nutrients. Where applicable, reduce bacteria and nutrient levels through activities such as:
 - Limiting livestock stream access by providing stock water systems and shade trees outside of the stream channel and riparian zones. Fence riparian areas as appropriate.
 - Relocating structures and situations that concentrate domestic animals near streams, such as barns, feedlots, and kennels. Where these structures cannot be relocated, establish dense and wide riparian vegetation zones to filter fecal material.
 - Repairing failing septic tanks and drain fields.
 - Using wastewater treatment plant effluent for irrigation.
 - Reducing chemical nutrient sources.
- Where data show that stream sediment or turbidity levels exceed established water quality standards, identify sediment sources such as urban runoff, failing culverts or roads, landside debris, construction or burns. Take action to remedy the problem or

seek assistance through organizations such as the UBWC and Soil and Water Conservation Districts.

- Obtain comprehensive map coverage of the road system within the watershed and prioritize areas of concern based on road type, condition, and proximity to nearest stream. If necessary, use this information to target projects for improving road stability and drainage patterns.
- Identify areas with high concentrations of the group D soils that have been disturbed; prioritize areas for vegetation plantings and limit activities in these sensitive areas. Limit activities in areas that will be slow to recover from disturbance.
- Use the Oregon Department of Forestry's debris flow hazard model to pinpoint areas that are naturally prone to erosion. Obtain the more refined debris flow data from Nature of the Northwest when published.
- Provide landowner education about water quality concerns and potential improvement methods:
 - Improving dirt and gravel road drainage to minimize sediment delivery to streams.
 - Enhancing soil infiltration by leaving vegetation litter on the ground after timber and crop harvests.
 - Planting bio-swales near streams in urban and suburban areas to catch urban runoff.
- Work with ODEQ to educate landowners about activities that will reduce any non-point sources of ammonia, chlorine, and cadmium in the watershed.

3.4. Water quantity

3.4.1. Water availability⁸³

Data from the Oregon Water Resources Department (OWRD) have been used to determine water availability in the Lower South Umpqua Watershed.⁸⁴ Availability is based on streamflow, consumptive use and instream water rights. The amount of water available for issuance of new water rights is determined by subtracting consumptive use and the instream water right from streamflow. The OWRD has divided the Umpqua Basin into sub-basins, or water availability basins (WABs), for the purpose of analyzing water availability. In the Lower South Umpqua Watershed, one WAB (#351) encompasses most of the watershed.

Figure 3-7 shows surface water availability for Lower South Umpqua Watershed in cubic feet per second (cfs). The solid yellow area is the average streamflow, while the pink line represents the instream water right. The dark blue line is the estimated consumptive use. In this WAB, average streamflow exceeds consumptive use for the entire year. From August through October, the instream water right is close to or exceeds average streamflow.

⁸³ David Williams, the OWRD Watermaster for the Umpqua Basin, contributed the text for section 3.4.1.

⁸⁴ Water availability data are available from the Oregon Water Resources Department web site <http://www.wrd.state.or.us/>.

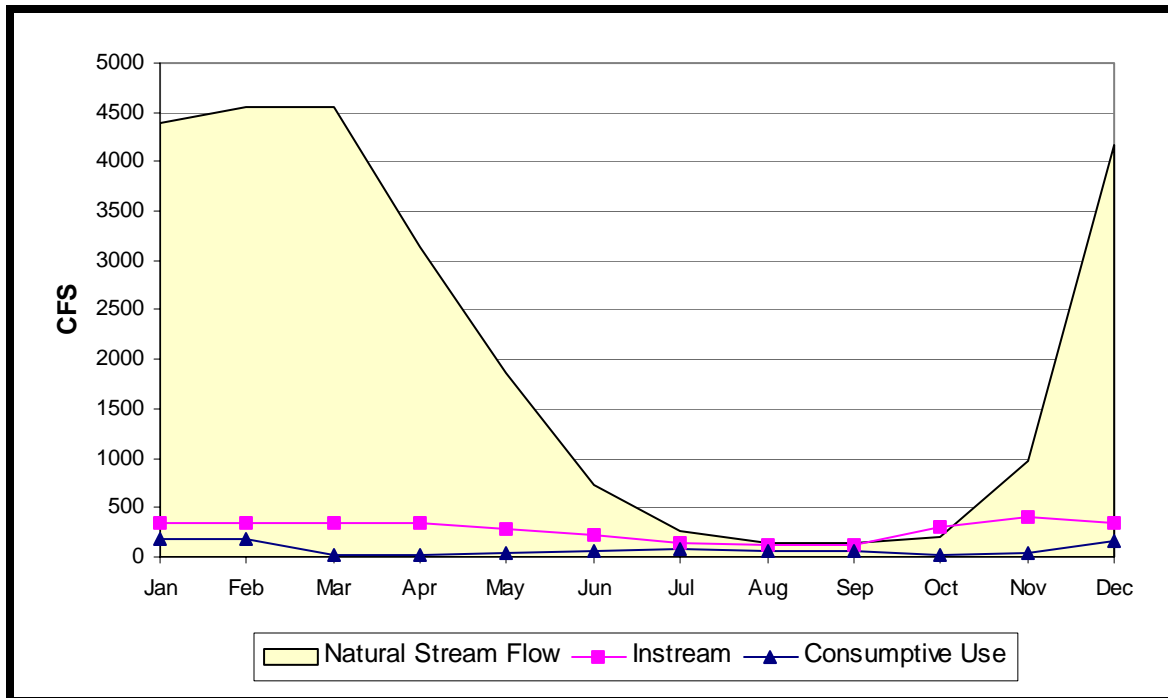


Figure 3-7: Water availability in the Lower South Umpqua WAB (#351).

Oregon law provides a mechanism for temporarily changing the type and place of use for a certificated water right by leasing the right to an instream use. Leased water remains in-channel and benefits streamflows and aquatic species. The water right holder does not have to pay pumping costs and while leased the instream use counts as use under the right for purposes of determining forfeiture.

3.4.2. Water rights by use

Table 3-14 shows consumptive use by category for the Lower South Umpqua Watershed.⁸⁵ Appendix 7 lists the possible uses included in each category. These records show uncanceled water rights, and do not indicate actual water consumption.⁸⁶

Irrigation is the largest use of water in the entire watershed (84%), followed by municipal use (13%) and industry (2.3%). Use for the South Umpqua follows the same trend as for the entire watershed. The largest use of water for watershed tributaries is also irrigation (96%), distantly followed by domestic use (1.6%) and fish and wildlife (1.0%).

⁸⁵ Water rights data are available from the Oregon Water Resources Department web site <http://www.wrd.state.or.us/>.

⁸⁶ Uncanceled water rights include: 1) valid rights, which are ones that have not been intentionally canceled and the beneficial use of the water has been continued without a lapse of five or more consecutive years in the past 15 years; and 2) rights that are subject to cancellation due to non-use. For more information about water rights, contact the Oregon Water Resources Department.

Source	Total Use		South Umpqua		Tributaries	
	Cubic feet/sec	% of total	Cubic feet/sec	% of S. Umpqua	Cubic feet/sec	% of tributaries
Irrigation	57.94	84.0%	46.87	81.0%	11.07	96.0%
Fish/WL	0.32	0.5%	0.20	0.3%	0.12	1.0%
Agriculture	0.20	0.3%	0.12	0.2%	0.08	0.7%
Industry	1.60	2.3%	1.60	2.8%	0.00	-
Municipal	8.97	13.0%	8.97	15.5%	0.00	-
Domestic	0.23	1.4%	0.05	<0.1%	0.18	1.6%
Recreation	0.10	0.1%	0.00	-	0.10	0.7%
Misc.	0.01	1.4%	0.01	<0.1%	0.00	-
Total	69.37	100%	57.82	100%	11.55	100%

Table 3-14: Water rights by use for the South Umpqua River and tributaries.

3.4.3. Streamflow and flood potential

There are no US Geological Survey (USGS) stream gauges in the Lower South Umpqua Watershed that take daily measurements. The closest station is located on the South Umpqua River near Brockway (gauge #14312000), and this station is used to assess streamflow and flood potential in the Lower South Umpqua Watershed. Data were intermittently collected at Brockway from 1905 through 1926 and has been steadily collected since 1942.

Figure 3-8 charts the average monthly streamflow for the South Umpqua River at Brockway. In 1986, Galesville Dam became fully operational. The dam is located in the headwaters of Cow Creek, which is the largest tributary to the South Umpqua River. Figure 3-8 has separated the historical streamflow into two units: before Galesville Dam (1926 to 1985) and after Galesville Dam (1986 to 2001).

As would be expected from climate information in this assessment's introduction, the winter months have the greatest streamflow due to precipitation. It appears that Galesville Dam has reduced winter flows and slightly increased summer flows within the South Umpqua River. However, the river can have less than 100 cfs during the summer.

Figure 3-9 shows average flow and peak flow for each year from 1942 until the year 2000 for the South Umpqua River at Brockway. The solid blue area represents average annual flow; the scale is on the right side of the chart. It appears from this chart that peak flows generally follow average annual flow trends. 1996 is a notable exception. While 1996 average annual flow is the highest recorded (5,123 cfs), the peak flow was below average (46,700 cfs).

The highest peak events are in December, 1964 (125,000 cfs) and January, 1974 (105,000 cfs). It appears from the graph that high annual peak flows were more common prior to the early 1980s, especially in the 1940s and 1950s. Galesville Dam was built, in part, for flood control, and has had a stabilizing effect on peak flow.

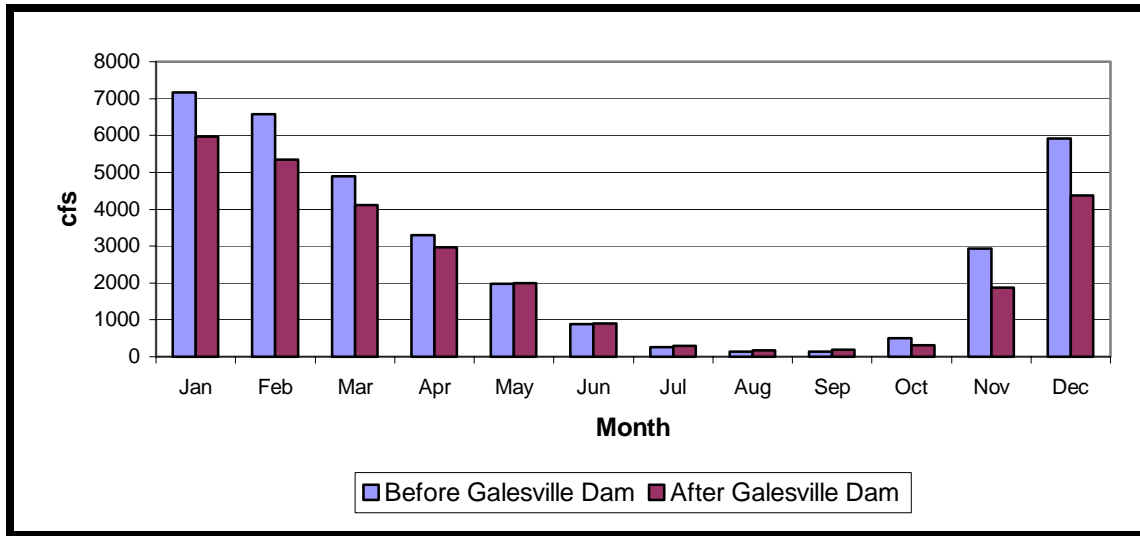


Figure 3-8: Mean monthly water flow for the South Umpqua River at Brockway (gauge #14312000).

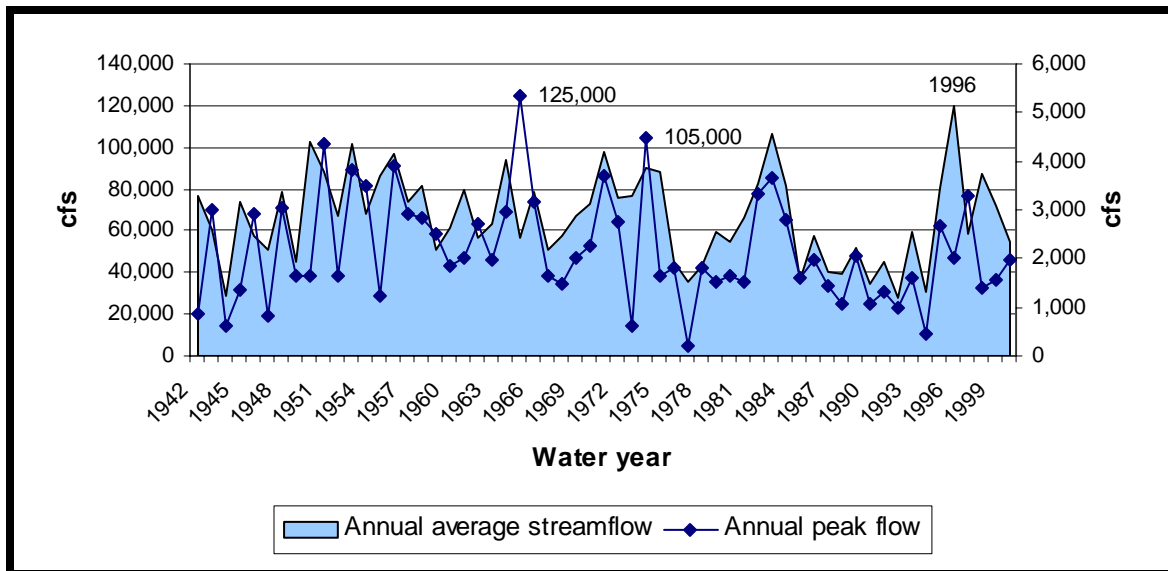


Figure 3-9: Annual average flow and peak flow for the South Umpqua River at Brockway (gauge #14312000).

Potential influences on flood potential

Approximately 2% of the Lower South Umpqua Watershed is within the transient snow zone (TSZ) (see Map 1-8 in section 1.2.6). In the TSZ, snow can accumulate in areas with open canopies such as meadows, burned areas, or timber harvest units. When warmer rain falls on the accumulated snow, the snow quickly melts and can result in high runoff levels and peak streamflows. Streams with headwaters in the TSZ zone, such as Elgarose Creek, are more susceptible to rain-on-snow events than lower elevation streams.

Road density can also influence peak flows. Table 3-15 shows the miles of road per square mile for surfaced and unsurfaced roads. Paved roads are impermeable to water, and rock or dirt roads are somewhat permeable. When it rains or accumulated snow on road surfaces melts, water that is not absorbed will flow off the road. The soil and vegetation surrounding the road may absorb the runoff. If the surrounding area is unable to absorb the excess water, and if the road is close to a stream, then the excess water flows into the stream, resulting in high peak flows. It is important to note that the relationship between roads, streams, and peak flows depend on many factors, and the influence of roads on stream flow and peak events is debatable.

Road type	Road miles/ square mile
Paved	3.6
Gravel	2.6
Dirt	0.3
Total	6.5

Table 3-15: Miles of road per square mile for surfaced and unsurfaced roads in the Lower South Umpqua Watershed.

Landowner comments

During a watershed assessment meeting held November 27, 2001, local landowners suggested that forest management practices in the 1940s and 1950s might have influenced flooding. According to residents, timber harvests at that time removed all vegetation, sometimes clearing multiple hillsides, leaving no riparian buffer strip along streams. Some participants suggested that the lack of trees permitted more surface runoff and resulted in frequent flood events, accounting for the pre-1960 peak flows in Figure 3-9.

3.4.4. Water quantity key findings and action recommendations

Water availability and water rights by use key findings

- From August to October, the instream water right is close to or exceeds average streamflow.
- The largest water users in the Lower South Umpqua Watershed are irrigators, municipalities, and industries.

Streamflow and flood potential key findings

- It is not unusual for the flow of the South Umpqua River at Brockway to be less than 100 cfs during the summer months.
- The construction of Galesville Dam appears to have had a stabilizing effect on winter peak flows for the South Umpqua River at Brockway.
- The degree to which road density and the transient snow zone influence flood potential in the Lower South Umpqua Watershed is unknown at this time.
- Some landowners believe that historical surface vegetation removal permitted greater surface water runoff and may have contributed to stream flashiness.

Water quantity action recommendations

- Increase summer streamflow levels through instream water leasing and by improving irrigation efficiency.
- Continue monitoring peak flow trends in the watershed. Try to determine the role of vegetative cover, flooding, road density, and the transient snow zone on water volume.
- Educate landowners about proper irrigation methods and the benefits of improved irrigation efficiency.

3.5. Fish populations**3.5.1. Fish presence**

Table 3-5 lists the fish species in the Lower South Umpqua Watershed that have viable, reproducing populations or annual runs. Warm water fish, including largemouth bass (*Micropterus salmoides*), yellow perch (*Perca flavescens*), and bluegill (*Lepomis macrochirus*) may also be present in the watershed. These fish are accidentally or intentionally introduced into the South Umpqua River and streams from private ponds.

The Oregon Coast coho salmon was listed as a threatened species in 1998 under the Endangered Species Act of 1973. Currently, there are no other threatened or endangered aquatic species in the Lower South Umpqua Watershed. In January, 2003, various groups petitioned to protect the Pacific lamprey and western brook lamprey, as well as two other lamprey species not present in the Umpqua Basin, under the Endangered Species Act.

Common Name	Scientific Name
Steelhead	<i>Oncorhynchus mykiss</i>
Coho salmon	<i>O. kisutch</i>
Chinook (spring and fall)	<i>O. tshawytscha</i>
Cutthroat trout	<i>O. clarkii</i>
Umpqua chub	<i>Oregonichthys kalawatseti</i>
Western brook lamprey	<i>Lampetra richardsoni</i>
Pacific lamprey	<i>Lampetra tridentata</i>
Umpqua dace	<i>Rhinichthys cataractae</i>
Sculpin	<i>Cottus sp.</i>
Redside shiner	<i>Richardsonius balteatus</i>
Speckled dace	<i>Rhinichthys osculus</i>
Umpqua pikeminnow	<i>Ptychocheilus oregonensis</i>
Largescale sucker	<i>Catostomus macrocheilus</i>
Smallmouth bass	<i>Micropterus dolomieu</i>
Brown bullhead	<i>Ameiurus nebulosus</i>

Table 3-16: Fish species with established populations or runs within the Lower South Umpqua Watershed.

3.5.2. Fish distribution and abundance

Information on fish distribution and abundance within the Lower South Umpqua Watershed is limited to salmonids. Although non-salmonid fish species are important as well, there are insufficient accessible data on the location of these types of fish, and they could not be included in the assessment. More information about these species may be available in the future.

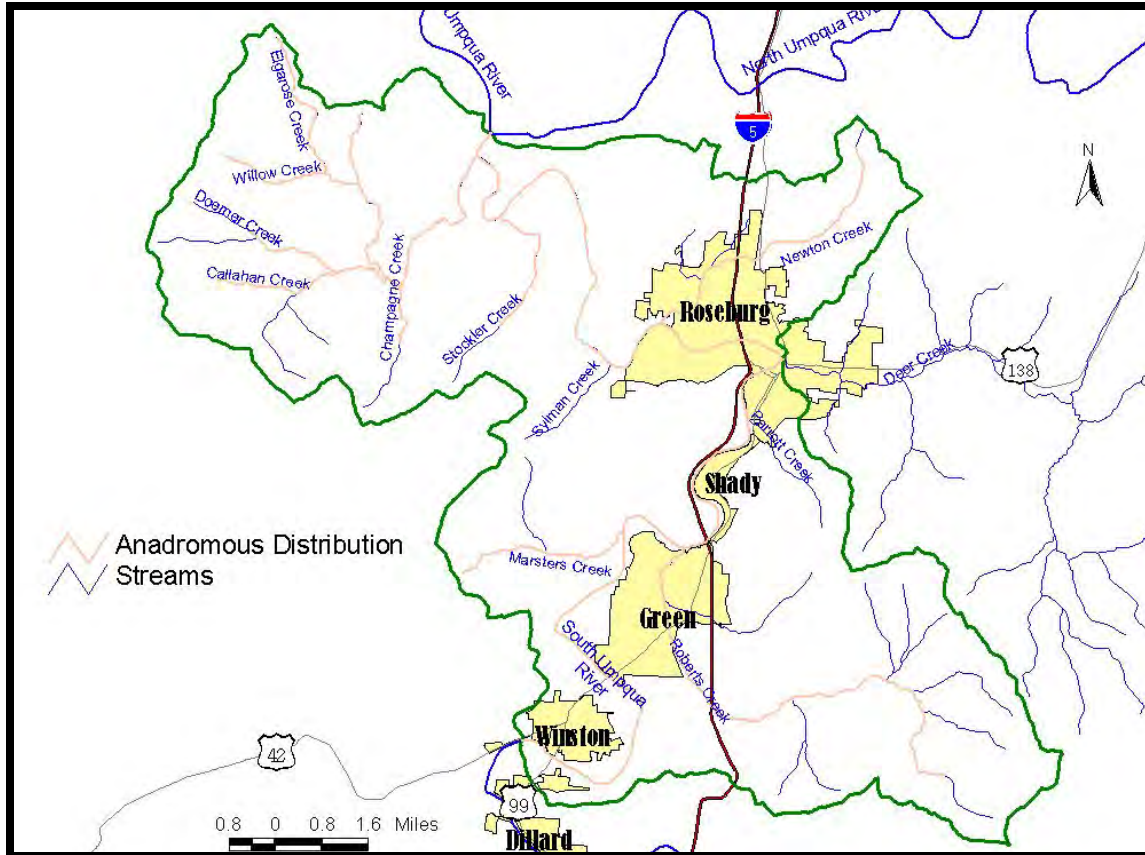
Anadromous salmonid distribution

The Oregon Department of Fish and Wildlife (ODFW) has developed anadromous salmonid distribution maps based on fish observations, assumed fish presence, and habitat conditions. Fish observations are the most accurate because ODFW personnel have seen live or dead fish in the stream. With assumed fish presence, streams or reaches are included in the distribution map because of their proximity to fish-bearing streams and adequate habitat. Also included on the map are streams that appear to have adequate habitat for a given salmonid, even if there have been no fish sightings and the stream is not near a fish-bearing stream. As of January, 2003, ODFW was in the process of revising the salmonid distribution maps to distinguish observed fish-bearing streams from the others. It is possible that some streams have been included in the distribution maps that do not have salmonid presence.

According to ODFW, coho and winter steelhead use over 64 stream miles within the Lower South Umpqua Watershed. Map 3-13 shows the distribution of these anadromous salmonids within the watershed and Table 3-17 lists the miles of stream used by each species. Total stream miles with anadromous salmonids does not equal the sum of miles used by each species because many species overlap (see Appendix 8). Coho and winter steelhead use many of the same stream reaches but at different times of the year.

	Total	Spring chinook	Fall chinook	Coho	Winter steelhead
Miles	64.6	24.9	24.9	58.6	62.7

Table 3-17: Miles of stream supporting anadromous salmonids in the Lower South Umpqua Watershed.



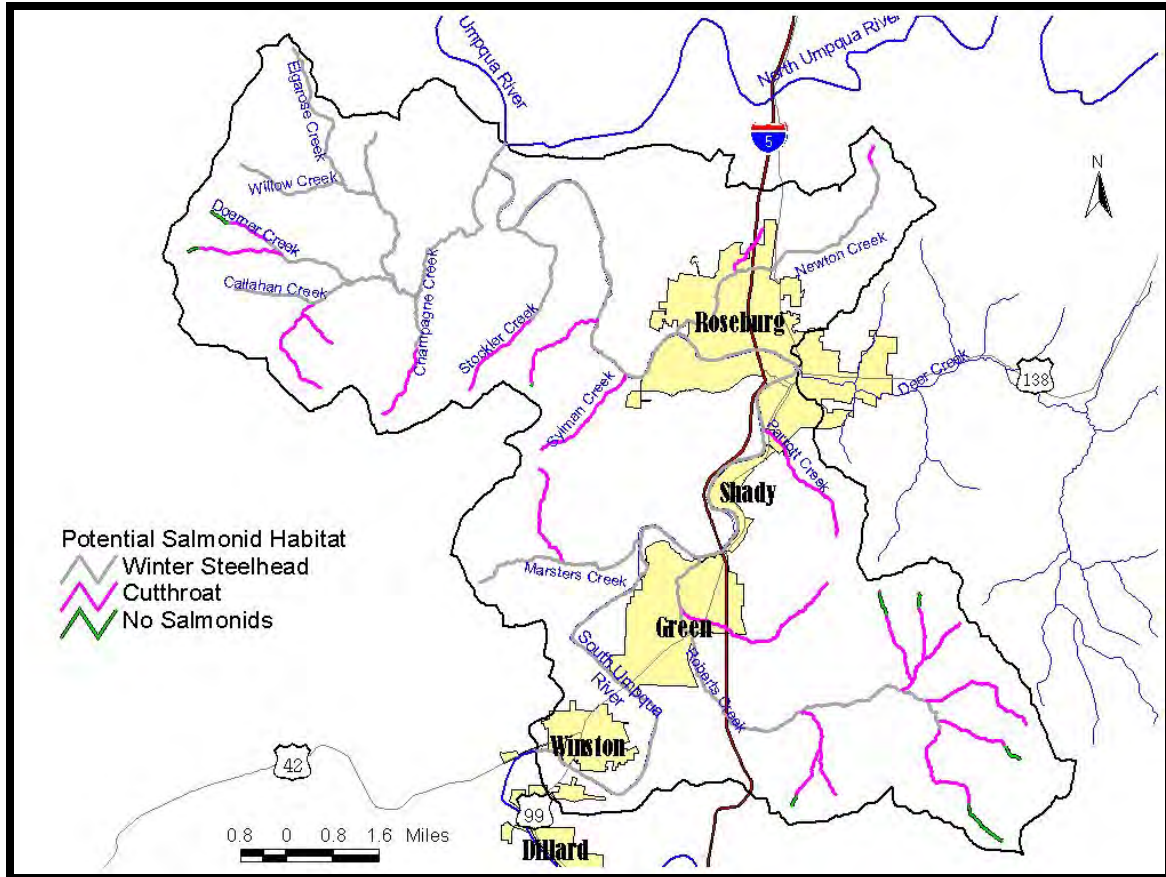
Map 3-13: Anadromous salmonid distribution within the Lower South Umpqua Watershed.

Resident salmon distribution

There are no comprehensive data about resident salmonid distribution in the Umpqua Basin. ODFW is compiling regional data and will develop maps indicating fish presence by stream. However, the project will not be completed until after this assessment is complete.

The only resident salmonid in the Lower South Umpqua Watershed is the cutthroat trout. Although there is much overlap, anadromous salmonids generally prefer streams with a zero to 4.0% gradient, whereas resident cutthroat trout prefer streams with gradients between 4.0% and 15%. Also, cutthroat are generally found beyond the range of winter steelhead.⁸⁷ Map 3-14 shows streams with gradients that are less than 15% and are beyond winter steelhead distribution. Streams such as the upper reaches of Doerner Creek may provide suitable habitat for cutthroat trout. However, there are many factors other than stream gradient that determine fish habitat suitability.

⁸⁷ From Dave Harris, fish biologist, Oregon Department of Fish and Wildlife, Roseburg District Office.



Map 3-14: Potential resident and anadromous salmonid habitat in the Lower South Umpqua Watershed.

Salmonid abundance

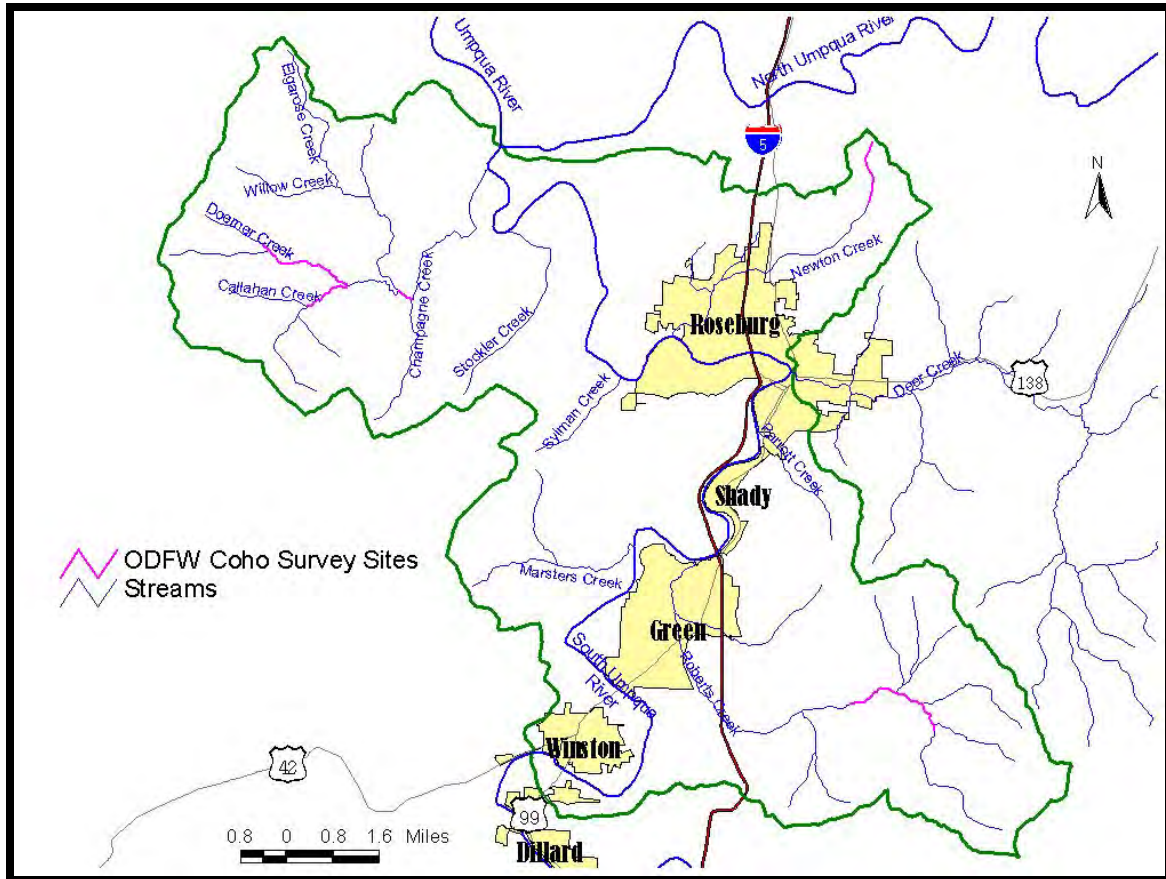
Fish abundance is difficult to assess in the Lower South Umpqua Watershed. Available data focuses on coho spawning and juvenile salmonid migration abundance. It was not possible to locate abundance data for resident salmonids.

Coho spawning surveys

ODFW conducts coho spawning surveys throughout the Umpqua Basin. Volunteers and ODFW personnel survey pre-determined stream reaches and count the number of live and dead coho. The same person or team usually does surveys every 10 days for two or three months. There are coho spawning data for the Lower South Umpqua Watershed from 1998 through 2000. Map 3-15 shows the surveyed stream reaches. Figure 3-10 shows the maximum number of live and dead coho seen per mile on a given day. The estimated total number of coho per mile is included as a red bar next to peak per mile count.

The number of coho spawning in a stream can fluctuate. ODFW personnel observed 10 coho spawning in Callahan Creek in 1999 but none in 2000. No coho were reported in Newton Creek in 1998. However, the map in Appendix 8 indicates that both these streams are within coho distribution. It is likely that coho have spawned in the creeks

during other years. More data are needed to draw conclusions about coho spawning in the watershed.



Map 3-15: Lower South Umpqua Watershed coho spawning survey locations.

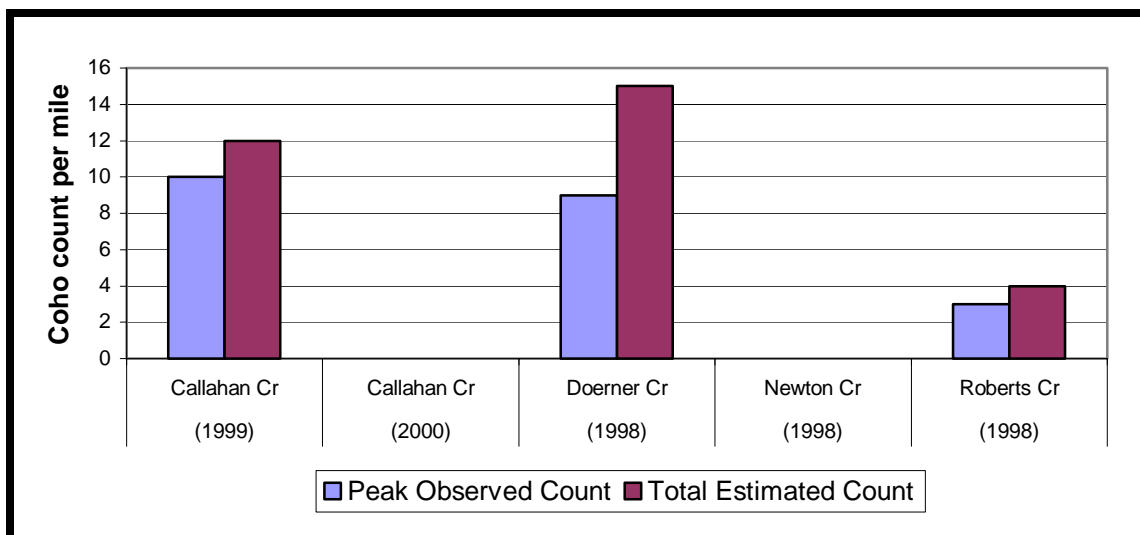


Figure 3-10: Lower South Umpqua Watershed coho spawning surveys (1998 through 2000).

Aerial fall chinook counts

Oregon Department of Fish and Wildlife (ODFW) conducts annual aerial counts of fall chinook fish redds in the South Umpqua River and in Cow Creek. The South Umpqua River is surveyed from the mouth to Milo. Flights are normally made twice a year, both before and after the height of the run. Counts are based on the average count for both flights.

Fall chinook adult fish have been surveyed since 1983. From 1983 until 1997, ODFW fish surveyors divided the South Umpqua River into reaches based on permanent features that are visible from a helicopter, such as an I-5 bridge. These divisions do not exactly follow watershed boundaries, but are close enough that these counts can be used to estimate chinook spawning in the Lower South Umpqua Watershed.

Figure 3-11 shows annual fall chinook fish counts for the Lower South Umpqua Watershed and for the total South Umpqua River from 1983 until 1997. There were no fish surveys conducted in 1985. Within the watershed, the highest fish count was 865 fish in 1995, and the lowest count was 29 fish in 1986. On average, one-fourth of the fall chinook counted in the South Umpqua River are in the Lower South Umpqua Watershed.

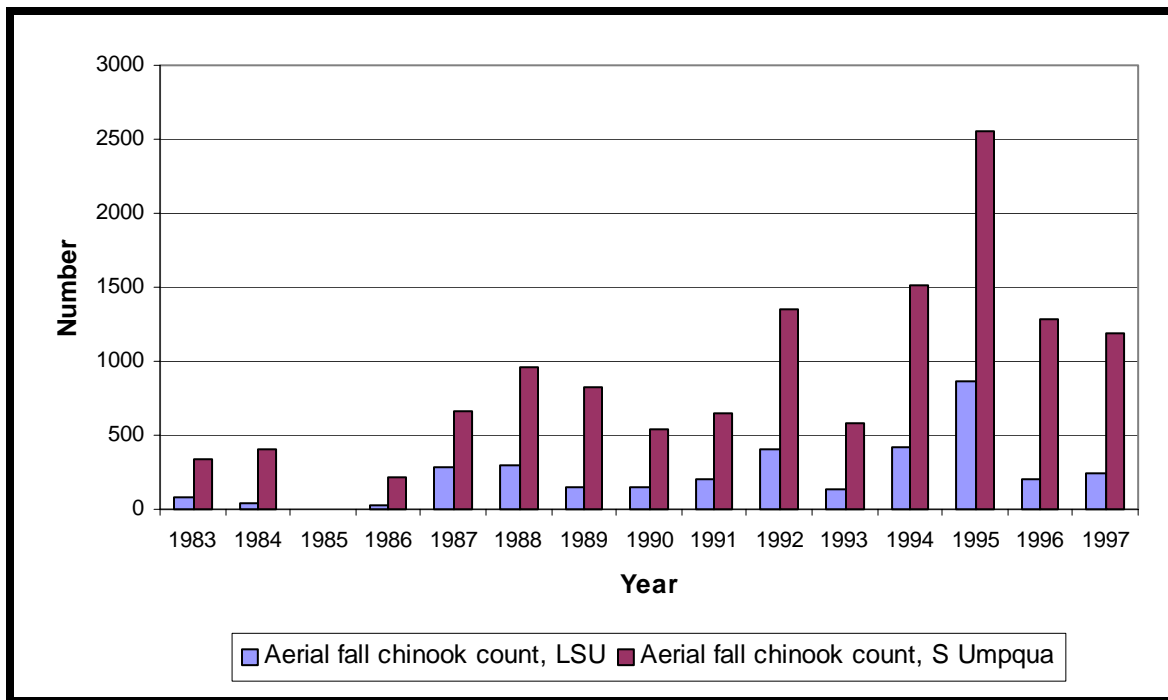


Figure 3-11: Aerial fall chinook count for the Lower South Umpqua Watershed and for the entire South Umpqua River.

Fall chinook redds have been surveyed since 1978. Redd counts are recorded for the entire river, and data are not specific to the Lower South Umpqua Watershed. In 1998 and 1999, the Pacific Salmon Commission (PSC) undertook a study on the South

Umpqua River to calibrate fall chinook aerial redd counts to actual population levels.⁸⁸ The study concluded that for each counted redd, 3.86 adult fish returned to the South Umpqua River to spawn. Figure 3-12 shows actual fall chinook fish and redd counts in the South Umpqua River, and the PSC fall chinook run size estimate. In 1995, there may have been nearly 10,000 fall chinook present in the South Umpqua River.

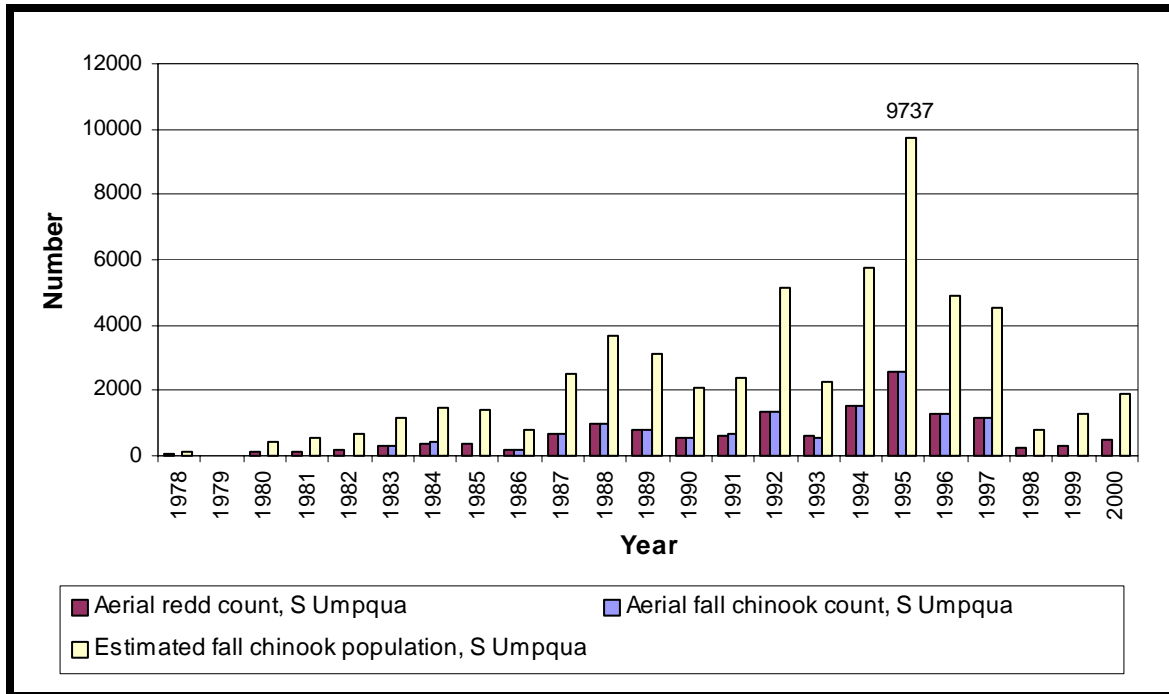


Figure 3-12: Aerial fall chinook count, redd count, and estimated total adult fish population for the South Umpqua River.

3.5.3. Fishing

The South Umpqua River is closed to all fishing during the fall chinook spawning season, which is from September 15 through November 15.⁸⁹ Table 3-18 shows creel data from 1998 through 2000 for the Lower South Umpqua Watershed during the open season. Fishing success appears to be low compared to number of anglers and angling hours. Steelhead are the most commonly caught fish.

Lower South Umpqua	Number of anglers	Number of angler hours	Spring chinook	Coho	Winter steelhead
1998	7	15	0	0	0
1999	54	98	0	1	8
2000	59	133	0	0	5
TOTAL	120	246	0	1	13

⁸⁸ From ODFW's *Development of Methods to Estimate Escapement of Chinook Salmon in the South Umpqua River* (2000).

⁸⁹ The South Umpqua River is open to winter steelhead fishing from November 16 until March 31. Cutthroat trout season is from the fourth Saturday of May through September 15th.

Table 3-18: Angler numbers, hours, and catches for the Lower South Umpqua Watershed.**3.5.4. Salmonid population trends**

According to Dave Harris of the Oregon Department of Fish and Wildlife, adult salmonid returns to the South Umpqua River system have increased from 1998 to 2002. This trend may be attributed to greater numbers of wild and hatchery fish surviving to adulthood because of normal winter storm events (i.e. no major floods or landslides) and ocean conditions that favor survival and growth. When both of these limiting factors are favorable over several years or fish generations, the result is an increase in adult run sizes. This trend is expected to continue until there is a change in ocean conditions or winter freshwater events.

Activities that improve freshwater conditions for salmonids will also help increase fish runs. These activities include removing barriers to fish passage, increasing instream flows, and improving critical habitat in streams and estuaries. It is also important to continue gathering data about salmonids and educating the public.

3.5.5. Fish populations key findings and action recommendations**Fish populations key findings**

- The anadromous fish species in the Lower South Umpqua Watershed are coho, spring chinook, fall chinook, winter steelhead, sea-run cutthroat trout, and lamprey. Although many Lower South Umpqua Watershed medium and large tributaries are within the distribution of one or more salmonid species, salmonid ranges have not been verified for each tributary.
- Non-native fish, including smallmouth bass, have established populations in the watershed. Other non-natives, such as bluegill, have been accidentally or intentionally introduced to the watershed, but have not established reproducing populations.
- More quantitative data are needed to evaluate salmonid abundance and the distribution and abundance of non-salmonid fish in the watershed.
- Umpqua Basin-wide data indicate that salmonid returns have improved. Although ocean conditions are a strong determinant of salmonid run size, improving freshwater conditions will also improve salmonid fish populations.

Fish populations action recommendations

- Work with local specialists and landowners to verify the current and historical distribution of salmonids in tributaries.
- Support salmonid and non-salmonid distribution and abundance research activities in the watershed, especially at the local level.
- Encourage landowner and resident participation in fish monitoring activities.
- Conduct landowner education programs about the potential problems associated with introducing non-native fish species into Umpqua Basin rivers and streams.
- Encourage landowner participation in activities that improve freshwater salmonid habitat conditions.

4. Current Trends and Potential Future Conditions

This chapter evaluates the current trends and the potential future conditions that could affect important stakeholder groups in the watershed.

Key Questions

- What are the important issues currently facing the various stakeholder groups?
- How can these issues affect the future of each group?

4.1. Overview

There are many commonalities among the identified stakeholder groups. All landowners are concerned that increasing regulations will affect profits, and all have to invest more time and energy in the battle against noxious weeds. The non-industrial private landowners are concerned about the global market's effect on the sale of local commodities. These groups are also struggling with issues surrounding property inheritance. Some groups are changing strategies in similar ways; community outreach is becoming increasingly important for both the Oregon Department of Environmental Quality (ODEQ) and industrial timber companies. Overall, the future of fish habitat and water quality conditions in the Umpqua Basin is bright. According to ODEQ, basin-wide conditions are improving and have the potential to get better.

4.2. Stakeholder perspectives⁹⁰

4.2.1. The City of Roseburg⁹¹

The City of Roseburg is the largest city in the Umpqua Basin. According to the US Census Bureau, the city's 2000 population was 20,017 people. The city's annual growth rate is approximately 2.0%; therefore the city's 2003 population is projected to be 21,242 people. Of these, an estimated 79% (16,781) live within the Lower South Umpqua Watershed.

Roseburg area population growth

City officials believe that for the next 10 years or more, the Roseburg vicinity's demographics will remain stable.⁹² However, the city's 2.0% population growth and increasing school enrollment indicate people are moving to the area. Observation suggests that the newcomers fall into three general categories; people seeking the area's livability, those who move for employment reasons, and return residents.

Newcomers seeking the area's livability are often retirees and people from urban areas with families. Many residents believe that the retiree group is mostly "out-of-staters"

⁹⁰ It was not possible to develop a comprehensive viewpoint of the current trends and potential future conditions for the conservationist and environmentalist community in the Umpqua Basin. Therefore, this perspective is not included in section 4.2.

⁹¹ This information is primarily from an interview with Dan Huff, the Community Development Director for the City of Roseburg.

⁹² Please see section 1.3.2 for a description of Roseburg's social and demographic characteristics.

(especially Californians) willing to pay a lot of money for their Oregon dream home, but have little interest in being part of the community.⁹³ However, most retirees who move to the Roseburg area are younger than the term “retiree” conveys, are very active, and become involved in the community. Some people with young children move to the Roseburg area from bigger cities because they believe that the rural atmosphere is a better environment to raise their families. These people generally find jobs in Roseburg after having decided to move to a smaller city.

Another group consists of people who came to Roseburg for employment reasons. Many of these residents have jobs in public sectors and were transferred to the area, such as federal employees. Others are people in the private and public sector who are in specialized or professional fields. Filling these types of positions locally is difficult, so people from other parts of the state or country are hired and are brought to the Roseburg area. The final group consists of people who lived in the Roseburg area at some point, left, and moved back again. This is quite common with young adults who left to continue their education elsewhere. However, some career people and even retirees also fall into this category.

City expansion

All cities in Oregon have two boundaries. The first is the actual corporate city limit, which is the boundary where the city officially ends. Roseburg’s estimated population of 21,242 people includes only the area within the city limits, and only people within the city limits can vote for city officials. Urban growth boundaries delineate the area that will most likely be incorporated into a city sometime in the future. By law, all cities must establish urban growth boundaries so they can reasonably plan for future population growth. Areas within the urban growth boundary can be developed as if it is within the city limits, and have access to city services like water, sewer, and electricity. In many cases, it is very difficult to differentiate between the city limits and the urban growth boundary. Including the urban growth boundary, the population of Roseburg is approximately 34,000. By the year 2020, the population is expected to reach 46,000 people.

It is very possible that by the year 2020 Roseburg’s city boundary and urban growth boundary will expand. It is difficult to predict exactly how the boundaries will change because residents have a voice in the process of being included (annexed) into the city and urban growth boundaries. There have been cases of residents protesting their annexation while others lobby to be part of the city. Nevertheless, the Roseburg city officials have a general idea of how the city’s boundary and population will most likely change, and have planned their development strategies accordingly; the city actively updates its roads, water lines, and other services to accommodate projected future growth.

⁹³ Although there are still “out-of-staters” who move to the Roseburg area and are willing to pay high prices for housing, that trend has lessened; houses in 2002 are selling at lower prices than comparable housing in 1998.

Economic development

For many years the City of Roseburg has worked to diversify its economy and reduce the city's dependence on industries like timber and mining. To date the city has been very successful. Roseburg's location along I-5 and its position as county seat make it a natural location for many businesses, such as hotels and retail stores, and for government agencies. Strengthening the city's economic growth is still a primary goal, and the City of Roseburg is very active in its efforts to continue bringing diverse businesses and industries to the area. Recently, the city, the Roseburg Chamber of Commerce, Douglas, Coos, and Curry Counties, as well as other groups, formed the Umpqua Economic Development Partnership. The goal of this partnership is to attract businesses to the Umpqua Basin. This group has a full-time staff person who actively seeks out business opportunities for the Umpqua Basin, and is primarily responsible for Dell Computers' selecting Roseburg as the location for its newest call center.

To accommodate the businesses, manufacturing plants, and factories it is actively seeking, the City of Roseburg is making improvements within both the city limits and urban growth boundary. The city systematically upgrades utilities and expands these services to accommodate the future needs of prime industrial development sites. For example, the water main along Diamond Lake Boulevard was replaced with an 18-inch pipe. The city is doing similar work north of the city on Highway 99, so this area will be capable of meeting the needs of manufacturers.⁹⁴ Another activity aimed at attracting businesses is improving Roseburg's infrastructure. For example, there are plans to expand the airport to accommodate private jets, since access to air transportation is a necessity for many large businesses.

Another way that the City of Roseburg hopes to attract more industry is by improving the recreational opportunities and services within the city. Roseburg's mayor, Larry Rich, has recently established citizens' groups with the goal of developing plans for improving recreation, aesthetics, and revitalizing industrial areas. One group is evaluating waterfront development potential conditions along the South Umpqua River near downtown Roseburg. Although no decisions have been made, this group is exploring the possibility of expanding the park system, removing decrepit buildings, and attracting waterfront restaurants. Another citizen group is looking at improving Roseburg's bikeways, while the third is considering ways to revitalize the industrial areas along Diamond Lake Boulevard.

Current trends and future conditions

Roseburg officials believe the city's picturesque location, excellent climate, and proximity to recreational activities will encourage its continued growth. Officials are confident that their efforts to attract diverse business will have continued success and secure a positive economic future for the city. However, Roseburg officials are

⁹⁴ The City of Roseburg's municipal water rights are from the North Umpqua River. The water rights are substantial enough that city officials are confident that they will be able to support the needs of its growing population and that of multiple high water-use industries for many generations to come.

concerned that diminishing revenues resulting from measures five, 47, and 50 will limit their ability to maintain the quality of life expected by its citizens. Even if the economy is strong, tax-based revenues are necessary for the city to continue upgrading utilities and roads. Services that improve the city's livability, such as maintaining the city's parks and recreational facilities, are possible only through taxes. City officials hope taxpayers will recognize that without sufficient revenues, many of the services that residents enjoy every day will no longer be possible.

4.2.2. The City of Winston⁹⁵

The City of Winston's estimated population growth rate is 2.5% per year. According to the 2000 US Census, Winston's population was 4,613 people. Assuming a 2.5% growth rate, Winston's 2003 population is 4,968 people.

Population growth

Over the past 10 years, the City of Winston's population has increased by 25%. Job opportunities within the city have not increased at the same rate. City officials believe that Winston's growth is due to inexpensive housing costs and an abundance of flat, developable land compared to Roseburg and other nearby cities. This has made Winston an affordable place for people to purchase, rent, or build homes. Enrollment in Winston public schools has not followed the same growth trend as the city. This supports local observation that many of the newcomers to Winston are retirees.

Even with the influx of retirees, it is believed that approximately 50% of Winston's residents are low or moderate income, which means that half of the city's population earns less than 80% of the area's median income. As such, there is a strong need for affordable housing, such as manufactured homes, apartments, duplexes, and townhouses. Some groups are building affordable housing complexes in Winston, but many developers are focusing on upscale homes to attract higher-income retirees. Although bringing higher-income people to the city is desirable, the reality is that Winston needs more affordable housing. The city is working to increase the number of developments that cater to its low and moderate-income population.

Local observation suggests that many of Winston's young adults do not stay in the city. Officials believe that Winston's manufacturing, retail, and service-oriented job market is not attractive to young adults, so they leave to find better opportunities elsewhere. Many people believe that Winston's older population is growing, while the number of young adults is decreasing.

Economic development

Although Winston is economically depressed, officials do not believe it is in the city's best interest to increase industrial development within its urban growth boundary. Winston officials support the efforts of groups like the Umpqua Economic Development Partnership, and believe the city's residents will benefit from industrial development in Roseburg and along I-5. Winston also highly prizes its small-town atmosphere, close-

⁹⁵ This information is primarily from an interview with Bruce Kelly, City Administrator for the City of Winston.

knit neighborhoods, and slower pace. Officials believe that increasing heavy or light industry within the urban growth or corporate city boundaries would reduce the quality of life the city's residents enjoy.

Winston officials would like to increase retail and tourism-related businesses within the city. Winston has an abundance of second-hand shops, but has few stores that deal in new clothing, kitchenware, and other household goods. Despite less costly rents compared to Roseburg, it is difficult for Winston-area stores to compete with stores in its larger neighbor, since most residents are accustomed to shopping in Roseburg. City officials believe that specialty retail stores could be very successful in Winston. For example, the city currently has a shop that specializes in decorative rubber stamps and stamping-related products. Stamping is a popular hobby, and this business attracts many customers beyond the city limits. Winston officials believe that other specialty stores could find equal success in their city.

Winston is probably best known as the location of Wildlife Safari, which attract upwards of 150,000 visitors per year. The access road to Wildlife Safari is on the eastern edge of town; few tourists to the game park travel the extra distance to visit Winston, possibly because there are no attractions within the city. Winston is also on a main route to the coast, but the lack of tourist-oriented businesses results in few of these travelers spending money in the city. Winston officials believe the city could capitalize on the large number of people that visit the area every year by providing more tourist-oriented attractions. The city is opportunistically pursuing a variety of options, including supporting the establishment of an old-fashioned metal and glass foundry.

City services

Compared to other Douglas County cities and towns, Winston is very young. The city was incorporated in 1953, but the Winston-Dillard Water District predates the city. The community's water source is from water rights from the South Umpqua River. In the summer, water availability is a problem for the community, but the district purchases additional water from Ben Irving Reservoir and has the ability to purchase water from Galesville Reservoir. The Water District plans to acquire additional water from the reservoirs over the next several years. Within the next five years, the Water District plans to upgrade the water treatment facility.

In 2000, the Winston-Green wastewater treatment plant completed over six million dollars worth of upgrades in anticipation of stricter water quality standards. However, the upgrades did not increase the plant's wastewater treatment capacity. Should the City of Winston continue to grow at its current rate, in 10 years the wastewater treatment plant will need to be expanded.

Winston officials are hoping to increase the number of parks within the city limits to create more green space. Along the South Umpqua River south of Highway 42, the city would like to establish a park that could also serve as a floodway. If possible, the city will build a bike path along parts of the river as well as benches and picnic tables. Officials believe that creating more green space through this and other parks will provide

more recreational opportunities and therefore improve the overall quality of life in the city.

The future of Winston

Twenty years from now, the City of Winston expects its population to reach 10,000 residents. At that time, the city hopes that it will have successfully increased its green space and have a community center. Officials also hope to improve transportation choices by expanding the sidewalk system and building a network of bike paths. Officials would like to eventually establish and maintain a citywide public transportation system, which would reduce older and low-income residents' need to drive.

When asked what factors would most likely have the greatest impact on the city, officials identified economics and population changes. Like many other economically depressed cities, Winston relies heavily on state-shared revenues, such as those that come from liquor and cigarette taxes. These funds are distributed based on population. Should these funds decrease or become unavailable to Winston, the city would face financial hardships and would be unable to continue to provide some services to its residents.

The city would also struggle if it had a sudden change in population. For example, if Roseburg Forest Product's mill in Dillard closed, many city residents would move elsewhere, since the mill is a primary employer in the area. This type of sudden population drop could turn Winston into a ghost town. A sudden boom in population would also be hard to manage. The city's urban growth boundary and development activities are sufficient to manage its current growth rate for the next 20 years. However, in the event of a sudden, high demand for housing in the area, the city would have difficulties providing the necessary services.

4.2.3. Agricultural landowners⁹⁶

Farmers in the Umpqua Basin/Douglas County area produce a variety of agricultural goods, including corn, beans, alfalfa, peaches, strawberries, filberts, and grapes for wine. Livestock operations mostly raise beef cattle and sheep, with a small number of poultry operations.⁹⁷ Approximately 58% of the Lower South Umpqua Watershed is zoned for agriculture, and 94% of the watershed is privately owned (see section 1.3.1).⁹⁸ The agricultural community could potentially have the greatest influence on fish habitat and water quality restoration efforts in the Umpqua Basin. Barriers to farmer and rancher participation in fish habitat and water quality activities are limited time, limited money, and in many cases low awareness or understanding of restoration project requirements, benefits, and funding opportunities.

⁹⁶ The following information is primarily from interviews with Tom Hatfield, the Douglas County Farm Bureau representative for the Umpqua Basin Watershed Council, and Kathy Panner, a member of the Douglas County Livestock Association. Shelby Filley from the Douglas County Extension Service and Stan Thomas from the USDA Wildlife Services provided additional information.

⁹⁷ There are people who raise pigs, dairy cows, horses, llamas, and other animals, but few are commercial operators.

⁹⁸ Many farmers and ranchers are also forestland owners (see section 4.2.4).

Agricultural producers

Local observation suggests that there are four types of agricultural producers in the Umpqua Basin/Douglas County area. The first group is people who have been very successful in purchasing or leasing large parcels of lands, sometimes thousands of acres, to run their operations. This group generates all their income from agricultural commodities by selling very large quantities of goods on the open market. The second group is medium to large-sized operators who are able to support themselves by selling their products on the direct market (or “niche” market). This group is able to make a profit on a smaller quantity of goods by “cutting out the middlemen.” The third group is smaller operators who generate some income from their agricultural products, but are unable to support themselves and so must have another income as well. The last group is “hobby” farmers and ranchers who produce agricultural goods primarily for their own enjoyment and have no plans in place to make agricultural production their primary income source. Agricultural hobbyists often produce their goods to sell or share with family and friends. In many cases, members of this group do not identify themselves as part of the agricultural community. Observation suggests that in Douglas County the few very large operators are continuing to expand their land base. At the same time, smaller operators who hold outside jobs and agricultural hobbyists are becoming more common.

Factors influencing farmers and ranchers

Weeds

One concern for farmers and ranchers is weeds. There are a greater variety and distribution of weeds now than there were 20 years ago, including gorse, Himalayan blackberry, a variety of thistles, and Scotch broom.⁹⁹ Many of these species will never be eradicated; some, like Himalayan blackberries, are too widespread, and others, like Scotch broom, have seeds that can remain viable for at least 30 years.

Weeds are a constant battle for farmers and ranchers. These plants often favor disturbed areas and will compete with crops and pastures for water and nutrients. Many weeds grow faster and taller than crops and compete for sunlight. On pasturelands, weeds are a problem because they compete with grass and reduce the number of livestock that the land can support. Some species are poisonous; tansy ragwort is toxic to cattle, horses, and most other livestock except sheep. Whereas foresters must battle weeds only until the trees are “free to grow,” farmers and ranchers must constantly battle weeds every year. As a result, an enormous amount of time, effort, and money is invested for weed management, which reduces profits and can drive smaller operators out of business.

Predators

Predators have always been a problem for ranchers. Cougar, coyote, and bear cause the most damage, but fox, bobcat, domestic dogs, and wolf/dog hybrids have also been documented killing and maiming livestock.¹⁰⁰ Prior to the 1960s, the US Department of

⁹⁹ Tansy ragwort is less common today than 10 years ago due to the introduction of successful biological control methods.

¹⁰⁰ The last confirmed wild wolf sighting in Douglas County occurred in the late 1940s. Wolf/dog hybrids are brought to the Douglas County/Umpqua Basin area as pets or for breeding and escape or are intentionally released.

Agriculture (USDA) handled all predator management in Douglas County. The county took over all predator control programs in the 1960s until 1999. Now, the USDA once again handles all predator management.

The populations of cougar and bear appear to be on the rise, which is due, in part, to changes in predator control regulations.¹⁰¹ These species are territorial animals. As populations increase, animals that are unable to establish territories in preferred habitat will establish themselves in less suitable areas, which are often around agricultural lands and rural residential developments. Some wildlife professionals believe that cougars are less shy than they have been in the past, and are becoming increasingly active in rural and residential areas. As cougar and bear populations continue to rise, so will predation by these species on livestock. It is also possible that incidents involving humans and predators will increase as well.

Contrary to popular belief, predators do not only kill for food. Local ranchers have lost dozens of sheep and cattle overnight to a single cougar. In these cases, only a few of the carcasses had evidence of feeding, which indicates that the cougar was not killing livestock for food. Small animals like sheep are easy prey, so some ranchers are switching to cattle. However, local observation indicates that cougar, bears, and packs of coyote are quite capable of killing calves and adult cattle as well.

Loss of quality farmland

Due in part to the difficulties facing today's ranchers and farmers, many young people are favoring other careers over agriculture. As a result, many agricultural lands are sold out of the original families. In some cases, the land is purchased by other nearby farmers and ranchers, and remains in production.¹⁰² Local observation suggests that new residents from outside of southwest Oregon purchase some of these agricultural lands. In the case of smaller operations, new owners are often unable to turn a profit. Some residents suggest this may be because the newcomers do not understand local conditions or the specific needs of the property and are therefore unable to manage it profitably. In other cases, family farms and ranches are purchased by developers and divided into smaller lots for hobby farms, or converted into residential developments and taken out of production entirely. Statewide, there were 18.1 million acres of farmland in 1980; this number dropped to 17.2 million acres in 2000. This averages to be a loss of 45,000 acres of Oregon farmland per year.¹⁰³

Regulations

Another concern for ranchers and farmers is the threat of increasing regulations. Since the 1970s, farmers and ranchers have had to change their land management practices to comply with stricter regulations and policies such as the Endangered Species Act, the

¹⁰¹ Cougar populations have been increasing since protection laws were passed in the 1960s. Coyote, fox, bobcat, and other predator populations appear to be stable.

¹⁰² The topography of the Umpqua Basin makes this area undesirable to large agricultural conglomerates.

¹⁰³ Data are from the 2000-2001 Oregon Agriculture and Fisheries Statistics publication compiled by the US Department of Agriculture. A farm is defined as a place that sells or would normally sell \$1,000 worth of agricultural products.

Clean Water Act, and the Clean Air Act. The costs associated with farming and animal husbandry have increased substantially, partially attributable to increased standards and restricted use of pesticides, fertilizers, and other products. More regulations could further increase production costs and reduce profits.

Market trends

Perhaps the most important influence on agricultural industries is market trends. In the United States, there are around 10 food-marketing conglomerates that control most of the agricultural market through their immense influence on commodity prices. These conglomerates include the “mega” food chains like Wal-Mart and Costco. Also, trade has become globalized and US farmers and ranchers are competing with farmers in countries that have lower production costs because they pay lower wages, have fewer environmental regulations, and/or have more subsidies. The conglomerates are in fierce competition with one another and rely on being able to sell food at the lowest possible price. These food giants have no allegiance to US agriculture, and the strength of the dollar makes purchasing overseas products very economical. On the open market, US farmers and ranchers must sell their goods at the same price as their foreign competitors or risk being unable to sell their products at all. In many cases, this means US producers must sell their goods at prices below production costs. As a result, it is very difficult for all but the very largest producers to compete with foreign agricultural goods, unless they are able to circumvent the open market by selling their goods directly to local or regional buyers (“niche” marketing).

The future of local agriculture

The future of farmers and ranchers depends a lot on the different facets of these groups’ ability to work together. The agricultural community tends to be very independent, and farmers and ranchers have historically had limited success in combining forces to work towards a common goal. By working together, Oregon’s agricultural community may be able to overcome the issues described above. If not, it is likely that in the Umpqua Basin hobby farms and residential developments will replace profitable family farms and ranches.

4.2.4. Family forestland owners¹⁰⁴

The term “family forestland” is used to define forested properties owned by private individuals and/or families. Unlike the term “non-industrial private forestland,” the definition of “family forestlands” excludes non-family corporations, clubs, and other associations. Of the 12,793 forested acres in the watershed, approximately 86% are non-industrial private forestlands. Family forestlands most likely constitute a slightly smaller percent of the private non-industrial forests.

¹⁰⁴ The following information is from an interview with Bill Arsenault, President of the Douglas Small Woodland Owners Association and member of the Family Forestlands Advisory Committee, and from “Sustaining Oregon’s Family Forestlands” (Committee for Family Forestlands, 2002). For more information about this document, contact Wally Rutledge, Secretary of the Committee for Family Forestlands, Oregon Department of Forestry, 2600 State Street SE, Salem, OR 97310.

Family forestlands differ from private industrial forests. Industrial timber companies favor expansive stands of even-aged Douglas-fir. Family forestlands are more often located in lower elevations, and collectively provide a mixture of young and medium-aged conifers, hardwood stands, and non-forested areas such as rangeland. Family forestland owners are more likely to manage their property for both commercial and non-commercial interests such as merchantable timber, special forest products, biological diversity, and aesthetics.

Family forestland owners play a significant role in fish habitat and water quality restoration. Whereas most public and industrial timber forests are in upper elevations, family forestlands are concentrated in the lowlands and near cities and towns. Streams in these areas generally have low gradients and provide critical spawning habitat for salmonids. As such, issues affecting family forestland property management may impact fish habitat and water quality restoration efforts.

Family forestland owners

Who are Douglas County's family forestland owners? In Oregon, most family forestland owners are older; nearly one in three are retired and another 25% will reach retirement age during this decade. Douglas County woodland owners seem to follow this general trend. Local observation suggests that many family forestland owners in Douglas County are either connected to the timber industry through their jobs or are recent arrivals to the area. The impression is that many of the latter group left higher-paying jobs in urban areas in favor of Douglas County's rural lifestyle. In general, few family forestland owners are under the age of 35. It is believed that most young forestland owners inherit their properties or have unusually large incomes, since the cost of forestland and its maintenance is beyond the means of people just beginning their careers.

Factors influencing family forestlands

Changing markets

There are very few small private mills still operating in Douglas County, so timber from family forests is sold to industrial timber mills. Timber companies are driven by the global market, which influences product demand, competition, and production locations. As markets change, so do the size and species of logs that mills will purchase. Family forestland owners must continually reevaluate their timber management plans to meet the mills' requirements if they want to sell their timber. For example, mills are now favoring smaller diameter logs, and so family forestland owners have little financial incentive to grow large diameter trees.

Another aspect of globalization is a growing interest in certified wood products as derived from sustainably managed forests. Family forestland owners follow the Oregon Forest Practices Act. Many family forestland owners consider their management systems sustainable. The Committee for Family Forestlands is concerned that wood certification parameters do not take into account small forest circumstances and management techniques. They fear that wood certification could exclude family forest-grown timber from the expanding certified wood products market. However, the long-term effect of wood certification is still unclear.

Ultimately the key to continued family forestland productivity is a healthy timber market. Although globalization and certification may change the way family forestland owners manage their timber, foreign log imports have kept local mills in operation, providing a place for family forestland owners to sell their timber. The long-term impact of globalization on forestland will depend on how it affects local markets.

Indirectly, changes in the livestock industry also influence family forestland owners. The livestock market is down and many landowners are converting their ranchlands to forests. Douglas County supports these efforts through programs that offer landowners low-interest loans for afforestation projects.¹⁰⁵ Should the market for livestock remain low, it is likely that more pastureland will be converted to timber.

Land management issues

Exotic weeds are a problem for family forestland owners. Species like Scotch broom, gorse, and blackberries can out-compete seedlings and must be controlled. Unlike grass and most native hardwoods, these exotic species require multiple herbicide applications before seedlings are free to grow, which raises the cost of site maintenance by about \$200 per acre. The cost is not enough to “break the bank” but can narrow family forestland owners’ profit margins. The cost of weed control may increase if these exotic species and others such as Portuguese broom become more established in the Umpqua Basin.

Regulations

Many family forestland owners fear that increasing regulations will diminish forest management profitability. For example, some Douglas County forestland owners are unable to profitably manage their properties due to riparian buffer protection laws. Although most family forestland owners support sound management practices, laws that take more land out of timber production would further reduce the landowners’ profits. This would likely discourage continued family forestland management.

Succession/inheritance

Succession is a concern of many family forestland owners. It appears that most forestland owners would like to keep their property in the family; however, an Oregon-wide survey indicates that only 12% of private forestland owners have owned their properties since the 1970s. Part of this failure to retain family forestlands within the family unit may result from complex inheritance laws. Inheritors may find themselves overwhelmed by confusing laws and burdensome taxes and choose to sell the property. Statewide, over 20,000 acres of timberland leave family forestland ownership every year. Private industrial timber companies are the primary buyers. Although the land remains forested, private industrial timber companies use different management prescriptions than do most family forestland owners. Other family forestlands have been converted to urban and residential development to accommodate population growth.

¹⁰⁵ “Afforestation” is planting trees in areas that have few or no trees. “Reforestation” is planting trees in areas that recently had trees, such as timber harvest sites or burned forests. Contact the Douglas County Extension Forester for more information on this program.

4.2.5. Industrial timber companies¹⁰⁶

Most industrial timberlands are located in areas that favor Douglas-fir, which tend to be hillsides and higher elevations.¹⁰⁷ Higher gradient streams provide important habitat for cutthroat trout. Riparian buffer zones in stream headwater areas may influence stream temperatures in lower gradients.

In the Lower South Umpqua Watershed industrial timber companies own 940 acres, which is 7.3% of the total forested area in the watershed. These lands are intensively managed for timber production. For all holdings, timber companies develop general 10-year harvest and thinning schedules based on 45 to 60 year timber rotations, depending upon site indices.¹⁰⁸ The purpose of these tentative harvest plans is to look into the future to develop sustained yield harvest schedules. These harvest and thinning plans are very general and are modified depending on market conditions, fires, regulatory changes, and other factors, but are always developed to maintain sustained timber yield within the parameters outlined by the Oregon Forest Practices Act.

Current land management trends

Land acquisition

Most industrial timber companies in the Umpqua Basin have an active land acquisition program. When assessing land for purchase, industrial timber companies consider site index along with the land's proximity to a manufacturing plant, accessibility, and other factors. The sale of large private forestlands is not predictable, and it would be difficult for timber companies to try to consolidate their holdings to a specific geographic area. However, most land holdings and acquisitions by timber companies tend to be where conditions favor Douglas-fir production. While purchasing and selling land is commonplace, land exchanges are rare.

Weeds

Noxious weeds are a concern for industrial timber managers. As with family forestlands, species such as Scotch broom, hawthorn, and gorse increase site maintenance costs. Weeds can block roads, which add additional costs to road maintenance. Some weeds are fire hazards; dense growth creates dangerous flash and ladder fuels capable of spreading fire quickly. To help combat noxious weeds, some industrial timber companies are working with research cooperatives to find ways of controlling these species.

Fire management

Fires are always a concern for industrial timber companies. The areas at greatest risk are recently harvested and thinned units, because of the flammable undecayed slash (debris) left behind. Timber companies believe that the fire risk is minimized once slash begins to

¹⁰⁶ The following information is primarily from an interview with Dick Beeby, Chief Forester for Roseburg Forest Product's Umpqua District, and Jake Gibbs, Forester for Lone Rock Timber and President of the Umpqua Chapter of the Society of American Foresters.

¹⁰⁷ Hillsides and higher elevations are often a checkerboard ownership of Bureau of Land Management administered lands (see section 4.2.6) and industrial timberlands.

¹⁰⁸ Site index is a term used to describe a specific location's productivity for growing trees. Specifically, it relates a tree's height relative to its age, which indicates the potential productivity for that site.

decay. Although many timber companies still use prescribed burning as a site management technique, it is becoming less common due to regulations and the associated cost versus risk factors.

Road maintenance

Although a good road system is critical to forest management, poorly maintained roads can be a source of stream sediment and undersized or damaged culverts can be fish passage barriers. Roads on industrial timberlands are inventoried and monitored routinely. Problems are prioritized and improvements scheduled either in conjunction with planned management activities or independently based on priority. Currently, most industrial timber companies repair roads so they do not negatively affect fish habitat and water quality, such as replacing failing culverts with ones that are fish-passage friendly. Road decommissioning is not common, but is occasionally done on old roads. When a road is decommissioned, it is first stabilized to prevent erosion problems, and then nature is allowed to take its course. Although these roads are not tilled or plowed to blend in with the surrounding landscape, over time vegetation is re-established. New roads are built utilizing the latest technology and science to meet forest management objectives while protecting streams and other resources.

Community outreach

The population of Douglas County is growing, and local observation suggests that many new residents are retirees or transfer incomes from urban areas. Many of these new residents moved to the area for its “livability” and are not familiar with the land management methods employed by industrial timber companies. As a result, establishing and maintaining neighbor relations is becoming increasingly important. Many timber companies will go door-to-door to discuss upcoming land management operations with neighboring owners and address any questions or concerns that the owners may have. These efforts will continue as the rural population within the Umpqua Basin grows.

Regulations

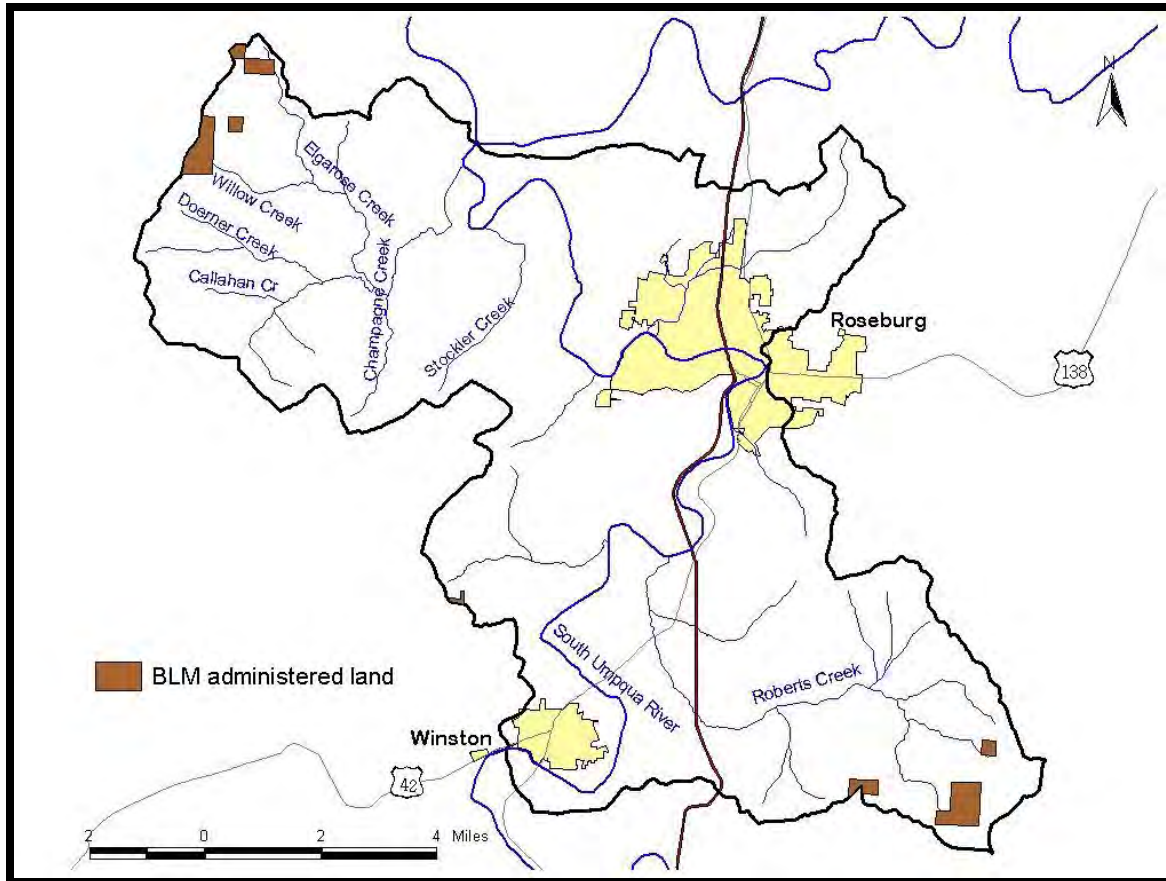
Increased regulations will most likely have the greatest impact on the future of industrial timber companies. Like family forestland owners, most industrial timber companies believe in following sound forest management principles and consider their current management systems sustainable. There is concern that the efforts and litigation that changed forest management methods on public lands will now be focused on private lands. Should forestry become unprofitable due to stricter regulations, industrial timber companies would most likely move their business elsewhere and convert their forestlands to other uses.

4.2.6. The Bureau of Land Management¹⁰⁹

The Roseburg District Office of the Bureau of Land Management (BLM) administers a total of 425,588 acres of which most is within the Umpqua Basin and all is within

¹⁰⁹ The following information is from the Roseburg District of the Bureau of Land Management’s 1995 Record of Decision and Resource Management Plan and the District’s Annual Program Summary and Monitoring Report for fiscal year 2000 to 2001.

Douglas County.¹¹⁰ In the Lower South Umpqua Watershed, the BLM administers approximately 1.2% of the watershed (see Map 4-1).



Map 4-1: Location of BLM administered lands in the Lower South Umpqua Watershed.

The Bureau of Land Management and US Forest Service activities within the range of the Northern Spotted Owl follow the guidelines of the 1994 Northwest Forest Plan. In compliance with this policy, the Roseburg BLM's District Office developed a Record of Decision and Resource Management Plan in 1995.¹¹¹ The plan outlines the on-going resource management goals and objectives for lands administered by the BLM. All of the BLM's activities are guided by the resource management plan, and this assessment summarizes the main points of the document.

General overview

The BLM Roseburg District Office's vision is that the "Bureau of Land Management will manage the natural resources under its jurisdiction in western Oregon to help enhance

¹¹⁰ Including 1,717 acres of non-federal land with federal subsurface mineral estate administered by the BLM.

¹¹¹ For copies of this document, contact the Bureau of Land Management Roseburg District Office at 777 Northwest Garden Valley Road, Roseburg, Oregon 97470.

and maintain the ecological health of the environment and the social well-being of the human population.” Ecosystem management is the strategy used by the Roseburg BLM to guide its vision:

Ecosystem management involves the use of ecological, economic, social, and managerial principals to ensure the sustained condition of the whole. Ecosystem management emphasizes the complete ecosystem instead of individual components and looks at sustainable systems and products that people want and need. It seeks a balance between maintenance and restoration of natural systems and sustainable yield of resources (p. 18).

The BLM manages all its land using two primary management concepts outlined in the Northwest Forest Plan. The first is “Ecological Principles for Management of Late Successional Forests.” One goal for this management concept is “to maintain late-successional and old-growth species habitat and ecosystems on federal lands.” The second goal is “to maintain biological diversity associated with native species and ecosystems in accordance with laws and regulations.”

The second management concept is the “Aquatic Conservation Strategy.” This strategy was developed “to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within them on public lands.” A primary intent is to protect salmonid habitat on federal lands administered by the Bureau of Land Management and US Forest Service through activities such as watershed restoration and protecting riparian areas.

Land use allocations and resource programs

As part of its strategy, the BLM has four land use allocations that are managed according to specific objectives and management actions/directions that contribute to the two primary management concepts. The first land use allocation is Riparian Reserves. These areas are managed to provide habitat for various wildlife species. The second is Late-Successional Reserves (LSR). These are managed to protect and enhance conditions of late-successional and old-growth forest ecosystems that provide habitat for many species such as the northern spotted owl. Third, Matrix Areas have multiple objectives, which include providing a sustainable supply of timber and other forest commodities, connecting late successional reserves, and providing habitat for organisms associated with young, mature, and older forests. The last land use allocation is Adaptive Management Areas, where the agency develops and tests new management approaches to integrate ecological health with other social parameters, such as economic stability. In the Roseburg BLM District, the Adaptive Management Area is located in the Little River Watershed. The BLM also manages for 20 specific resource programs such as wilderness, timber resources, rural interface areas, and noxious weeds. As with the land use allocations, there are specific objectives and management actions/directions for each of the resource programs that are congruent with the Northwest Forest Plan management concepts.¹¹²

¹¹² For specific information about land use allocations and management, see the BLM Roseburg District’s Resource Management Plan.

Current trends

A requirement of the Roseburg District BLM's Resource Management plan is to publish a report on its annual activities. This document is called the Annual Program Summary and Monitoring Report.¹¹³ It describes the BLM's accomplishments during the fiscal year, provides information about its budget, timber receipt collections, and payments to Douglas County.

Overall, the Roseburg BLM District is implementing the Northwest Forest Plan. The BLM met its goals for its land use allocations and for many of its resource programs, such as "water and soils" and "fish habitat." However, uncertainty surrounding the Survey and Manage standard, as well as on-going litigation, has affected the BLM's ability to implement some of its program elements.¹¹⁴ For the third year in a row, the BLM's forest management and timber resource program did not come close to achieving its goal of sustainably harvesting 45 million board feet (MMBF) of timber. During fiscal years 1996 through 1998, the BLM came close to or exceeded its 45 MMBF goal. In 1999, harvests fell to 10 MMBF (22% of goal), and then dropped to 1.4 MMBF in 2000 (3% of goal). In 2001, harvest levels climbed slightly to 2.7 MMBF (6% of goal). Under the Resource Management Plan, more acres of BLM-administered forested lands are approaching late-successional stage than are being managed for timber.

Future of BLM management

The BLM's Resource Management Plan is the guide to all of the BLM's activities and is not subject to casual changes. There are three situations that may result in significant alterations to the current plan. First, major policy changes, such as modifying the Northwest Forest Plan, would require the BLM's Resource Management Plan to be updated so it corresponds with new policies. Second, landscape-wide ecological changes, such as a 60,000-acre fire or a landscape-wide tree disease outbreak, could require changes to the BLM's current plan. Finally, the Resource Management Plan is slated for evaluation in 2005. At that time, the current plan would be evaluated to ascertain if newer information or changed circumstances warranted an amendment or revision of the Resource Management Plan. In all cases, the public has the opportunity to review and comment on an amendment or revision of the plan.

4.2.7. Oregon Department of Environmental Quality¹¹⁵

The Oregon Department of Environmental Quality (ODEQ) plays an important and unique role in fish habitat and water quality restoration. ODEQ's primary responsibility is to support stream beneficial uses identified by the Oregon Water Resources Department through the following activities:

¹¹³ Copies of the Roseburg District BLM's Annual Program Summary and Monitoring Report from fiscal year 2001 are available through the Roseburg District Office.

¹¹⁴ The Northwest Forest Plan's Survey and Manage standard requires that all agencies conduct surveys prior to any activities on public lands to identify resident species of which little is known (such as mosses, mollusks, and fungi) and develop appropriate management strategies. Depending on the specific species requirements, surveys for a project can take two years or more to complete.

¹¹⁵ The following information is primarily from an interview with Paul Heberling, a water quality specialist for the Oregon Department of Environmental Quality in Roseburg.

- Establishing research-based water quality standards;
- Monitoring to determine if beneficial uses are being impaired within a specific stream or stream segment; and
- Identifying factors that may be contributing to conditions that have led to water quality impairment.

Approximately every three years, ODEQ reassesses its water quality standards and streams that are 303(d) listed as impaired. Throughout the development and reassessment of water quality standards, ODEQ attempts to keep the public involved and informed about water quality standards and listings. All sectors of the public, including land managers, academics, and citizens-at-large, are encouraged to offer input into the process. Water quality standards and 303(d) listings may be revised if comments and research support the change.

Current and future efforts

To fulfill its responsibilities into the future, ODEQ will continue to prioritize areas that are important for the various beneficial uses through their own research and the research of other groups. When these areas have been identified and prioritized, ODEQ will examine current land use practices to determine what changes, if any, will benefit preserving and/or restoring resources. Also, ODEQ will continue its efforts to work with individuals, agencies, citizen groups, and businesses to encourage them to voluntarily improve fish habitat and water quality conditions.

ODEQ hopes that education and outreach will help residents understand that improving conditions for fish and wildlife also improves conditions for people. For example, well-established riparian buffers increase stream complexity by adding more wood to the stream channel. Increased stream complexity provides better habitat for fish. It also helps downstream water quality by trapping nutrients and preventing stream warming, which can lead to excessive algae growth and interfere with water contact recreation.

Potential hindrances to water quality restoration

One hindrance to ODEQ's work is the financial reality of many water quality improvement activities. In some cases, the costs associated with meeting current standards are more than communities, businesses, or individual can easily absorb. For example, excessive nutrients from wastewater treatment plants can increase nitrate and phosphate levels and result in water quality impairments. The cost for upgrading a wastewater treatment plant can run into tens of millions of dollars, and is usually passed on to the community through city taxes and higher utility rates. Upgrading septic systems to meet current standards can cost a single family in excess of \$10,000, more than many low and middle-income rural residents can afford. People's interest in improving water quality often depends on the degree of financial hardship involved.

Another potential hindrance to ODEQ's work is budget cuts and staff reductions. There are two Healthy Stream Partnership positions assigned to the Umpqua Basin, which is approximately three million acres. Without sufficient funding or personnel, it is difficult

for ODEQ to conduct its basin-wide monitoring activities and reassess current water quality standards and impaired streams.

Current and potential future water quality trends

Although many Umpqua Basin streams and reaches are water quality impaired, current trends indicate that conditions are improving. In 1998, there were 1,067 streams or stream segments identified as failing to meet one or more of Oregon's water quality standards. Of these, approximately 10% were in the Umpqua Basin.¹¹⁶ Table 4-1 shows by parameter the number of Umpqua Basin streams failing to meet water quality standards.

Parameter	# of listed streams or reaches	Parameter	# of listed streams or reaches
Ammonia	1	Iron	4
Aquatic weeds/algae	3	Lead	3
Arsenic	4	Manganese	2
Biological criteria	7	Mercury	4
Cadmium	1	pH	14
Chlorine	2	Phosphorus	1
Copper	2	Sediment	7
Dissolved oxygen	7	Temperature	180
<i>E. coli</i> and fecal coliform	14	Total dissolved gas	4

Table 4-1: Number of Umpqua Basin 303(d) listed streams by parameter.

Accordingly, the focus for preservation and restoration efforts is directed toward improving stream temperature and bacterial levels to support the various beneficial uses. Improving stream temperature may provide the greatest cost-benefit ratio because temperature is a major factor in impacting or exacerbating other water quality parameters, including dissolved oxygen, pH, bacteria, and ammonia. Land management activities that reduce the rate of stream warming, such as establishing functional riparian buffers, can also improve other water quality parameters, such as sedimentation. Reducing bacteria levels is also a focus because of the serious human health risks associated with fecal bacteria. There is a clear rationale for activities that reduce bacteria levels, such as fixing failing septic systems and reducing the amounts of fecal wastes reaching streams from livestock, pets, and other sources.

Data from ODEQ long term monitoring sites in the Umpqua Basin indicate that between 1989 and 1998, water quality conditions of many Umpqua Basin rivers and streams improved. The South Umpqua River at Melrose Road, Stewart Park Road, Winston, and Days Creek Cutoff Road, as well as Cow Creek at the mouth, Calapooya Creek at Umpqua, and the North Umpqua at Garden Valley Road, are listed as sites that have

¹¹⁶ See section 3.3.1 for more information about 303(d) listed streams in the Lower South Umpqua Watershed.

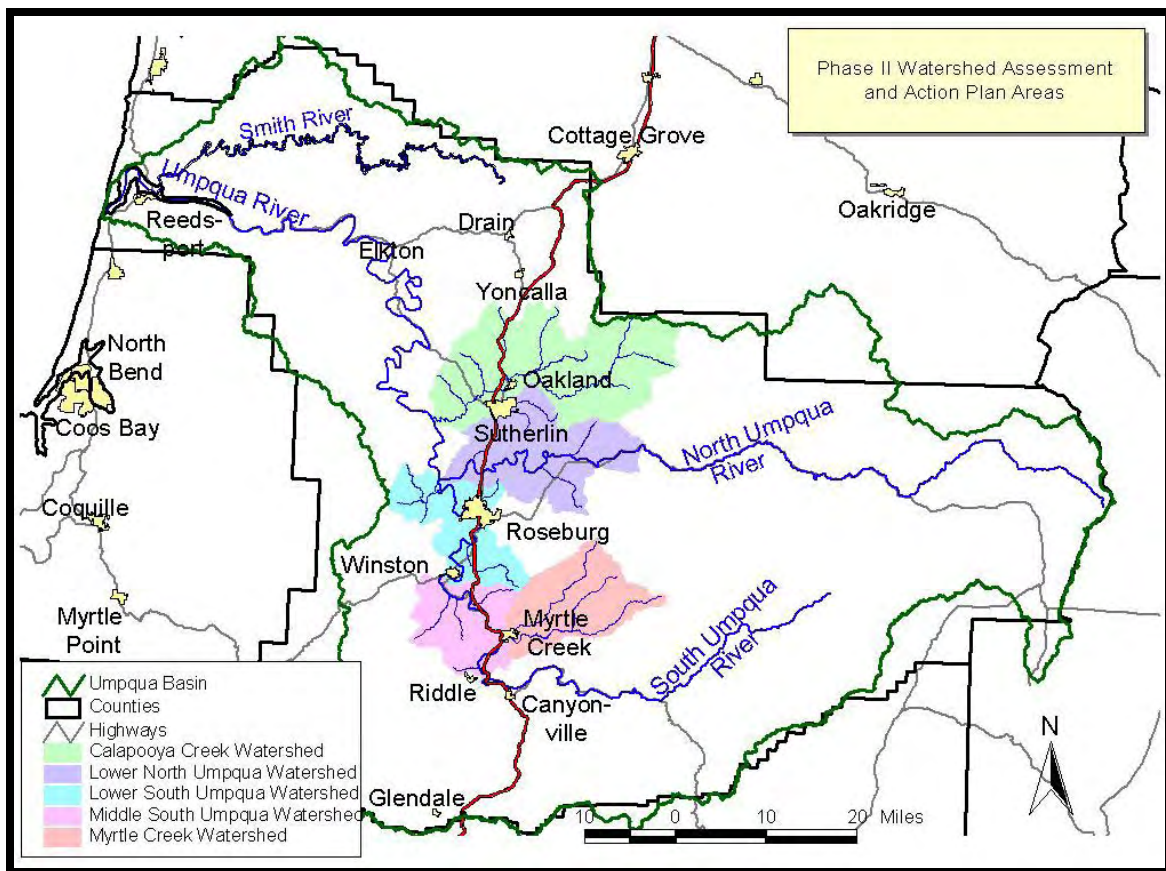
shown significant improvement. From these data, ODEQ believes that continuing to support beneficial uses through water quality improvement activities will insure a bright future for fish habitat and water quality in the Umpqua Basin.

5. Landowner Perspectives

This chapter provides insight into the thoughts, opinions, and perspectives of landowners in the Umpqua Basin.

5.1. Overview

The Lower South Umpqua Watershed assessment was part of phase II of the UBWC's watershed assessment and action plan program. The document was written during the same general time period as assessments for four other watersheds along I-5: Calapooya Creek, Lower North Umpqua, Lower South Umpqua, and Middle South Umpqua (see Map 5-1).



Map 5-1: Phase II watershed assessment and action plan areas.

The coordinator for the phase II watershed assessments started conducting landowner interviews for the past conditions section as suggested in the Oregon Watershed Assessment Manual. Some interviewees have lived in the Umpqua Basin area for most of their lives and had a wealth of historical knowledge. Other landowners were recent arrivals who knew little about the area's history, but had unique perspectives about land management, fish habitat, life as a "newcomer," and other topics. In the end, the interviews were most valuable because of the insight they provide into the different

perspectives, opinions, and thoughts of Umpqua Basin landowners. Therefore, interviews from all five watersheds are included in this chapter.

5.2. *Landowner interviews*

Mr. and Mrs. A; Lower South Umpqua Watershed

Mr. and Mrs. A are recent residents of the Winston area and own a sheep ranch in Lookingglass, which is managed by one of their children. An unfenced stream flows through their property, but heavy brush and blackberries prevent sheep access. The couple says they have never seen fish in the stream, but they also rarely go down to look.

Although these landowners have not been in Oregon long, they have been farming and ranching their entire lives. The A's feel that farmers and ranchers are often wrongly accused of being the primary contributors to environmental problems. The A's believe that farmers and ranchers are among the best stewards of the earth; they manage their property to produce quality crops while protecting the land. As Mrs. A stated, "a farmer who manages his land poorly is only hurting himself." Mrs. A points out that their heavily grazed 100 acres all have healthy, green grass and there is no evidence of soil erosion, even on steep slopes. This couple rotates their sheep pasture to allow the land to recuperate, as all good ranchers do.

These landowners are very concerned that the "global market" is hurting local agriculture. Mr. and Mrs. A believe that Oregon is, for the most part, capable of feeding itself. Douglas county farmers grow fruits and vegetables and ranchers raise cattle, sheep, and hogs. These landowners feel that Americans need to buy US-grown products. Why purchase New Zealand lamb when Oregon lamb is not only better quality, its purchase supports the community? Mrs. A states that developing countries like Mexico do not have the same environmental standards as the US, and imported agricultural products may be contaminated by US-banned chemicals. This couple feels very strongly that if the global food market continues as it is, US farmers will lose their way of life.

Mr. B; Lower South Umpqua Watershed

A lifetime Winston-area resident, Mr. B has lived more than 60 years on a farm by the South Umpqua River. His father farmed the same property before him. Mr. B had a day job for most of his working life but was able to earn additional income through farming and ranching his 80 acres. We discussed what has changed since his childhood, current issues, and the future of the Winston-Roseburg areas.

Aspects of the river channel have changed since Mr. B was young. A gravel bar located upstream of the Happy Valley bridge has grown at least 100 feet, and many of the stream bank features he vividly remembers as a child are gone. Mr. B believes that the river's features have changed because the direction of flow has shifted and eroded banks. He pointed out full-sized trees in his riparian area that are tipping towards the river, which he said is a sign of bank erosion. When asked why he thinks this happens, he stated that the complexities of stream flow dynamics make it impossible to pinpoint a single culprit.

Erosion has always occurred on the banks of the South Umpqua River to varying degrees. On his own property, Mr. B pointed out slumping on the riverbank. These are recent slumps that did not occur during flood events. Although they are now overgrown with herbaceous plants, Mr. B stated that without trees, these slumps are more susceptible to erosion. He made it clear that bank erosion, like slumping, can occur at any time of the year. Mr. B believes that flood events cause the most damage to stream banks.

Mr. B doesn't think that normal flooding rates or levels have changed. Using Oregon Department of Water Resources data, Mr. B showed that since 1950, the river has been above 26 feet nine times. The floods are random and don't appear to have become more or less severe. However, Mr. B believes that extreme floods are not as severe as in the past. Although he doesn't have exact figures, Mr. B believes the 1964 flood levels were higher than the 1996 flood

When asked why slumping and bank erosion occur (other than because of streamflow changes and flooding), Mr. B suggested that a growing nutria population might be a culprit (he says the beaver population has remained stable). Nutria are an introduced species that burrow into streambanks. Their burrows create weak points on the bank and encourage erosion during high water. Also, livestock are a problem. Where ranchers allow their livestock to drink from the river, the banks are often denuded, and erosion is a problem. Mr. B fenced his riparian area over 35 years ago, and uses a stock water system for his cattle. He has a very lush riparian area.

Mr. B commented on changes in water quality. During his childhood, he regularly drank from the river. Now he would never consider doing so. Not only does he know what's occurring upstream, but also algae sometimes grows over a third of the river's surface, and he frequently observes foam floating on the water. When asked what the foam was from, he said he didn't know for sure, but suspected it might originate at one of the upstream mills or wastewater treatment plants. Although the South Umpqua was always turbid right after a storm event, it seems to take longer now for the river to run clean again than when he was younger. Not being much of a fisherman, Mr. B couldn't comment on changes in fish populations. He did say as a child there were catfish in the river and an abundance of bullfrogs. He has not seen a catfish nor heard a bullfrog in over 25 years. When asked why he thought that might be, Mr. B said he suspects that the introduced bass might be the cause.

Except for changes in size and ownership, the primary industries in the Winston-Roseburg area have remained the same. The South Umpqua River supported many mom-and-pop mills and small-scale gravel mines. Since his youth, the many, small mills have been replaced with fewer, large mills. Similarly, aggregate gravel has been mined from the South Umpqua for as long as he can remember. There were always many small commercial mines, and most riverside landowners would freely take the aggregate they needed. Now, the small aggregate mines are gone and have been replaced by large-scale mines. Mr. B has noted that where large-scale gravel mining occurs next to the river, the channel fills with sediment and becomes wider, shallower, and the river's direction of flow shifts. To make his point, Mr. B provided Photo 5-1 and Photo 5-2 that show how

during high flows, the South Umpqua River can inundate gravel mines. This landowner didn't comment on the effects that many small mines had on the river.



Photo 5-1: Gravel mine along the South Umpqua River during high water.

According to Mr. B, the number and size of farms, as well as the types of crops, have changed since his youth. His father, like most farmers, was able to support his family through agriculture alone. Fifty years ago, most farmers had substantial acreage and grew a variety of fruits and vegetables and had pasture for livestock. Much of the Winston area had orchards. Over time, the orchards, especially pears and plums, were replaced with other crops. When asked why this happened, Mr. B said that pears and plums are more labor-intensive than other crops, and as the cost of workers increased, orchards became less profitable. Mr. B stated that the cost of labor has continued to rise, so most farmers are unable to support their families from agriculture alone. Now, farms are smaller and most farmers hold day jobs in addition to growing crops, hay, or grazing livestock. Only very large properties with intensive agricultural practices are able to support a family.

Mr. B commented that overall, people's activities on the land and in the river have improved since his youth. Before, landowners didn't know better and would do things that damaged the environment, like driving tractors into streams. Now we know better and have established laws to protect the river and other natural resources. Mr. B pointed out that unfortunately, there always seems to be ways around the laws. He is very concerned that an adjacent, upstream property purchased by Beaver State will be mined

for river aggregate. The site of the proposed mine is prime farmland with excellent soil, and Mr. B believes that prime farmland is supposed to be protected under the law. In addition, Mr. B is downstream of the proposed gravel mine; he is concerned that an aggregate mine will cause the river to change its course and erode his banks and topsoil.



Photo 5-2: Gravel mine along the South Umpqua River during normal flows

Mr. B believes that to ensure economic stability, the Roseburg-Winston area needs to attract diverse industries. In the past, a variety of businesses have come and gone but no big businesses have stayed for any length of time. Mr. B believes that increasing tourism is not the answer. He says that Roseburg, Winston, and other towns along I-5 are places where tourists stop on their way elsewhere, not a place where people stop to visit for a long time. The increase in retirees from California and other states settling in this area has helped some, since retirees spend money and purchase locally grown produce. This landowner states that he is willing to accept the fact that population growth is unavoidable and has an overall affect on the area. However, he would rather not have such growth. Mr. B states that he does not think all growth is from California, and they should not take all the blame or the credit for changes in the area.

When asked what will have the single greatest impact on the future of the Winston-Roseburg area, Mr. B identified the area's population growth. He recognizes that we can't turn the clocks back to 1945. The area's population is growing and Mr. B feels we need to plan appropriately to make the best use of our resources. Across from his house on a hill is a new housing development. Although he is not delighted with the change in

view, Mr. B agrees that putting in new housing on poorer, upland soil is much better than filling in the formerly abundant wetlands or subdividing farms to build housing for more people. Mr. B also stated that quality gravel used for cement and roads can be obtained from upland quarries instead of using river aggregate. This landowner is concerned that unless we plan well, the Roseburg-Winston area will have the same fate as the East and the Seattle-Portland areas; money will be in abundance but quality food, water, and air will be limited. Only by managing our area's resources for the best uses will we be able to accommodate a growing population and protect our natural resources.

Like Mr. and Mrs. A, Mr. B believes that North American Free Trade Agreement (NAFTA) and the global market hurt local farmers. He states that US labor is too expensive compared to other nations and farmers can't turn enough of a profit. Therefore, in the future most farmers will be like him; those who continue to farm because they enjoy the lifestyle and the additional source of income. Mr. B is concerned that today's youth are not interested in farming; they perceive it as requiring too much work for the financial benefit.

Mr. C; Lower South Umpqua Watershed

Mr. C offers an interesting perspective as a newcomer to the Roberts Creek area. He and his wife moved up permanently from southern California a year before the interview. When asked what brought him to the area, he said that they have family on Roberts Creek, and life in southern California was becoming too expensive and hectic. He and his wife wanted to live somewhere peaceful where they could have some property. Their 12-acre parcel has brought them just that. When asked if he faced any hostility from locals because he's from California, he said no. Mr. C believes that most of the anti-California attitude is directed at businesspeople who come to this area and bring with them the fast-paced, high stakes approach to life. Overall, local residents have been very nice to Mr. C, but then he has adapted himself to the slower pace of life along Roberts Creek.

Roberts Creek runs through Mr. C's land, and he pointed out the bare, eroded banks. Mr. C hasn't lived on his property long enough to know the flood trends. However, he reported that the neighbors, who are long-time residents, are very concerned with the stream changing its course and would like Roberts Creek to stay where it belongs. Mr. C didn't mention any activities the neighbors had done, if any, to prevent stream meandering. Mr. C is looking at options to prevent further erosion of Roberts Creek stream banks within his property.

Mr. C reported a stream-related incident that he found curious. Last spring, Pacific Power needed to replace power line poles on either side of the Roberts Creek reach on Mr. C's property. There is no bridge across the stream, but Mr. C has an established crossing that he uses to reach his pasture on the other side of the creek. That pasture can also be accessed via a vacant lot off of Carnes Road. According to Mr. C, the contractors working for Pacific Power created a new stream crossing to reach the other side of Robert's Creek rather than using the Carnes Road access. He also stated that they tore up the active channel doing so. Mr. C told the contractors they needed to return and clean

up the mess. The contractors didn't return until December, at which point Mr. C was told the ground was too wet for anything to be done, although they promised to come back when the ground was dry. The UBWC recommended Mr. C contact Pacific Power and report the incident.

Mr. D; Myrtle Creek Watershed

Mr. D is an Oregon native who moved to the San Francisco Bay area and then returned to Oregon. He and his wife have lived on over 100 acres of timberland on a North Myrtle Creek tributary since the late 1970s. Mr. D teaches at a nearby school.

Earlier last century, Mr. D's property was the site of a small mill. In the 1950s, the property was heavily logged and not replanted but did regenerate naturally. Mr. D did a logging operation on his property in 1979. Now, this landowner mostly manages his timber using selective cutting. Using this method, Mr. D can obtain all the firewood he needs and periodically harvest some logs. Mr. D does not have enough property to harvest timber every year, but once every five years or so, he is able to cut enough logs to provide some additional income. Mr. D avoids tree planting by encouraging natural regeneration. He uses hand methods rather than chemical sprays to control competing vegetation. Fifteen years ago, this landowner planted knobcone pine on southern slopes. Unfortunately, they are not doing well. Mr. D speculates that drought may have made these trees susceptible to bark beetle attack.

When asked if his land management method was pretty common in his area, he said that it varies. Mr. D pointed out that most of the timberland in Myrtle Creek is either federally managed or owned by private industrial timber companies. As for small woodland owners, some do little or no active management. These folks are often retirees from other areas. On the other hand, another couple nearby was short of cash and clearcut their entire property. These folks have yet to replant. As such, Mr. D could not generalize on how most small woodland owners manage their property.

Two creeks run through Mr. D's property. Neither stream is fish-bearing. Downstream from Mr. D's property, there are three culverts that may block fish passage. When asked about replacing the culverts, Mr. D said that he, and probably the neighbors as well, would not be interested. Without fish, Mr. D can block off the culvert during the summer months and store 80,000 gallons of water for fighting forest fires. The neighbors can create a small pond in their yard as well. These activities would not be possible if the stream had anadromous fish. Mr. D obtains all of his domestic water from springs further upstream.

As a side note, Mr. D stated that many people claim riparian trees do not reduce stream flow. From his observations, this timberland owner has concluded in large numbers, young alders can take up so much water that the stream flow is reduced to a trickle. As the alders mature, they naturally thin out and take up less stream water while providing shade.

When asked about changes in the streams, Mr. D stated that both of the creeks on his property have remained about the same over the last 25 years. Both creeks have ample riparian habitat, instream wood, and are well shaded. Mr. D has never noticed an erosion problem, although the streams become caramel-colored during “gully-washer” floods. There hasn’t been a really big flood in many years. The only long-term change in the stream that he’s noted is more brush, which is probably due to opening the forest canopy from his selective logging activities. There are probably few snags since Mr. D also occasionally removes dead trees for firewood.

Outside of the stream, Mr. D noted that he is seeing more invasive plant species. Four or five years ago, he started finding tansy ragwort and Scotch broom. To date, Mr. D has not found any gorse on his property, but it is not far away, and he suspects that eventually it will make its way to his area.

When asked about changes in the population, Mr. D noted that there are fewer active farms than before. Business in recent years has remained stable; small companies come and go, but the number of businesses and stores remains about the same. The population of Myrtle Creek is growing some due to an influx of retirees from other areas. This has resulted in more housing construction in the city. When asked what long-time residents feel about the newcomers, Mr. D concurred with Mr. C; attitude is everything.

Mr. D identified three major events in the past 25 years that he believes have changed Myrtle Creek. First, the nickel mine on Nickel Mountain closed, costing many jobs. Second, the reduction in logging from federally managed forests also resulted in a loss of jobs for Myrtle Creek residents. Finally, in the 1970s the state welfare system relocated several people on public assistance to Myrtle Creek because the cost of living was cheaper than in the larger, northern cities. Mr. D believes these events have resulted in Myrtle Creek’s higher than the county average poverty and unemployment rate, and have shaped the culture of Myrtle Creek. According to this landowner, there are a large number of families that have had multiple generations on public assistance, and many people don’t see the value of school. There are few profitable jobs in the area and a large population of high school dropouts. Many people have difficulties earning a living wage and are apathetic. Apathy puts the skids on community growth.

This landowner feels very strongly that a strong vocational education program is critical for Myrtle Creek’s children. Since education is not a high priority, finishing high school is, for some people, their most significant educational accomplishment; they will most likely not continue their education to learn a trade or marketable skill. Mr. D believes that providing high school graduates with marketable skills, such as carpentry, welding, and “mechanicking,” will give them the background needed to seek jobs for skilled laborers.

When asked about the future of Myrtle Creek, this landowner stated that unless timber can be harvested from federal forests, or unless another industry moves into the area, Myrtle Creek is destined to be a bedroom community for Roseburg, Canyonville, and Winston.

Mr. E; Calapooya Creek Watershed

Mr. E moved to the Calapooya Creek Watershed in 1981. Since that time, Mr. E has worked very hard to improve his 100-acre ranch and the 0.25 miles of cutthroat trout-bearing stream that runs through his property. Mr. E has extensively cross-fenced his property. The uplands are planted with various conifers including KMX, which is a cross between knobcone pine and Monterey pine. The trees range from 20 years old to less than two. For each grazing section he has planted triangular clusters of trees to provide weather protection for his livestock. Mr. E also cuts all the Scotch broom and any other invasive plant he finds on his property.

Mr. E has done substantial work on his stream's riparian area. When this landowner purchased the property, cattle had full access to the stream and there were no trees. In the summer, the creek sometimes went dry. Mr. E fenced the riparian area and planted various conifers and hardwoods. Shortly after the cattle were excluded, beaver returned to that section of the creek. When asked why this occurred, Mr. E speculated that cattle discourage beaver because they crush beaver burrows and compete for food. Once the cattle were gone and the stream was once again "safe," the beavers returned. When the beaver returned they built dams that have resulted in deep pools and year-round water. Unfortunately, Mr. E also lost many of his trees. Consequently, Mr. E builds four-foot high wire fabric tubes to protect trees of all ages, because he has noted that beavers can cut trees more than 12 inches in diameter. This landowner still plants trees in the riparian area, which he also protects from competing vegetation using mats made from the Wall Street Journal and through hand control methods.

Today, Mr. E's stream section has many tall trees and willows providing shade; the stream flows slowly through many deep pools that boast both ample cutthroat trout and crayfish. Although there is some bank erosion, Mr. E is not concerned because the downcutting is minimal and most likely a result of the increased flow. Overall, Mr. E's efforts have dramatically improved his stream section, especially compared to the neighboring reaches.

Mr. E's efforts have been very beneficial to the fish in his creek. However, this landowner is very clear that it would be very difficult for people working a full-time job to accomplish what he did. Mr. E is retired and can dedicate much of his time to successfully restoring his stream.

6. Action Plan

The action plan summarizes key findings and action recommendations from all previous chapters, and identifies specific and general restoration opportunities and locations within the watershed. The Umpqua Basin Watershed Council, the Oregon Department of Fish and Wildlife, and the Douglas Soil and Water Conservation District developed the action plan for the Lower South Umpqua Watershed.

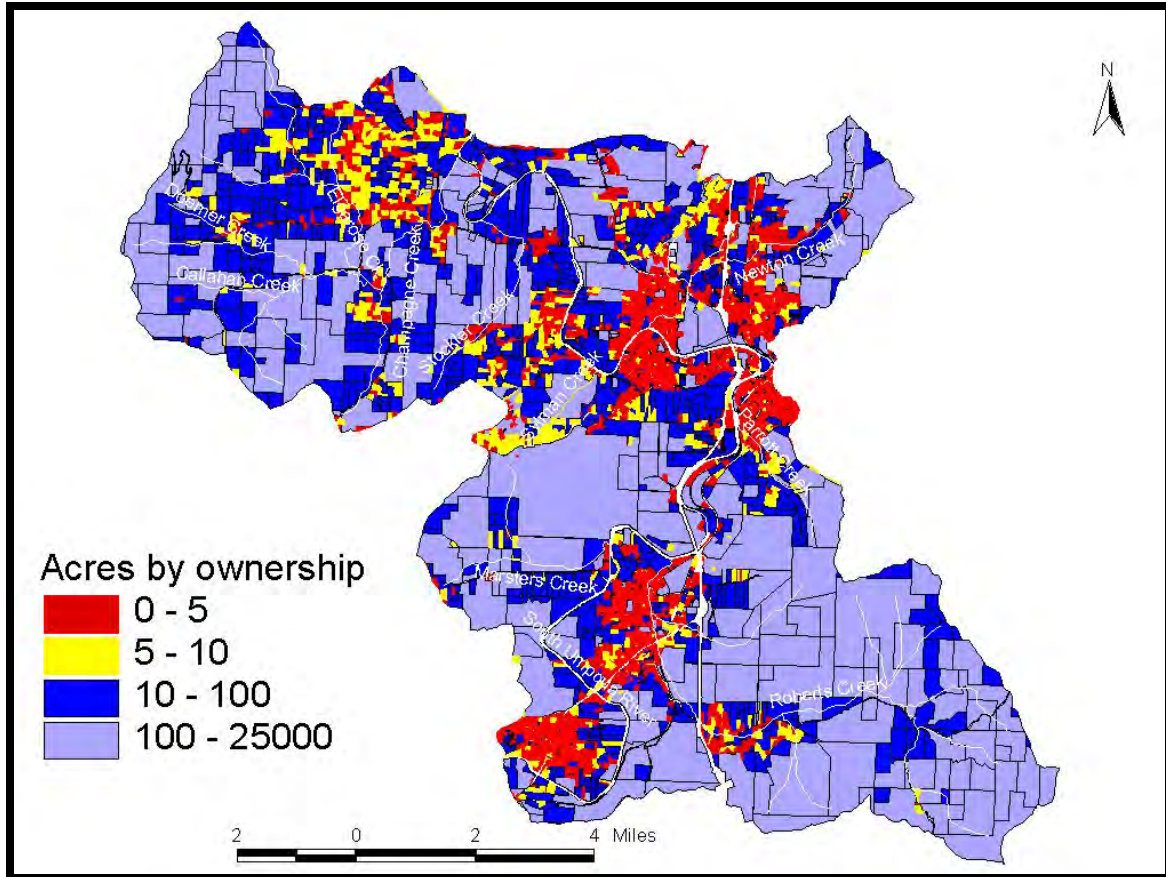
Key Questions

- Where are potential project location sites and activities in the watershed?
- How does property ownership affect restoration potential?

6.1. Property ownership and restoration potential

For some projects, such as eliminating fish passage barriers, the actual length of stream involved in implementing the project is very small. If only one culvert needs to be replaced, it doesn't make any difference if the participating landowner has 50 feet or a half-mile of stream on the property. The benefits of other activities, such as riparian fencing and tree planting, increase with the length of the stream included in the project. Experience has shown that for the UBWC, conducting projects with one landowner, or a very small group of landowners, is the most efficient approach to watershed restoration and enhancement. Although working with a large group is sometimes feasible, as the number of landowners cooperating on a single project increases, so do the complexities and difficulties associated with coordinating among all the participants and facets of the project. For large-scale enhancement activities, working with one or a few landowners on a very long length of stream is generally preferred to working with many landowners who each own only a short segment of streambank.

Map 6-1 shows parcel size in acres by ownership in the Lower South Umpqua Watershed. Unlike Map 1-11 in section 1.3, all parcels owned by the same person, family, agency, group, etc., are colored to reflect total ownership size. For example, if a single family owns three five-acre parcels, all parcels will be colored dark blue to reflect the total ownership of 15 acres. This map indicates that there are streams and stream segments in the Lower South Umpqua Watershed, such as upper Roberts Creek, which mostly run through larger ownerships and are good candidates for large-scale stream habitat restoration projects. Other streams that mostly consist of smaller ownerships, such as Newton Creek, should be considered for smaller-scale restoration and enhancement activities, and for landowner education programs.



Map 6-1: Ownership size by acre for the Lower South Umpqua Watershed.

6.2. *Lower South Umpqua Watershed key findings and action recommendations*

6.2.1. Stream function

Stream morphology key findings

- The majority of streams within the Lower South Umpqua Watershed have low gradients with few stream miles in source areas, where most large woody material is recruited into the stream system. This may limit instream large woody material abundance.
- Newton Creek is the only stream that has been surveyed by ODFW. No conclusions about Lower South Umpqua stream conditions can be made based on these data. Surveys in the neighboring Deer Creek and Middle South Umpqua Watersheds suggest that lack of adequate large woody material, poor quality pools, and poor riparian tree composition limit fish habitat in these areas; these may be limiting factors in the Lower South Umpqua Watershed as well.

Stream connectivity key findings

- Culverts and, to some degree, dams, reduce stream connectivity, affecting anadromous and resident fish productivity in the Lower South Umpqua Watershed. More information about fish passage barriers will be available from UBFAT in 2003.

Channel modification key findings

- Many landowners may not understand the detrimental impacts of channel modification activities or may be unaware of active stream channel regulations.

Stream function action recommendations

- Through public education and outreach, recruit community participation in the ODFW stream habitat surveys.
- Where appropriate, improve pools, collect gravel, and increase the amount of large woody material by placing large wood and/or boulders in streams with channel types that are responsive to restoration activities and have an active channel less than 30 feet wide.¹¹⁷
- In areas with inadequate riparian conditions, encourage land use practices that enhance or protect riparian areas:
 - Protect riparian areas from livestock-caused browsing and bank erosion by providing stock water systems and shade trees outside of the stream channel and riparian zones. Fence riparian areas as appropriate.
 - Plant native riparian trees, shrubs, and understory vegetation in areas with poor or fair riparian areas.
 - Manage riparian zones for uneven-aged stands with large diameter trees and younger understory trees.
- Maintain areas with good native riparian vegetation.
- Encourage landowner participation in restoring stream connectivity by eliminating barriers and obstacles to fish passage. Restoration projects should focus on barriers that, when removed or repaired, create access to the greatest amount of fish habitat.
- Increase landowner awareness and understanding of the effects and implications of channel modification activities through public outreach and education.

6.2.2. Riparian zones and wetlands

Riparian zones key findings

- For both the South Umpqua River and tributaries within the watershed, hardwoods are the dominant vegetation type. Brush/blackberry is the second most common vegetation type. Over 10% of tributaries have riparian areas dominated by range/grass/blackberry.
- For both the South Umpqua River and its tributaries, approximately 60% of riparian zones are dominated by treeless buffers and buffers that are one tree wide.
- Almost a third of tributaries are mostly exposed to direct sunlight.

¹¹⁷ Thirty feet is the maximum stream width for which instream log and boulder placement projects are permitted.

Wetlands key findings¹¹⁸

- Historical wetlands within the Lower South Umpqua Watershed contained mixed conifer and hardwood forests of various ages and sizes interspersed with wetland prairies and scrub/shrub wetlands.
- The most common wetland types found within the watershed are riverine wetlands confined to active channels and palustrine wetlands located within low-lying areas.
- Riverine wetlands within the Lower South Umpqua Watershed are often unvegetated.
- Many wetlands within the watershed are seasonal, and are mostly dry in summer months without persistent hydrologic sources. Seasonal wetland prairies benefit from wildfires that reduce competition from woody vegetation.

Riparian zones and wetlands action recommendations

- Where canopy cover is less than 50%, establish wide buffers of native trees (preferably conifers) and/or shrubs, depending upon local conditions. Priority areas are fish-bearing streams for which more than 50% canopy cover is possible.
- Identify riparian zones dominated by blackberries and convert these areas to native trees (preferably conifers) and/or shrubs, depending on local conditions.
- Investigate methods of controlling blackberries.
- Where riparian buffers are one tree wide or less, encourage buffer expansion by planting native trees (preferably conifers) and/or shrubs, depending on local conditions.
- Maintain riparian zones that are two or more trees wide and, along tributaries, provide more than 50% cover.
- Enhance riverine and palustrine wetlands through high-density planting and seeding in locations with appropriate conditions.
- Educate policy makers, landowners, and community members on the importance of maintaining wetlands for healthy watersheds, and their educational, recreational, and aesthetic values for the local community.
- Opportunities for wetland restoration are limited in urban areas due to the higher cost of land. Wetlands established in urban areas provide several benefits, and should be protected for the long term to maximize their potential

6.2.3. Water quality

Temperature key findings

- Monitoring locations within the watershed indicate that streams within the Lower South Umpqua Watershed frequently have seven-day moving average maximum temperatures exceeding the 64°F water quality standard during the summer. High stream temperatures may limit salmonid rearing in these reaches.
- Warmer sites often lack shade. Increasing shade on small and medium-sized streams may improve overall stream temperature.
- Groundwater and tributary flows can contribute to stream cooling. Gravel-dominated tributaries may permit cooler subsurface flows when surface flows are low.

¹¹⁸ Brad Livingston and Loren Waldron of Land and Water Environmental Services, Inc., contributed the wetlands key findings and action recommendations.

- Fish may find shelter from high summer temperatures in the lower reaches and mouths of small and medium-sized tributaries and in reaches within warm streams that have proportionately high groundwater influx and shade.

Surface water pH, dissolved oxygen, nutrients, bacteria, and toxics key findings

- Temperature and the levels of pH, nutrients, and dissolved oxygen are interrelated. In the South Umpqua River during the summer, pH, nutrients, and dissolved oxygen exceed water quality standards. This condition is detrimental to resident fish, aquatic life, and human contact recreation. It is unknown if these parameters are concerns for other locations within the watershed
- In the South Umpqua River, bacteria levels exceed water quality standards all year, decidedly a human health concern. Additional monitoring is necessary to determine if other locations in the watershed have high bacteria levels.
- In the South Umpqua River, chlorine, arsenic, and cadmium levels exceed water quality standards and are a concern for resident fish and aquatic life, salmonid fish, drinking water, and fishing. Toxics may be a concern for other Lower South Umpqua streams.
- Organic compounds have been detected within the South Umpqua River, although not at levels considered hazardous to human health.

Sedimentation and turbidity key findings

- Turbidity data indicate that usual turbidity levels in the South Umpqua River do not impair sight-feeding fish like salmonids.
- Soils prone to high rates of erosion due to low infiltration and high runoff rates are located throughout the watershed but are concentrated in the northern and eastern portions of the watershed.
- The southern watershed boundary has areas that may sensitive to disturbance due to their high K-factor values, especially along Roberts Creek and its tributaries.
- Developed areas within the watershed may impact water quality (i.e. runoff from roads and roofs). Improperly drained roads and poor land management practices can increase sediment loads to streams. In the Umpqua Basin, more studies are needed to determine the impacts of roads, culverts, landslides, burns, soil type, and urban conditions on sedimentation and turbidity.

Water quality action recommendations

- Continue monitoring the Lower South Umpqua Watershed for all water quality conditions. Expand monitoring efforts to include tributaries.
- Identify stream reaches that may serve as “oases” for fish during the summer months, such as at the mouth of small or medium-sized tributaries. Protect or enhance these streams’ riparian buffers and, if needed, improve instream conditions by placing logs and boulders within the active stream channel to create pools and collect gravel.
- In very warm streams, increase shade by encouraging wide riparian buffers and managing for full canopies.
- Identify and monitor sources of bacteria and nutrients. Where applicable, reduce bacteria and nutrient levels through activities such as:

- Limiting livestock stream access by providing stock water systems and shade trees outside of the stream channel and riparian zones. Fence riparian areas as appropriate.
- Relocating structures and situations that concentrate domestic animals near streams, such as barns, feedlots, and kennels. Where these structures cannot be relocated, establish dense and wide riparian vegetation zones to filter fecal material.
- Repairing failing septic tanks and drain fields.
- Using wastewater treatment plant effluent for irrigation.
- Reducing chemical nutrient sources.
- Where data show that stream sediment or turbidity levels exceed established water quality standards, identify sediment sources such as urban runoff, failing culverts or roads, landside debris, construction or burns. Take action to remedy the problem or seek assistance through organizations such as the UBWC and Soil and Water Conservation Districts.
- Obtain comprehensive map coverage of the road system within the watershed and prioritize areas of concern based on road type, condition, and proximity to nearest stream. If necessary, use this information to target projects for improving road stability and drainage patterns.
- Identify areas with high concentrations of the group D soils that have been disturbed; prioritize areas for vegetation plantings and limit activities in these sensitive areas. Limit activities in areas that will be slow to recover from disturbance.
- Use the Oregon Department of Forestry's debris flow hazard model to pinpoint areas that are naturally prone to erosion. Obtain the more refined debris flow data from Nature of the Northwest when published.
- Provide landowner education about water quality concerns and potential improvement methods:
 - Improving dirt and gravel road drainage to minimize sediment delivery to streams.
 - Enhancing soil infiltration by leaving vegetation litter on the ground after timber and crop harvests.
 - Planting bio-swales near streams in urban and suburban areas to catch urban runoff.
- Work with ODEQ to educate landowners about activities that will reduce any non-point sources of ammonia, chlorine, and cadmium in the watershed.

6.2.4. Water quantity

Water availability and water rights by use key findings

- From August to October, the instream water right is close to or exceeds average streamflow. From September to October, the instream water right is close to or exceeds average streamflow.
- The largest water users in the Lower South Umpqua Watershed are irrigators, municipalities, and industries.

Streamflow and flood potential key findings

- It is not unusual for the flow of the South Umpqua River at Brockway to be less than 100 cfs during the summer months.
- The construction of Galesville Dam appears to have had a stabilizing effect on winter peak flows for the South Umpqua River at Brockway.
- The degree to which road density and the transient snow zone influence flood potential in the Lower South Umpqua Watershed are unknown at this time.
- Some landowners believe that historical surface vegetation removal permitted greater surface water runoff and may have contributed to stream flashiness.

Water quantity action recommendations

- Increase summer streamflow levels through instream water leasing and by improving irrigation efficiency.
- Continue monitoring peak flow trends in the watershed. Try to determine the role of vegetative cover, flooding, road density, and the transient snow zone on water volume.
- Educate landowners about proper irrigation methods and the benefits of improved irrigation efficiency.

6.2.5. Fish populations

Fish populations key findings

- The anadromous fish species in the Lower South Umpqua Watershed are coho, spring chinook, fall chinook, winter steelhead, sea-run cutthroat trout, and lamprey. Although many Lower South Umpqua Watershed medium and large tributaries are within the distribution of one or more salmonid species, salmonid ranges have not been verified for each tributary.
- Non-native fish, including smallmouth bass, have established populations in the watershed. Other non-natives, such as bluegill, have been accidentally or intentionally introduced to the watershed, but have not established reproducing populations.
- More quantitative data are needed to evaluate salmonid abundance and the distribution and abundance of non-salmonid fish in the watershed.
- Umpqua Basin-wide data indicate that salmonid returns have improved. Although ocean conditions are a strong determinant of salmonid run size, improving freshwater conditions will also improve salmonid fish populations.

Fish populations action recommendations

- Work with local specialists and landowners to verify the current and historical distribution of salmonids in tributaries.
- Support salmonid and non-salmonid distribution and abundance research activities in the watershed, especially at the local level.
- Encourage landowner and resident participation in fish monitoring activities.
- Conduct landowner education programs about the potential problems associated with introducing non-native fish species into Umpqua Basin rivers and streams.

- Encourage landowner participation in activities that improve freshwater salmonid habitat conditions.

6.3. *Specific UBWC enhancement opportunities*

1. Actively seek out opportunities with landowners, businesses, and resident groups in key areas to enlist participation in the following restoration projects and activities:
 - Future stream habitat surveys (all but Newton Creek);
 - Instream structure placement (case-by-case basis);
 - Improved irrigation efficiency and instream water leasing (all streams with water rights); and
 - Riparian planting, blackberry conversion, fencing, and alternative livestock watering systems, especially on the South Umpqua River, Champagne Creek, Roberts Creek, and Marsters Creek.
2. Work with interested landowners on a case-by-case basis to on the following project types:
 - Improve instream fish habitat in areas with good riparian zones and an active channel that is less than 30 feet; and
 - Enhance and/or protect riparian zones and wetlands to improve wildlife habitat, fish habitat, and water quality conditions.
3. Develop educational materials and/or outreach programs to educate target audiences about fish habitat and water quality-related issues:
 - Create educational brochures about bank erosion, the problems associated with channel modification, and the importance of riparian areas. These could be given to new landowners through real estate agents.
 - Develop public service announcements about ways of improving or maintaining riparian and instream conditions, such as the benefits of riparian fencing and how to use fertilizers and pesticides in a stream-friendly fashion.
 - Design engaging displays about fish passage barriers for community events, such as the Douglas County Fair.
 - Give presentations at citizen groups about the benefits to landowners and to fish that result from upland stock water systems, off-channel shade trees, and instream water leasing.
4. Support local fish habitat and water quality research:
 - Train volunteers to conduct fish and water quality monitoring and research.
 - Provide equipment necessary for local water quality research and monitoring.
 - Survey long-term landowners and residents about historical and current fish distribution and abundance.
 - Encourage school and student participation in monitoring and research.
5. Enlist landowner participation to remove fish passage barriers as identified.

6. Educate policy makers about the obstacles preventing greater landowner participation in voluntary fish habitat and water quality improvement methods.

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¹¹⁹ References for Chapter Two, "Past Conditions," and the "Wetlands" subsection are not included in this list.

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Appendix 1: Additional geological information for western Oregon and for the Lower South Umpqua Watershed.¹²⁰

Geologic History

The process of plate tectonics, or movement of large plates of solid rock crust on the earth's surface, can result in many different landscape-altering events, such as volcanic activity and mountain-building events. The collision of the North American continental plate with the Pacific oceanic plate resulted in a collision boundary that has shaped the geologic history of southwestern Oregon. In this case, the Pacific plate has been thrust beneath the continental plate, creating a collision boundary known as a subduction zone (see glossary for definitions of terms). The geologic history of this area has been driven by its location on the western edge of the North American plate adjacent to the Pacific Ocean. The collision of the Pacific plate with the North American plate also resulted in the accretions of islands and small landmasses to the continental plate. The Klamath Mountains and the Coast Range are examples of this process, known as accretionary tectonics. This refers to the addition of exotic crustal deposits, such as island arcs, to a continent through the process of tectonics.

During the Devonian period, a mountain-building event known as the Antler orogeny occurred, resulting in the formation of the Klamath Mountains (refer to Appendix table I for geologic time scale). This process began with the collision and the subsequent subduction of the oceanic crust beneath the western margin of the continental crust. With the collision, sedimentary deposits and exotic terranes began collecting atop the ocean floor. Terranes are defined as a suite of rocks usually bound by faults that have been displaced from their place of origin. During the Mesozoic era, the plates began to collide again, mashing the sediments and terranes into the North American plate. The resulting pressure caused these sediments and terranes to be crumpled into folds along thrust faults, laced with granite intrusions (Alt and Hyndman, p. 68), forming the Klamath Mountains. However, within the Lower South Umpqua Watershed, some of the geologic units are more typical of the sedimentary deposits of the Coast Range rather than the older deposits and terranes associated with the Klamaths. This could be explained by the Klamath deposits extending beneath the younger Tertiary deposits (Orr and Orr, 1996). The Klamaths are also thought to have once been contiguous with the Sierra Nevadas. However, the Klamaths separated and moved along a plate boundary forming a microcontinent that shifted west of the Sierra Nevadas. As the Klamath block shifted west, a 60-mile wide basin developed to the east, forming an ocean and subsequently filling with marine sediments.

The Coast Range was one of the last provinces to form in the Pacific Northwest. Its formation began early in the Cenozoic era with the separation of two oceanic plates. The

¹²⁰ Jenny Allen, Tim Grubert, and John Runyon of BioSystems, Inc., contributed the text and tables for Appendix 1. Terms such as "Jurassic" and "Cretaceous" refer to periods in the geologic/evolutionary timetable. However, the UBWC takes no position regarding the time periods with which these terms are associated and is using the terms to refer to natural processes and the relative order in which they occurred.

two divergent plates formed a rift from which magma was released that subsequently formed a chain of undersea volcanic islands arranged in a north-south direction between the two plates. These volcanic islands were subject to eruptions of basalt throughout the Paleocene and Eocene epochs. Furthermore, the chain remained submersed beneath the ocean, collecting marine deposits that later resulted in the creation of the Roseburg, Tyee, and Umpqua Formations. Later in the Eocene, this volcanic chain collided with the North American plate, beginning the formation of the Coast Range. During the Oligocene, an orogeny (mountain-building process) occurred that caused the Coast Range to rise out of the ocean. Also during this time, volcanoes of the Western Cascades were erupting frequently and depositing large amounts of ash into the ocean atop the emerging Coast Range, resulting in formations that are included in the Little Butte Series.

Era	Period	Epoch
Cenozoic	Quaternary	Holocene
		Pleistocene
	Tertiary	Pliocene
		Miocene
		Oligocene
		Eocene
		Paleocene
Mesozoic	Cretaceous	
	Jurassic	
	Triassic	
Paleozoic	Permian	
	Pennsylvanian	
	Mississippian	
	Devonian	
	Silurian	
	Ordovician	
	Cambrian	
Precambrian	Proterozoic	
	Archean	

Appendix table I: Geologic time scale (most recent to oldest – top to bottom).

Geologic units for the Lower South Umpqua Watershed.¹²¹

Periods	Epochs	Geologic Units	Description of Geologic Units
Quaternary	Holocene	Qal	Alluvial deposits: Sand, gravel, and silt forming floodplains and filling channels of present streams. In places includes talus and slope wash. Locally includes soils containing abundant organic material, and thin peat beds.
Quaternary	Holocene and Pleistocene	Qls	Landslide and debris-flow deposits: Unstratified mixtures of fragments of adjacent bedrock. Locally includes slope wash and colluvium. May include some deposits of late Pliocene age.
Tertiary	Middle Eocene	Tt	Tyee Formation: Very thick sequence of rhythmically bedded, medium- to fine-grained micaceous, feldspathic, lithic, or arkosic marine sandstone and micaceous carbonaceous siltstone; contains minor interbeds of dacite tuff in upper part. Foraminiferal fauna are referred to the Ulatisian Stage (Snively and others, 1964). Groove and flute casts indicate deposition by north-flowing turbidity currents (Snively and others, 1964), but probably provenance of unit is SW Idaho (Heller and others, 1985).

¹²¹ From Walker and MacCleod, 1991. References cited within Walker and MacCleod are provided at the end of Appendix 1.

Tertiary	Middle Eocene	Tmss	<p>Marine sandstone and siltstone: Thin- to thick-bedded, cross bedded, well-sorted, fine- to medium-grain sandstone, siltstone, and mudstone; characterized by sparse fine white mica; shallow marine depositional setting at least partly of deltaic origin. Contains foraminiferal and molluscan faunas of early middle Eocene age. Included by Diller (1898) in the upper part of the Umpqua Formation, by Baldwin (1974) and Ryberg (1984) in the Fluornoy Formation of the Umpqua Group, and by Molenaar (1985) in Camas Valley and the White Tail Ridge Members of Baldwin (1974) of the Umpqua Formation.</p>
Tertiary	Middle and Lower Eocene and Paleocene	Tsr	<p>Siletz River Volcanic and related rocks: Aphanitic to porphyritic, vesicular pillow flows, tuff-breccias, massive lava flows and sills of tholeiitic and alkalic basalt. Upper part of sequence contains numerous interbeds of basaltic siltstone and sandstone, basaltic tuff, and locally derived basalt conglomerate. Rocks of unit pervasively zeolitized and veined with calcite. Most of these rocks are of marine origin and have been interpreted as oceanic crust and seamounts (Snively and others, 1968). Foraminiferal assemblages referred to the Ulatisian and Penutian Stages (Snively and others, 1969); includes the lower part of the Roseburg Formation of Baldwin (1974).</p>

Tertiary	Lower Eocene	Tmsc	Marine siltstone, sandstone, and conglomerate: Cobble and pebble conglomerate, pebbly sandstone, lithic sandstone, siltstone, and mudstone; massive to thin-bedded; shelf and slope depositional setting. Contains foraminiferal faunas referred to the Penutian Stages of early Eocene age. Included by Diller (1898) in the Umpqua Formation; Baldwin (1974) and Ryberg (1984) included it in the Lookingglass Formation of the Umpqua Group of Baldwin; may be partly a shelf and slope facies of the sedimentary rocks of the Roseburg Formation of Baldwin (1974) according to Molenaar (1985) and Heller and Ryberg (1983).
Lower Cretaceous and Upper Jurassic		KJm	Myrtle Group: Conglomerate, sandstone, siltstone, and limestone. Locally fossiliferous. As shown, includes Riddle and Days Creek Formations (Imlay and others, 1959; Jones, 1969).
Lower Cretaceous and Upper Jurassic		KJds	Dothan Formation and related rocks: sedimentary rock: Sandstone, conglomerate, graywacke, rhythmically banded chert lenses. Includes western Dothan and Otter Point Formations of M.C. Blake, Jr. and A.S. Jayko (unpub. data, 1985) in Curry and southern Coos Counties.
Lower Cretaceous and Upper Jurassic		KJdv	Dothan Formation and related rocks: Volcanic rocks- basaltic pillow lavas, volcanic breccia, and silicified basalt lava flows.

Upper Jurassic		Jop	Otter Point Formation of Dott (1971) and related rocks: Highly sheared graywacke, mudstone, siltstone, and shale with lenses and pods of sheared greenstone, limestone, chert, blueschist, and serpentine. Identified as mélangé by some investigators.
Jurassic		Ju	Ultramafic and related rocks of ophiolite sequences: Predominantly harzburgite and dunite with both cumulate and tectonic fabrics. Locally altered to serpentinite. Includes gabbroic rocks and sheeted diabasic dike complexes. Comprises Josephine ophiolite of Harper (1980), ophiolites of Onion Mountain, Sextan Mountain, Pearsoll Peak, Rogue River, and Riddle areas (Smith and others, 1982) and Coast Range ophiolite and serpentinite mélangé of M.C. Blake, Jr. and A.S. Jayko (unpub. data, 1985). In southwest Oregon, locally includes small bodies of early Mesozoic or Late Paleozoic serpentinitized and sheared ultramafic rocks, mostly in shear zones. Locally, volcanic and sedimentary rocks shown separately.

Glossary of terms¹²²

- Accretion-** A tectonic process by which exotic rock masses (terrane) are physically annexed to another landmass after the two collided.
- Alluvial-** Refers to all detrital deposits resulting from operation of modern rivers, thus including the sediments laid down in riverbeds, flood plains, lakes, fans at the foot of mountain slopes, and estuaries.
- Andesite-** A volcanic rock type intermediate in composition between rhyolite and basalt.
- Arkosic (sandstone) -** Containing 25% or more feldspar usually derived from coarse-grained silicic igneous rock.
- Basalt-** Fine-grained, dark, mafic igneous rock composed largely of plagioclase feldspar and pyroxene.
- Breccia-** A clastic rock composed of mainly large angular fragments.
- Clastic Rock-** Sedimentary rock formed from particles that were mechanically transported.
- Colluvium-** Deposits of unstratified debris deposited by means of physical or chemical weathering.
- Conglomerate-** A sedimentary rock made up of rounded pebbles and cobbles coarser than sand.
- Diorite-** A coarse-grained, volcanically intruded rock similar in composition to granite but containing a higher percentage of potassium feldspar.
- Ecoglyte-** A metamorphic, semi-precious, pink-hued stone consisting of ruby, zoisite, muscovite, and quartz.
- Fault-** A crack or fracture in the earth's surface across which there has been relative displacement. Movement along the fault can cause earthquakes or--in the process of mountain-building--can release underlying magma and permit it to rise to the surface.
- Feldspar-** A common rock-forming silicate mineral and one of the most abundant minerals in the earth's crust.

¹²² These definitions were compiled from dictionaries of geologic terms at <http://www.geotech.org/survey/geotech/dictiona.html>, <http://www.tc.umn.edu/~smith213/newpage1.htm>, <http://volcano.und.nodak.edu/vwdocs/glossary.html>, and in Press and Siever (1986), Jackson (1997), Orr, Orr, and Ewart (1992) and Orr and Orr (1996). Additional definitions not included in this glossary can be found at the websites and sources given above.

Formation- A body of rock identified by lithic characteristics and stratigraphic position and is mappable at the earth's surface or traceable in the subsurface.

Geomorphology- The science of surface landforms and their interpretation on the basis of geology and climate.

Granite- Coarse-grained, intrusive igneous rock, composed of quartz, orthoclase feldspar, sodium-rich plagioclase feldspar, and micas.

Graywacke- A poorly sorted sandstone containing abundant feldspar and rock fragments, often in a clay-rich matrix.

Group- Two or more formations in a stratigraphic column that formed by similar events or processes.

Igneous- A rock type formed by the crystallization of molten material called lava (volcanic) or magma (intrusive).

Island Arcs – A linear or arcuate chain of volcanic islands formed at a convergent plate boundary. It is formed in the overriding plate from rising melt derived from the subducted plate and from the asthenosphere above that plate.

Landslide- The rapid downslope movement of soil and rock material, often lubricated by groundwater, over a basal shear zone; also the tongue of stationary material deposited by such an event.

Limestone- A bedded sedimentary deposit consisting largely of calcium carbonate, sometimes containing fragments of seashells or fossils.

Mass Wasting- The rapid movement of colluvial materials downslope.

Metamorphic- Type of rock, which has been altered or deformed through heat and/or pressure.

Micaceous- Containing a high percentage of the mineral muscovite (muscovite), a shiny, sheetlike, opaque mineral that separates from a parent body in thin sheets.

Montmorillonite- A term referring to a type of clay mineral characterized by its chemical composition and molecular structure which gives it greater plasticity and swelling capacity.

Morphology- The form, structure, or arrangement of features within a landscape.

Mudstone- The lithified equivalent of mud, a fine-grained sedimentary rock similar to shale but more massive.

Ophiolite- A sequence of ocean crust beginning with ultramafic rocks at the base, grading upward to sheeted dikes, pillow lavas, and deep-sea muds.

Orogeny- The tectonic process, in which large areas are folded, thrust-faulted, metamorphosed, and subjected to plutonism. The cycle ends with uplift and the formation of mountains.

Peridotite- A coarse-grained ultramafic rock consisting of olivine and pyroxene with other accessory minerals. Peridotite is thought to make up much of the earth's mantle, and when altered is called serpentinite.

Pillow lava- A general term for those lavas displaying pillow structures (globes of lava with curved tops and "pinched" bottoms) and considered to have formed under water.

Plate tectonics- The movement of large segments (plates) of the earth's crust and the study of their interrelationship.

Pluton- A large igneous body (such as a batholith) formed within in the earth's crust consisting of Ultramafic- Dark colored igneous rocks high in magnesium and iron and low in silica, such as serpentinite and peridotite.

Rhyolite- Fine-grained volcanic or extrusive equivalent of granite, light brown to gray and compact.

Rift- A narrow crevice or fissure in rock produced by splitting due to tension.

Sandstone- A consolidated sedimentary rock consisting of rock and mineral fragments ranging in size between 0.0625 to 2.0 mm in diameter and cemented together with silica, calcium carbonate, or iron oxide.

Sedimentary- Rock type comprised of weathered particles of other rocks and minerals and cemented together by calcium carbonate, silica, or iron oxide. Limestone is a sedimentary rock comprised of calcium carbonate compound becoming insoluble in water and hardening into various types of rock forms.

Shearing- The motion of surfaces sliding past one another.

Silica- A crystalline compound consisting of silicon and oxygen.

Siltstone- A consolidated sedimentary rock made up of fragments ranging between sizes smaller than sand grains and larger than clay grains.

Slopewash- Debris carried down a slope surface by one or more physical weathering processes.

Stratigraphy- The study of stratified layered rocks.

Subduction- The sinking of an oceanic plate beneath an overriding plate.

Subduction zone- A dipping planar zone descending away from a trench and defined by high seismicity, interpreted as the shear zone between a sinking oceanic plate and an overriding plate.

Talus- A deposit of large angular fragments of physically weathered bedrock, usually at the base of a cliff or steep slope.

Terrane- A suite of rocks bounded by fault surfaces that has been displaced from its point of origin.

Tonalite- A dark, igneous mafic rock containing the minerals hornblende, plagioclase, clinopyroxene, biotite, and quartz.

Tuff- A rock composed of volcanic ash with particles smaller than 4.0 millimeters in diameter.

Ultramafic- A magnesium-rich igneous rock with less than 45% silica (silicon dioxide); typical composition of the earth's mantle.

Vitric Ash- Volcanic ash that has cooled slowly enough to form a glassy texture in its matrix.

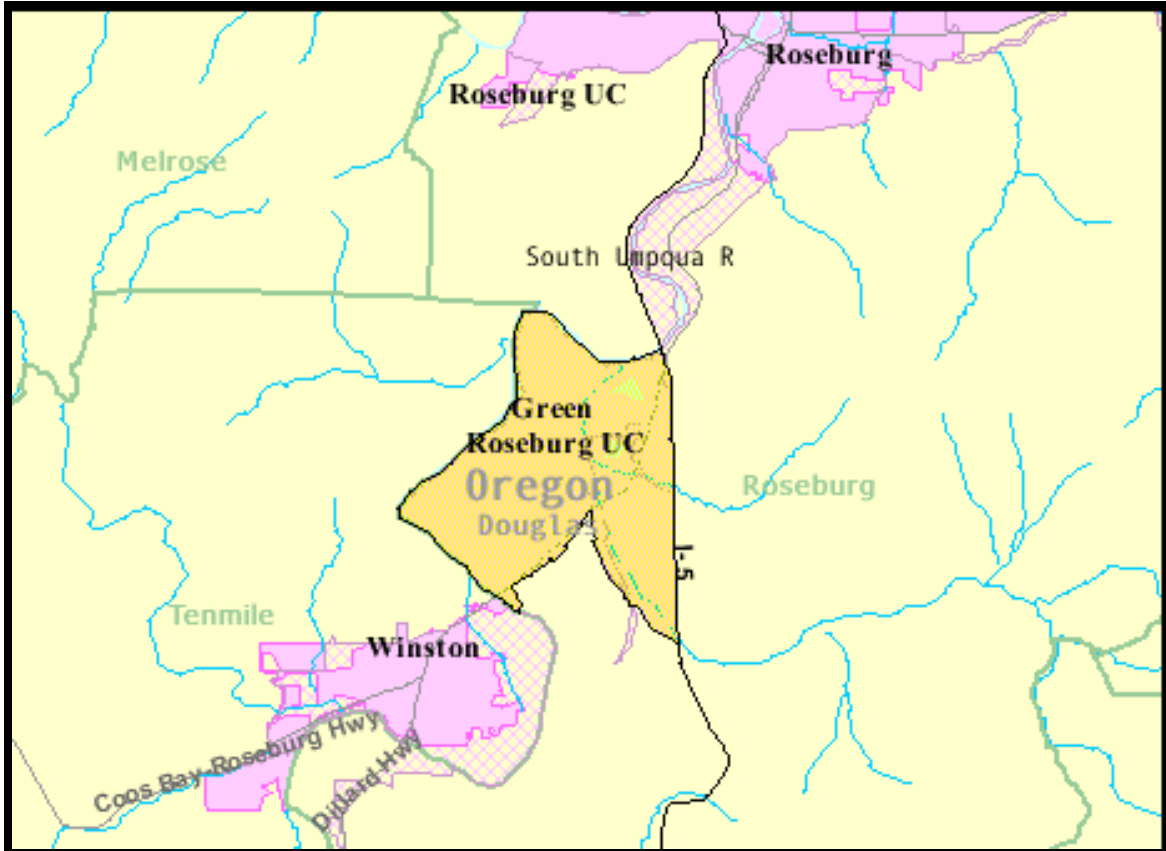
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Appendix 2: Census area locations and Douglas County data.

Location of the Green CDP



Location of the Melrose CCD



2000 Douglas County census information

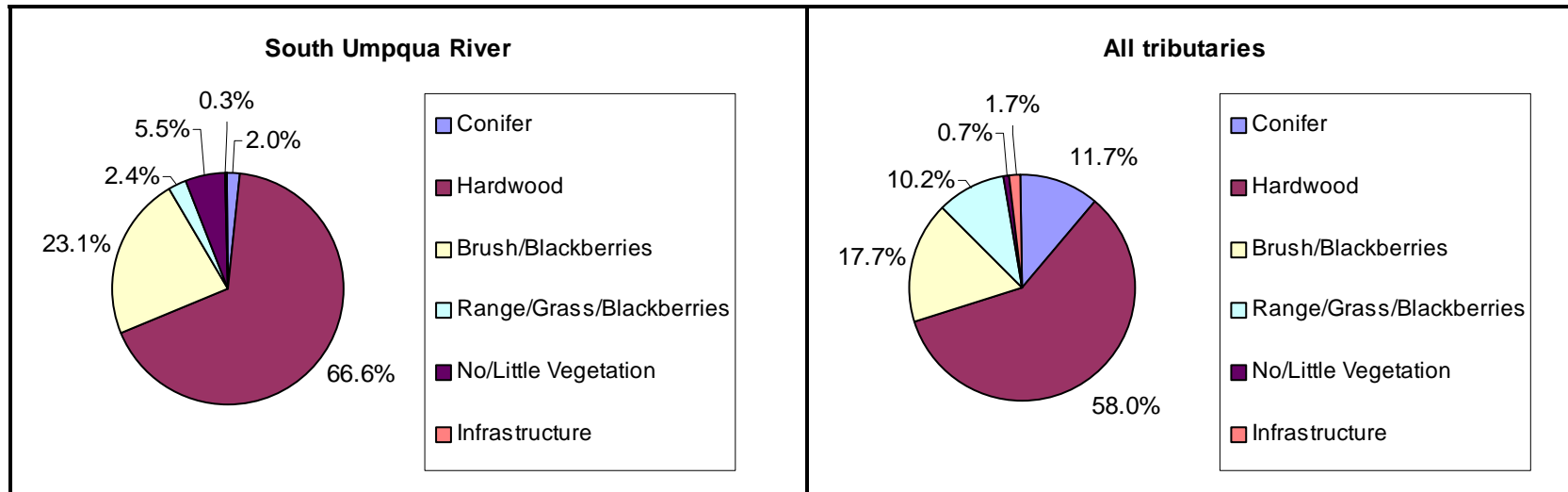
Age, race, and housing	
Population	100,399
Median age (years)	41.2
<i>Race</i>	
White	91.9%
Hispanic or Latino	3.3%
Asian	0.6%
American Indian or Alaskan Native	1.4%
African American	0.2%
Native Hawaiian and Pacific islander	0.1%
Some other race	0.1%
Two or more races	2.4%
<i>Housing</i>	
Avg. household size (#)	2.48
Avg. family size (#)	2.90
Owner-occupied housing	71.7%
Vacant housing units	8.0%
Education, employment, and income	
<i>Education – age 25 or older</i>	
High school graduate or higher	81.0%
Bachelor's degree or higher	13.3%
<i>Employment – age 16 or older</i>	
In labor force	56.9%
Unemployed in labor force	7.5%
Top three occupations	Management, professional and related occupations; Sales and office; Production, transportation, and material moving.
Top three industries	Educational, health, and social services; Manufacturing; Retail
<i>Income</i>	
Per capita income	\$16,581
Median family income	\$39,364
Families below poverty	9.6%

Appendix 3: 1968 streamflow and temperature measurements. ¹²³

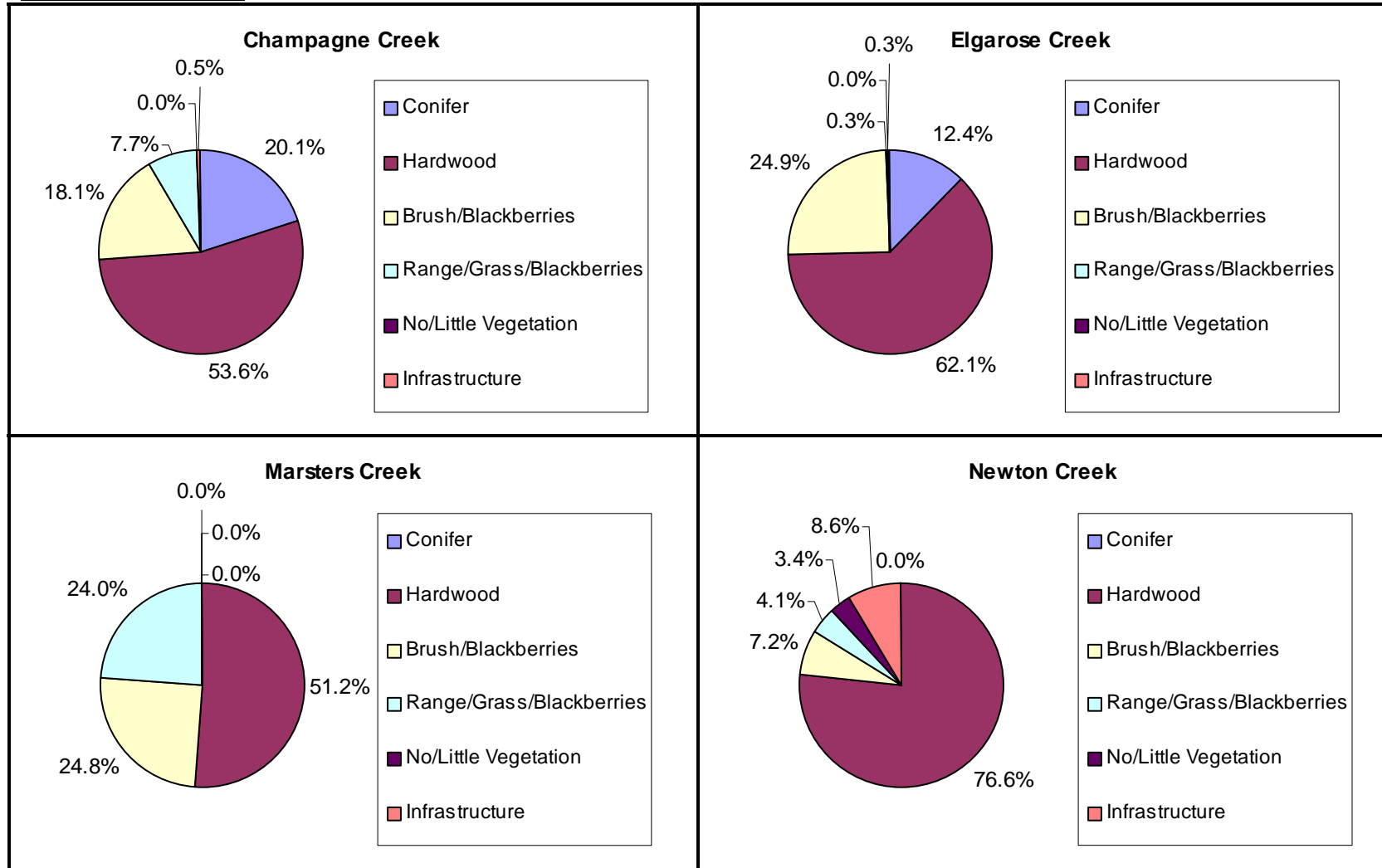
Stream	Location	Date	Degrees F.	Flow (cfs)
Roberts Creek	2 mi. above mouth	5/1/68	52	1.3
		5/27/68	59	1.0
		6/27/68	68	Intermittent
		7/26/68	--	Dry
		10/2/68	--	Dry
		11/3/68	48	1.0
		11/10/68	52	9.1
		11/12/68	49	93
Deer Creek	0.2 mi. above mouth	4/28/68	58	12
		5/23/68	57	16
		6/27/68	67	1.2
		7/26/68	63	0.1
		8/27/68	64	2.8
		10/4/68	55	1.5
		10/31/68	54	19
		11/3/68	50	25
		11/18/68	53	83

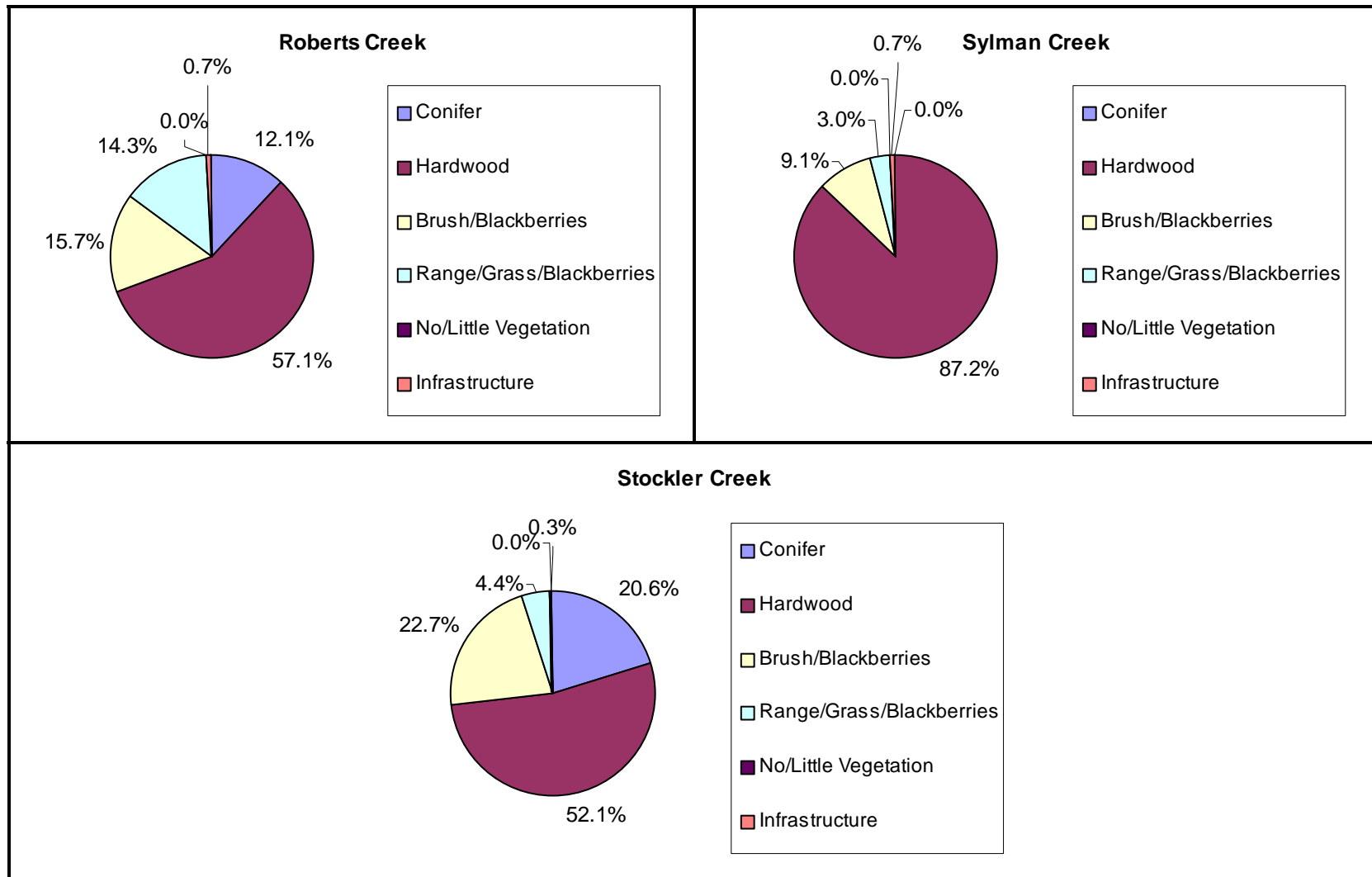
¹²³ The information in the following table was taken from Lauman et al., 1972. This document is cited in section 2.6.

Appendix 4: Riparian vegetation and features.

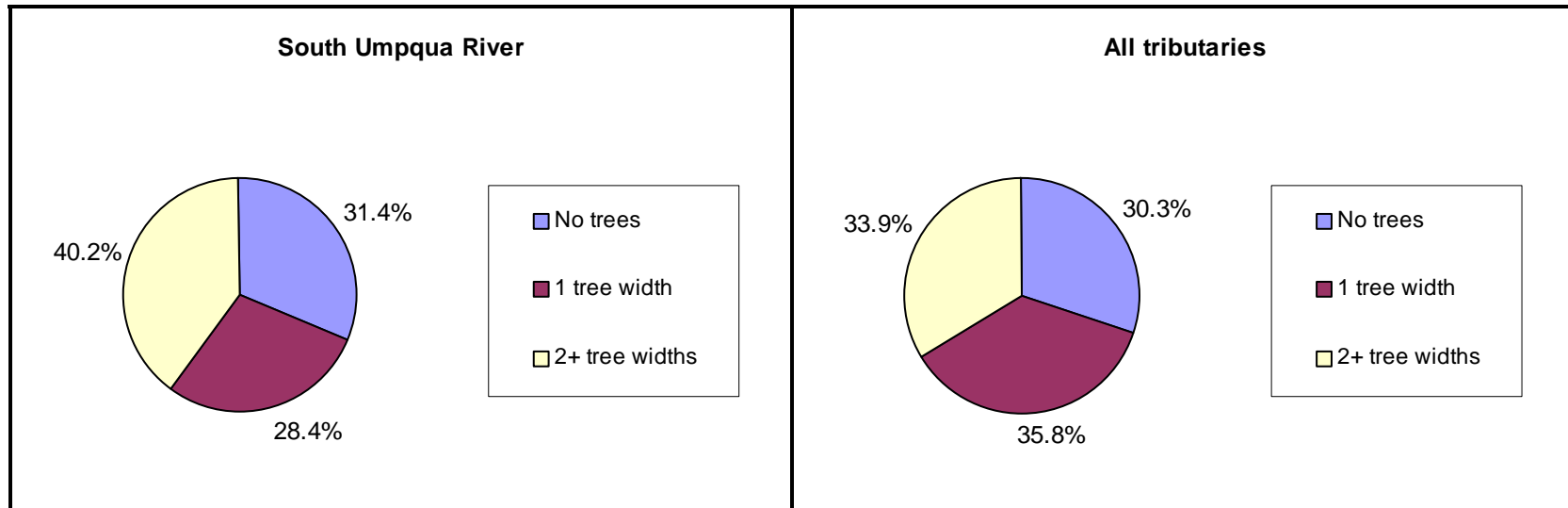


Individual tributaries

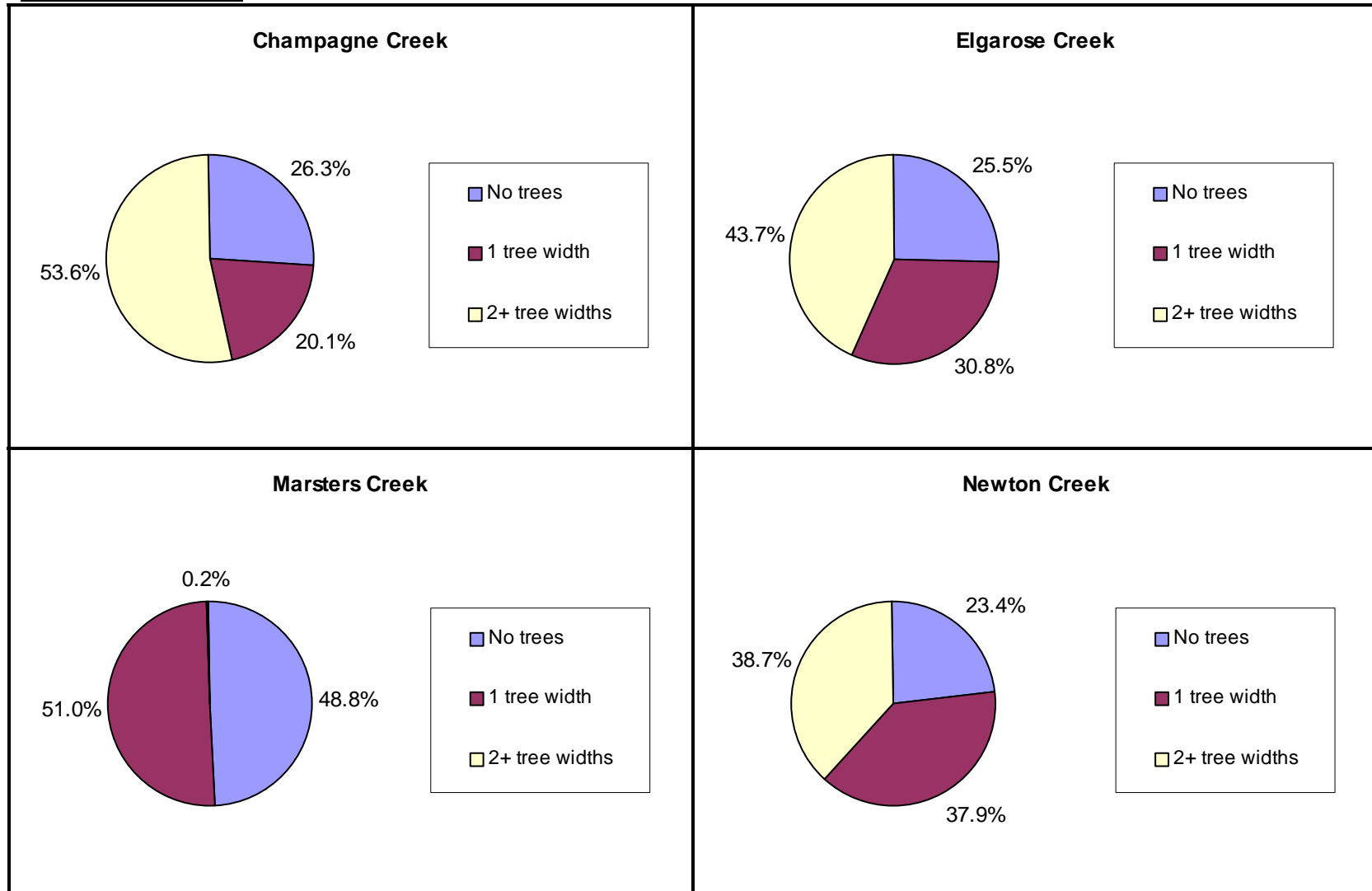


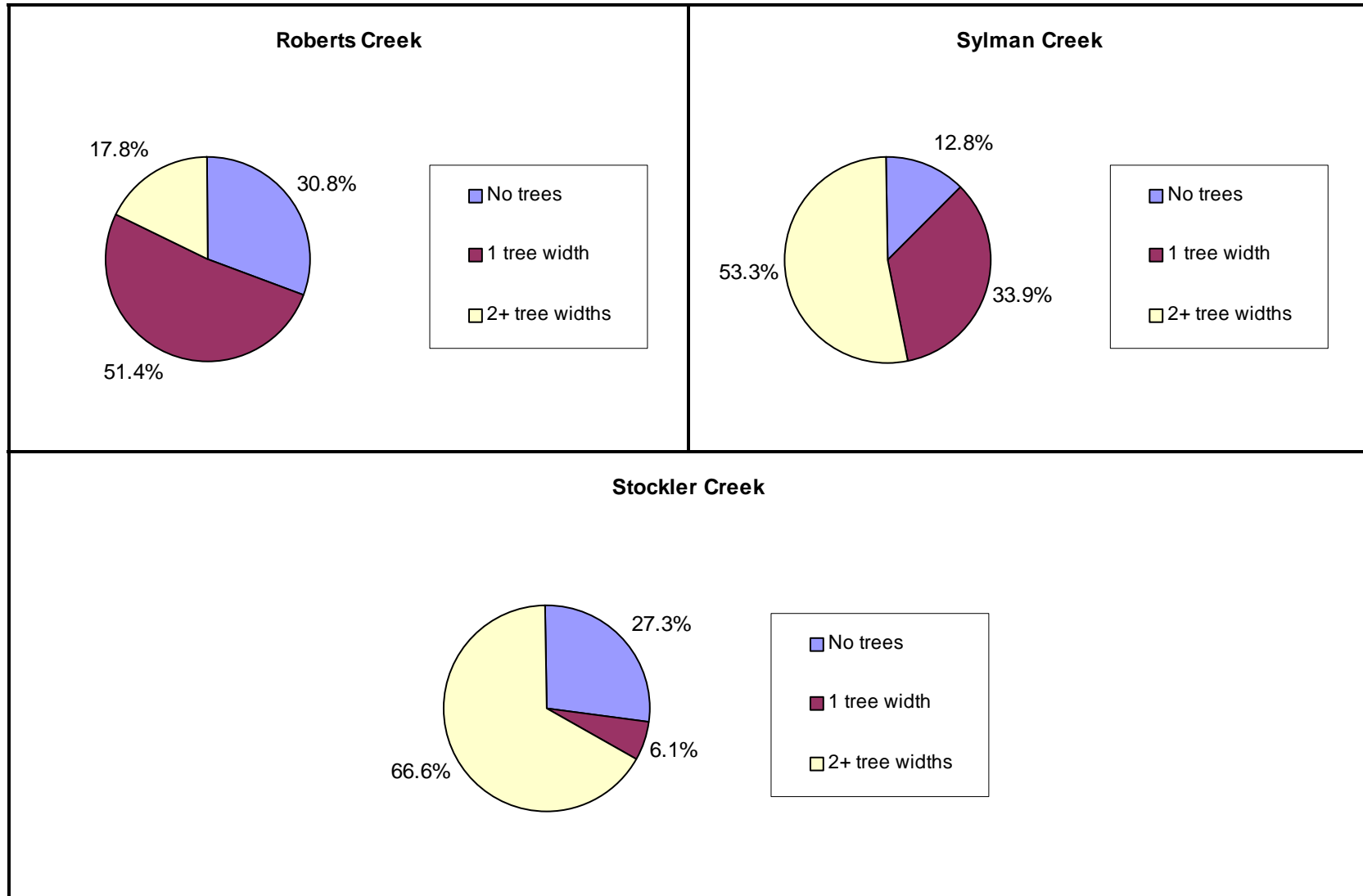


Appendix 5: Riparian buffer width.

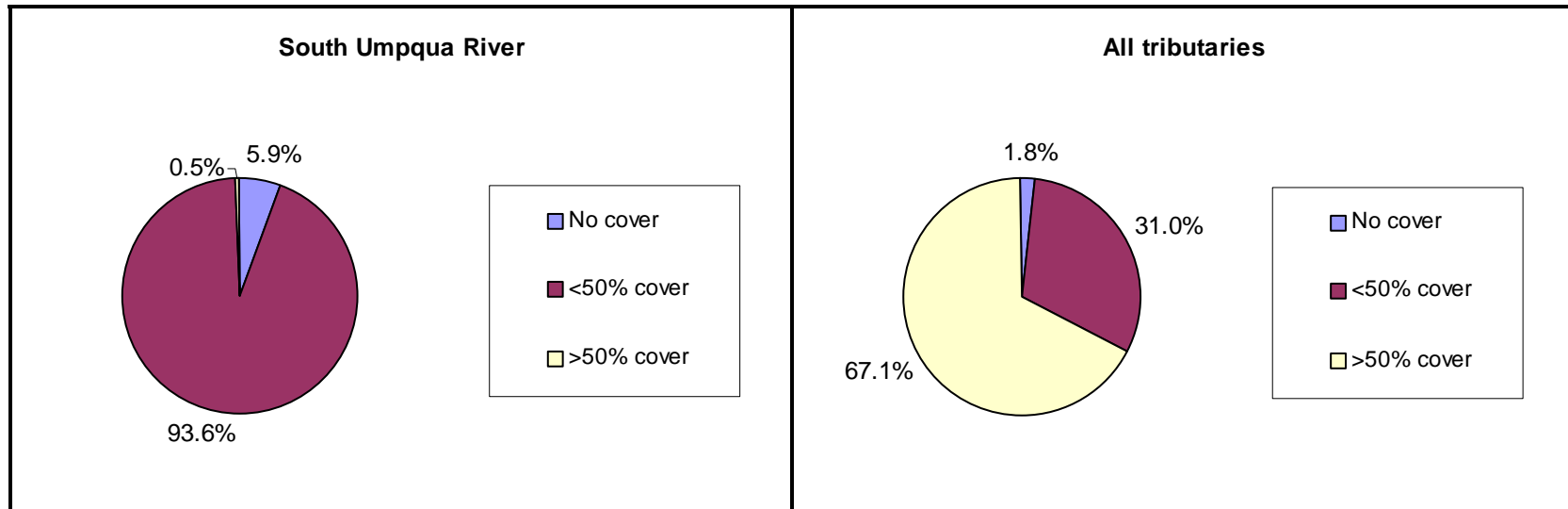


Individual tributaries

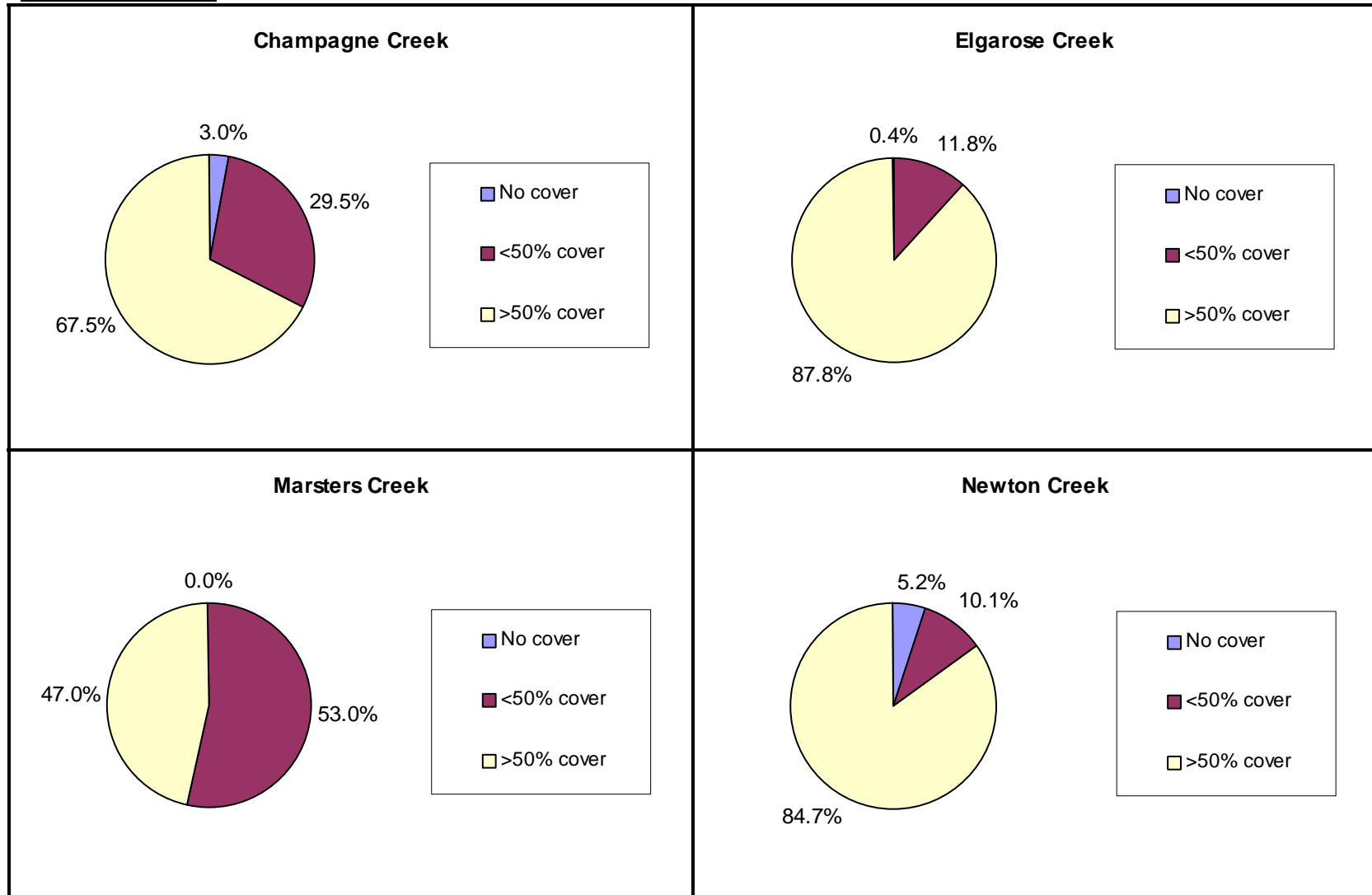


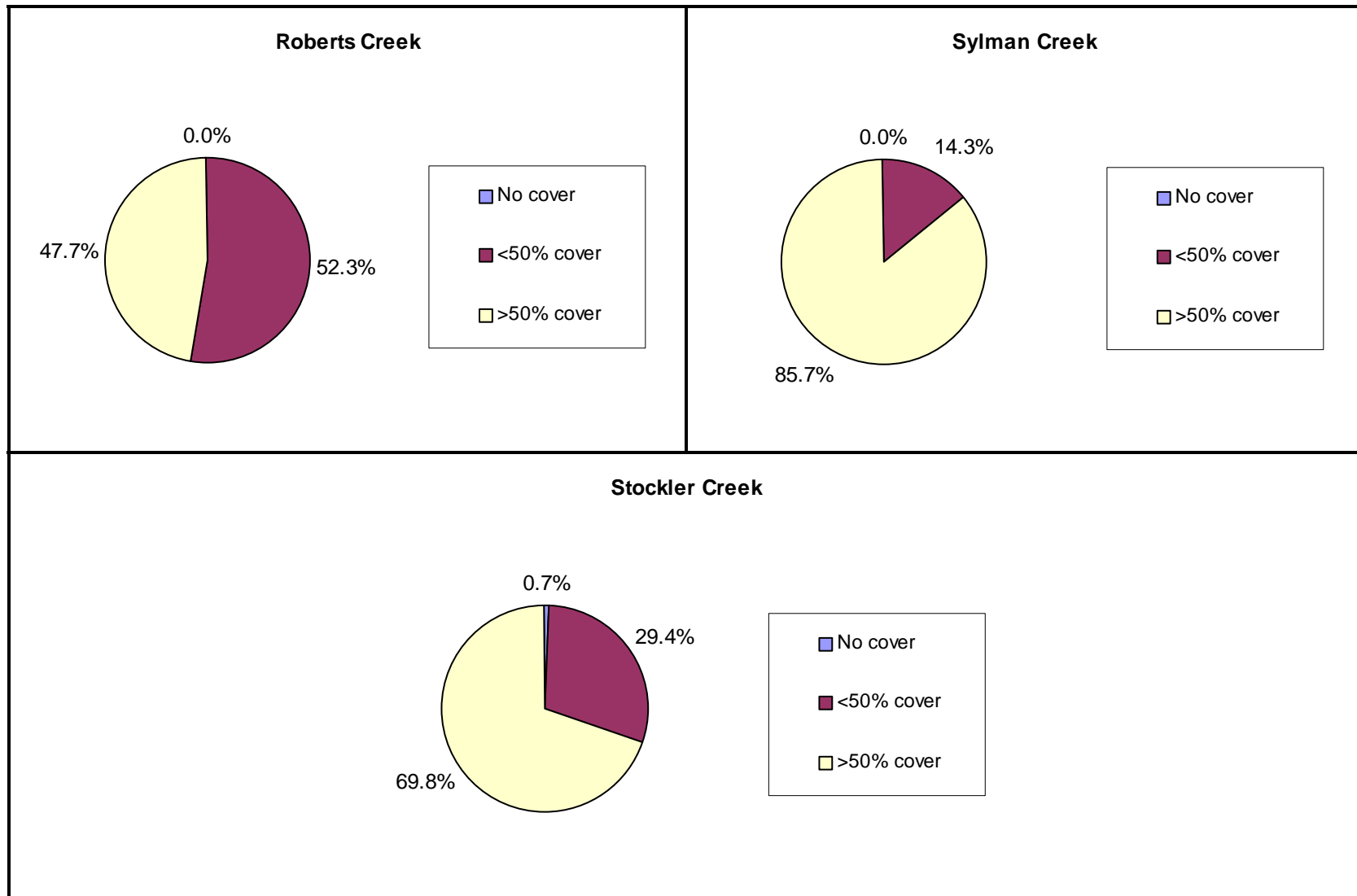


Appendix 6: Riparian cover.



Individual streams





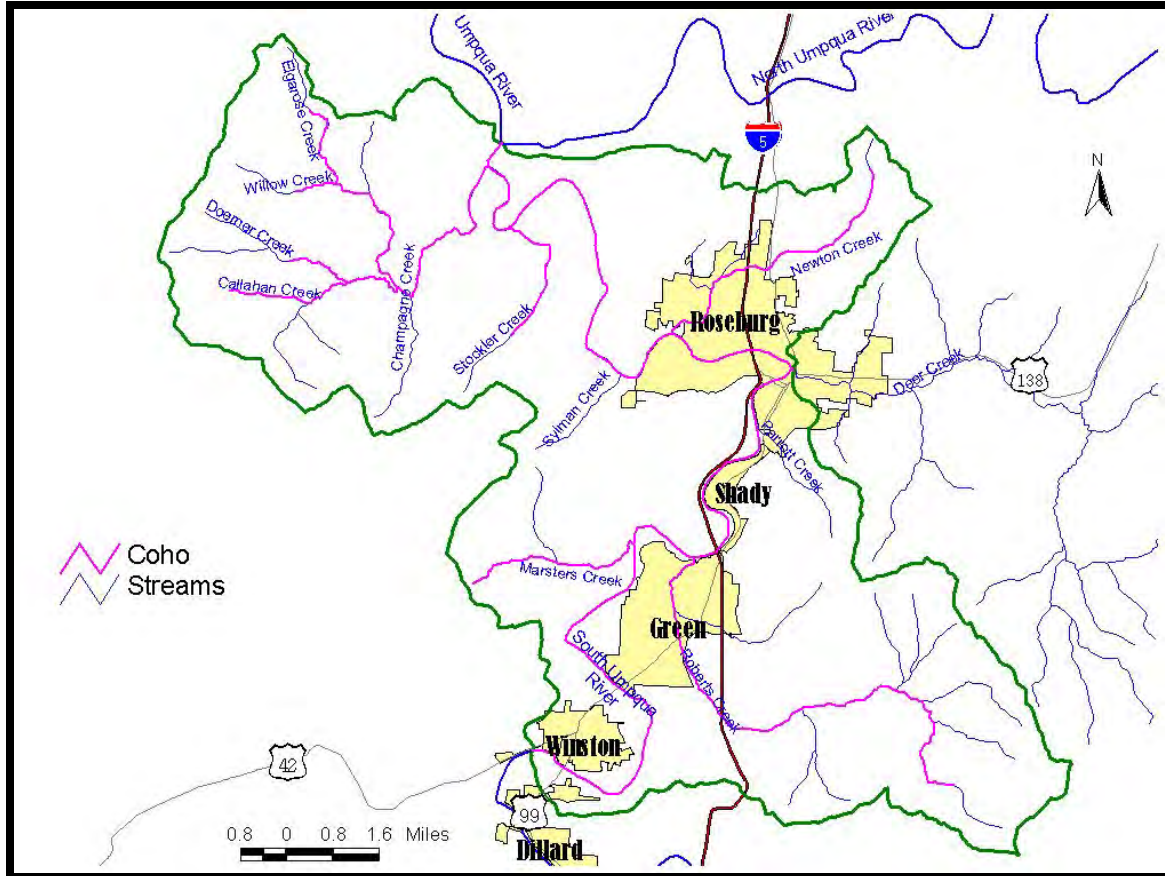
Appendix 7: Water use categories.

There are eight general water use categories in the Lower South Umpqua Watershed. The table below lists the Oregon Water Resources Department uses that are included in each category. Not all uses occur in the Lower South Umpqua Watershed.

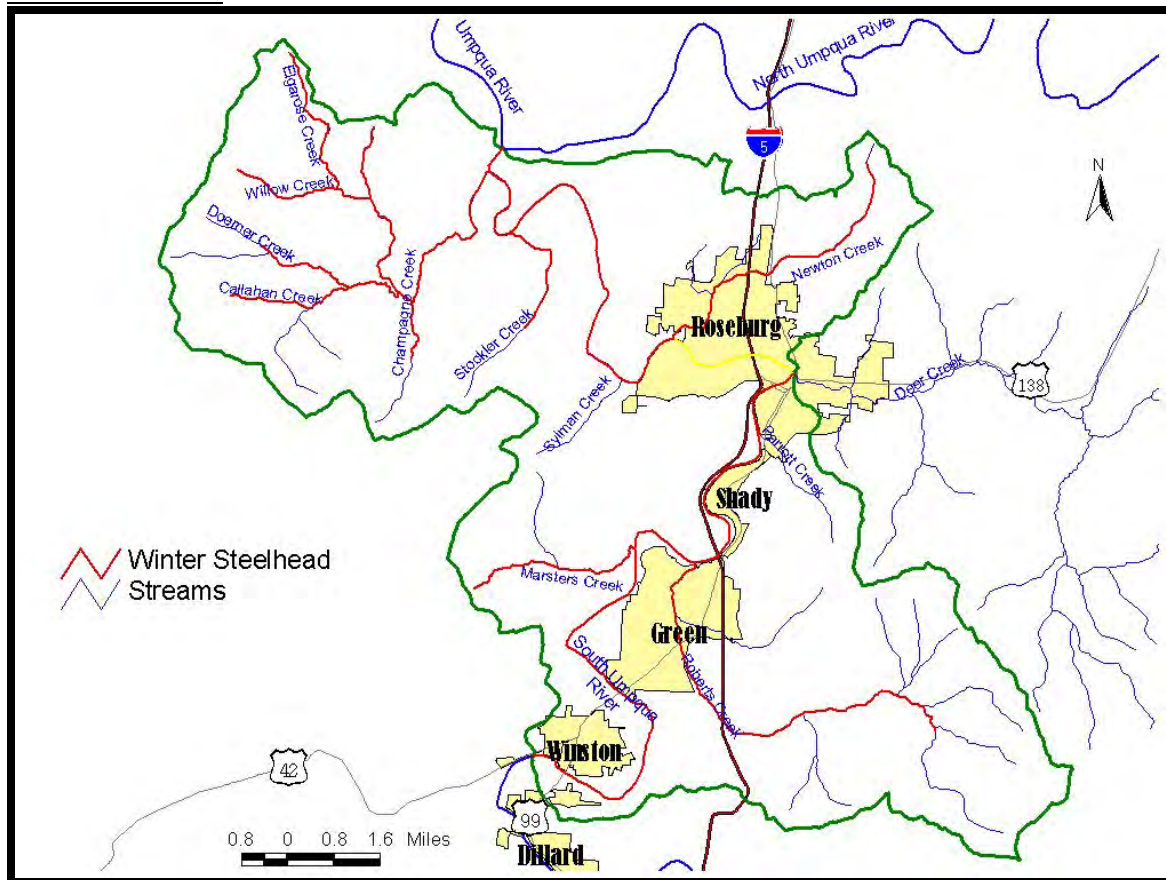
Irrigation	Industrial	Domestic
Primary and supplemental	Geothermal	Domestic
Irrigation	Manufacturing	Lawn and garden
Supplemental	Sawmill	Non-commercial
Cranberries	Shop	Stock
Irrigation, domestic & stock	Log deck	Group domestic
Irrigation & domestic	Commercial	Restroom
Irrigation & stock	Laboratory	School
Fish and Wildlife	Municipal	Recreation
Aquaculture	Municipal	Campground
Fish	Quasi-municipal	Recreation
Wildlife		School
Agriculture	Miscellaneous	
Agriculture	Air conditioning	
Cranberry harvest	Aesthetic	
Flood harvesting	Forest management	
All cranberry uses	Fire protection	
Temperature control	Groundwater recharge	
Dairy barn	Pollution abatement	
Frost protection	Road construction	
Greenhouse	Storage	
Mint still		
Nursery use		

Appendix 8: Anadromous salmonid distribution by species.

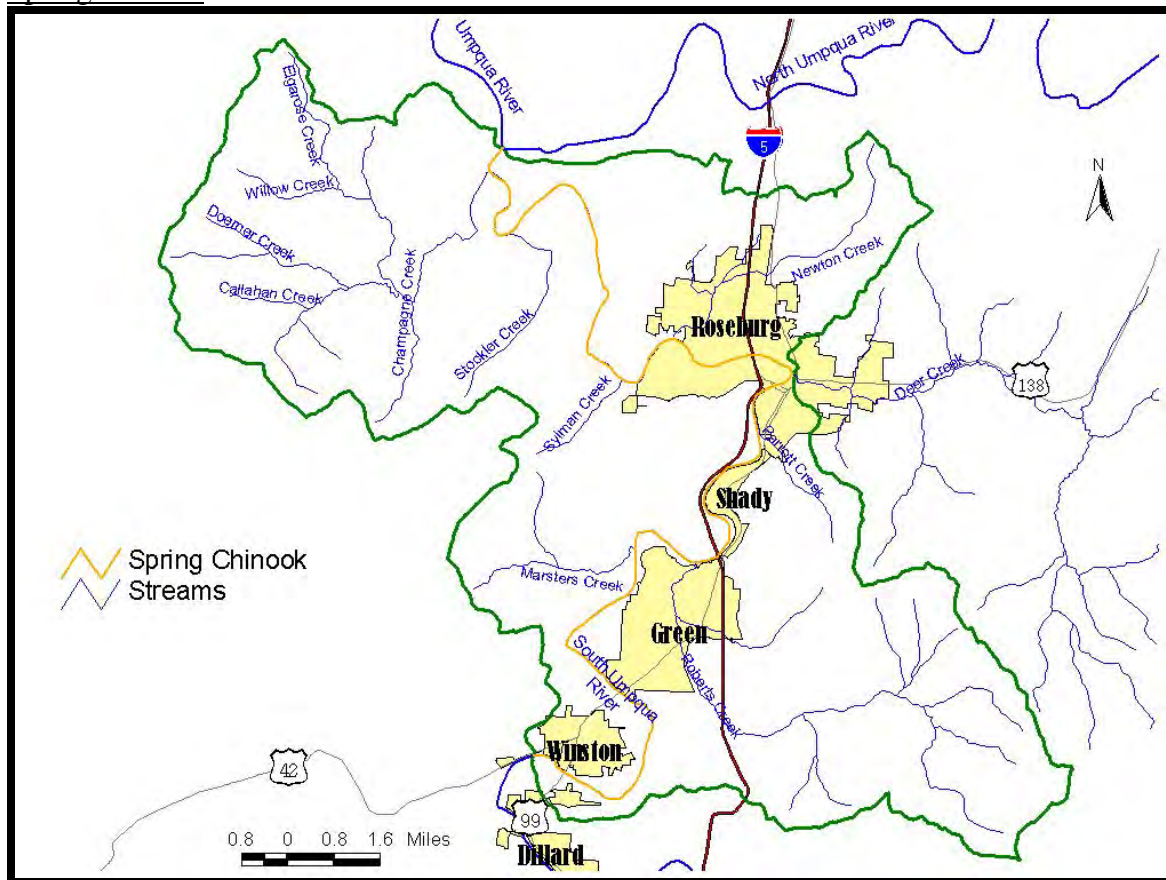
Coho



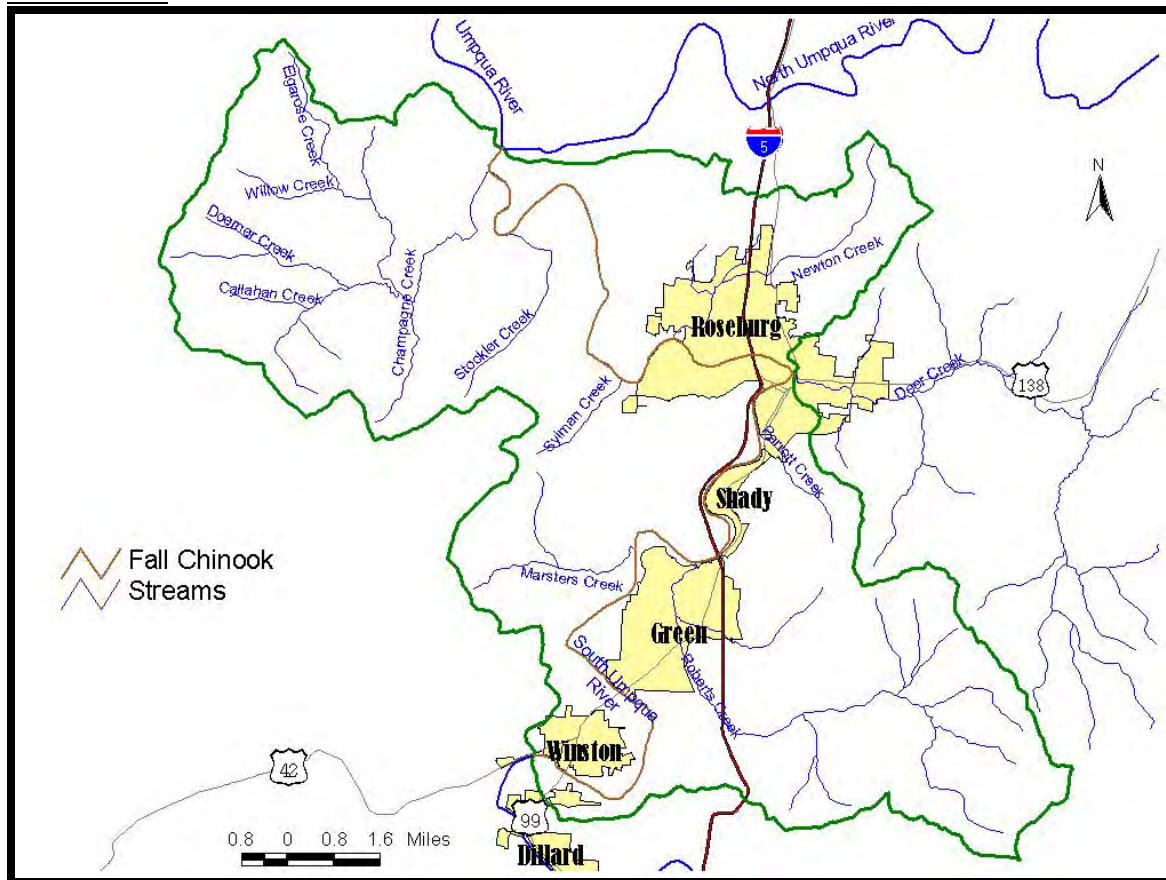
Winter steelhead



Spring chinook



Fall chinook



Acknowledgements

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I am also grateful for the assistance of the following individuals and groups:

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