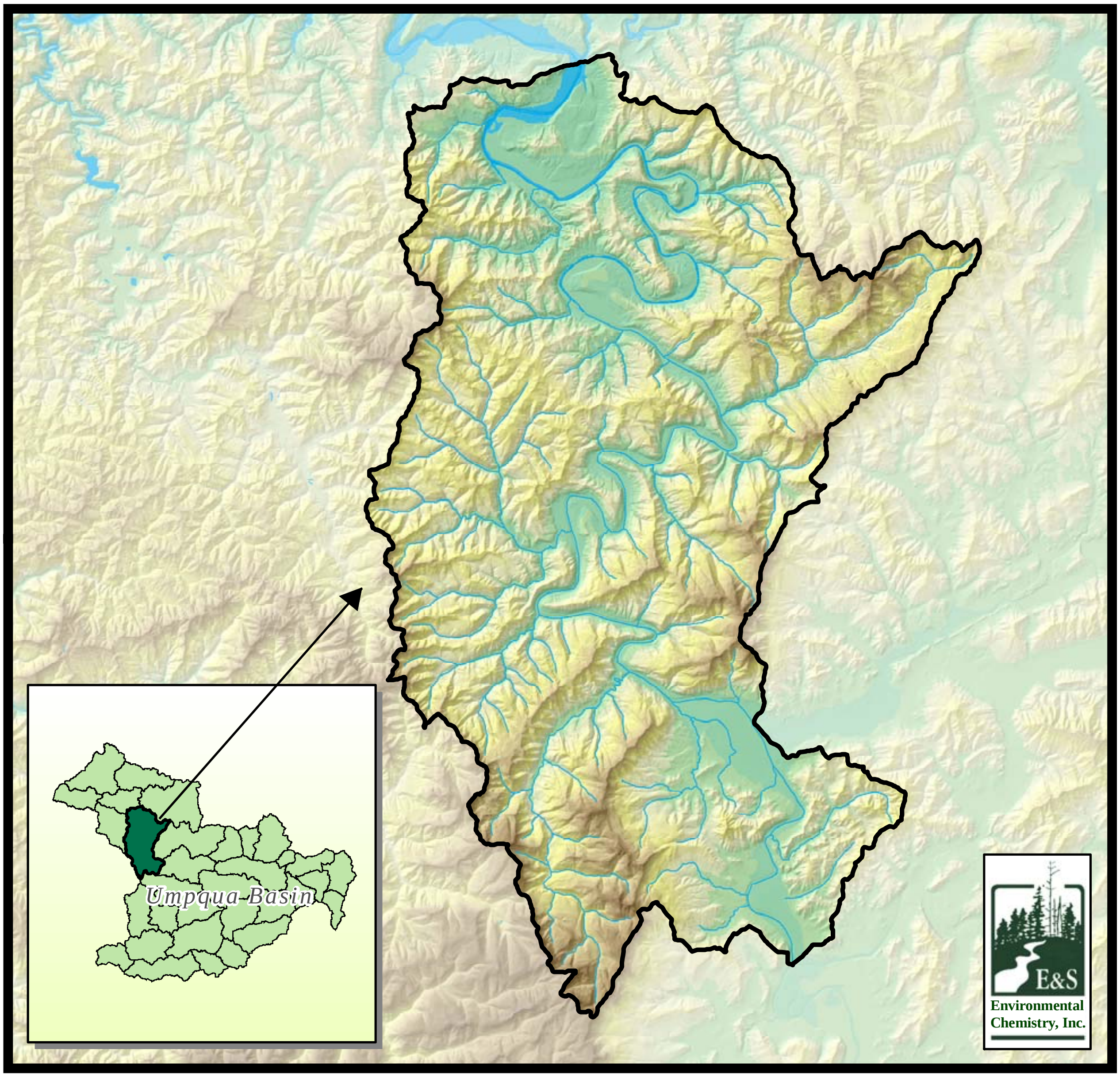
Upper Umpqua River Watershed Assessment



Prepared by E&S Environmental Chemistry, Inc.
for the Umpqua Basin Watershed Council

May, 2006

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Final Report

May, 2006

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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 was compiled from the *South Umpqua River Watershed Assessment and Action Plan* (Geyer 2003), *Elliott State Forest Watershed Analysis* (Biosystems 2003), and *Oregon Watershed Assessment Manual* (Watershed Professionals Network 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 Upper Umpqua River Watershed and what are its defining characteristics?
- What is land ownership and land use within the watershed?
- What are the demographic, educational, and economic characteristics of Upper Umpqua River Watershed residents?

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 organization that works with willing landowners on projects to enhance fish habitat and water quality in the Umpqua Basin. The council had its origins in 1992 as the Umpqua Basin Fisheries Restoration Initiative (UBFRI), and its name was changed to the UBWC in May of 1997. Three years later, the council was incorporated as a non-profit organization. The UBWC's 17-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, monitoring stream conditions and project impacts, and educating 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 Upper Umpqua River Watershed assessment has two goals:

1. To describe the past, present, and potential future conditions that affect water quality and fish habitat within the subject watershed; and
2. To provide a research-based action plan that suggests voluntary activities to landowners in order to improve fish habitat and water quality within the watershed.

The action plan developed from findings in Chapter 3 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, E&S Environmental Chemistry (E&S) scientists, landowners, and restoration specialists. Chapter 5 is a compilation of all key findings and action recommendations and includes a summary of potential UBWC watershed enhancement opportunities. Activities within the action plan *are suggestions for the kinds of voluntary projects and programs that would be most likely to have positive impacts on water quality and fish habitat in the watershed*. 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 assessment is the product of a collaborative effort between the UBWC, E&S, and watershed residents, landowners, and stakeholders. Members of the E&S and UBWC staffs assembled information about each assessment topic and compiled the data into graphic and written form. Landowners and other interested parties met with E&S and UBWC staff to review information about the watershed and offer comments and suggestions for improvement of draft versions of this assessment.

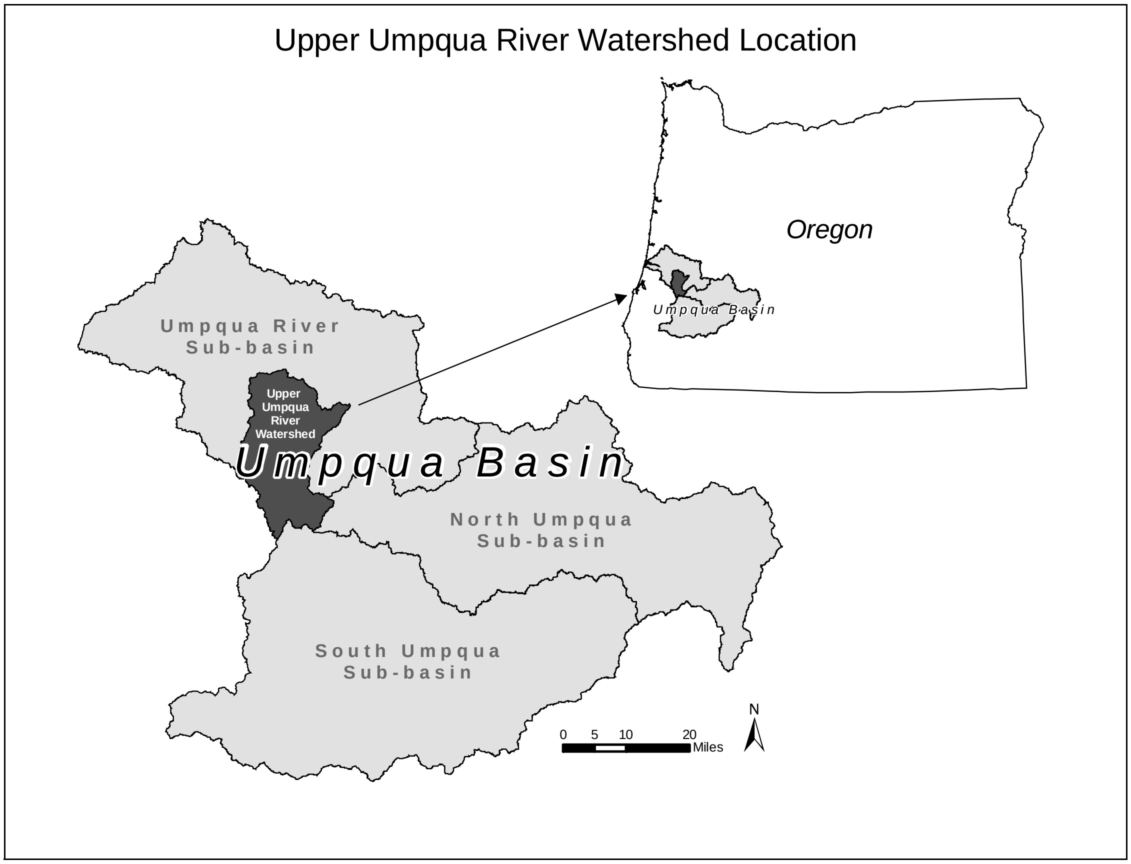
The Upper Umpqua River Watershed assessment meetings were held in conjunction with efforts to prepare this assessment. Landowners and residents met for four meetings and one field trip in 2005. A total of 17 people attended one or more meetings and the field trip. Meeting participants included ranchers, family forestland owners, industrial timber company employees, city officials, city residents, and land management agency personnel.

1.2. Watershed Description

1.2.1. Location, Size, and Major Features

For the purpose of this watershed assessment, the Umpqua Basin refers to the entire 2.7 million acre drainage area of the main Umpqua River, the North Umpqua River, the South Umpqua River, and all associated tributary streams. The Umpqua River sub-basin refers to the 387,000-acre area drained by the Umpqua River only. The North Umpqua sub-basin and the South Umpqua sub-basin are the drainage areas for the North Umpqua River and the South Umpqua River, respectively.

The area addressed in this assessment is the Upper Umpqua River Watershed, a 169,676-acre area in the Umpqua River sub-basin that drains into the Umpqua River from the confluence with Elk Creek upstream to the confluence with the North and South Umpqua rivers (also known as River Forks). Calapooya Creek, a large tributary that flows into the Umpqua River approximately eight miles downstream of River Forks, was not included in this watershed assessment because it was addressed in a separate watershed assessment in 2003. The Upper Umpqua Watershed stretches a maximum of 27 miles north to south and 12 miles east to west (Map 1.1). Kellogg, Tyee, Millwood, Umpqua, and Cleveland are the only population centers within the watershed. Highway 138 (Elkton-Sutherlin Highway) runs north-south, paralleling the Umpqua River in the northern part of the watershed. It is a major connecting route between the Umpqua Valley and the coast.



Map 1.1. Location of the Upper Umpqua River Watershed.

The watershed drains a varied landscape, from steep-sloped, highly-dissected headwaters to low-gradient broad floodplains. Steep slopes and rock outcrops characterize the upland terrain. Many small, high-gradient streams with deeply incised channels originate from headwalls at higher elevations. The major tributary streams within the watershed flow generally from headwaters in the Coast Range to the mainstem of the Umpqua River. Upstream of the Upper Umpqua River Watershed, the North Umpqua and South Umpqua rivers collect water from tributaries as far eastward as the crest of the Cascade Mountains. The alluvial valley width is highly variable, averaging approximately 1,000 feet but reaching a maximum of two miles in width. Over 90% of the floodplain is in private ownership, approximately 40% of which has been converted from native vegetation to agriculture.

1.2.2. Ecoregions

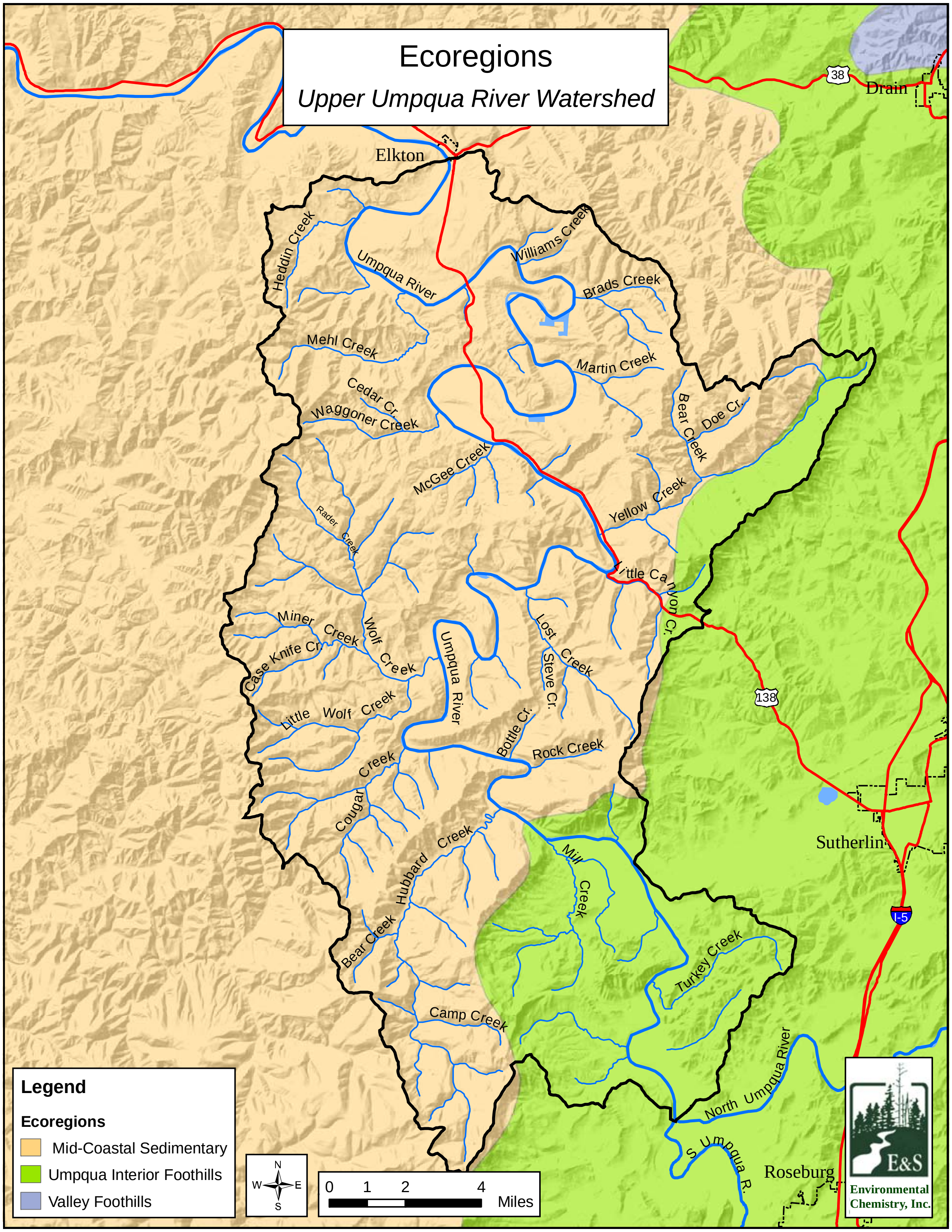
Ecoregions are land areas that are similar in climate, physiography, geology, natural vegetation, wildlife distribution, and land use that shape and form the function of watersheds. The hierarchical system of defining distinct ecoregions strives to help resource managers and scientists by identifying natural divisions and functional ecological units across the landscape. According to the US Environmental Protection Agency (USEPA) system of ecoregion classification, the Upper Umpqua River Watershed includes two ecoregions: Mid-Coastal Sedimentary and Umpqua Interior Foothills (Table 1.1, Map 1.2).

Table 1.1. Description of USEPA level IV ecoregion classifications in the Upper Umpqua River Watershed.

Geology[1]	Topography	Soils	Erosion	Climate	Land Use	Potential Natural Vegetation
1g. Mid-Coastal Sedimentary						
Quaternary colluvium. Eocene marine sandstone, siltstone, mudstone, and conglomerate.	Moderately-sloping, dissected mountains with medium to high gradient streams.	Inceptisols (Dystrudepts, Eutrudepts), Ultisols (Palehumults, Haplohumults)	Slopes are prone to failure when disturbed	Temp/moisture regime: Mesic/Udic; mean annual precipitation, 60-130 in.. Mean temps: Jan. min/max - 32/48; July min/max 48/78	Mostly forest; some pastureland in valleys. Timber management, wildlife habitat, and some rural residential development.	Hemlock-Douglas-fir forest/ Douglas-fir and/or western hemlock canopy, with salal, sword fern, vine maple, Oregon grape, and rhododendron shrub layer; tanoak on drier slopes to the south. Wetter slopes and riparian areas: bigleaf maple, western redcedar, grand fir, and red alder in the canopy, salmonberry and oxalis beneath; California bay-laurel increases to the south.
78c. Umpqua Interior Foothills						
Quaternary alluvium and colluvium. Pliocene marine sandstone. Eocene basalt.	Foothills and narrow interior valleys containing fluvial terraces and floodplains.	Mollisols (Haploxerolls, Argixerolls, Argiaquolls), Alfisols (Haploxeralfs), Inceptisols (Dystroxerepts)		Temp/moisture regime: Mesic/Xeric mean annual precipitation, 30-50 in.. Mean temps: Jan. min/max – 34/49; July min/max 53/84	Woodland, forest, pastureland, vineyards, orchards, cropland, and rural residential, commercial, and residential development.	Douglas-fir forest and Oregon oak woods/ Oregon white oak, Douglas-fir, ponderosa pine, grand fir, madrone, tanoak, and chinkapin. Understory plants include snowberry, salal, Oregon grape, poison oak, oceanspray, and swordfern.

[1] These terms refer to the relative order in which geologic events occurred.

Source: ftp://ftp.epa.gov/wed/ecoregions/or/or_back.pdf



Map 1.2. Ecoregions of the Upper Umpqua River Watershed.

Table 1.2. Acres and percent of the Upper Umpqua River Watershed within each ecoregion.

Ecoregion	Total Acres	Percent of Total
Mid-Coastal Sedimentary	136,083	80.2
Umpqua Interior Foothills	33,593	19.8

Most of the watershed lies within the Mid-Coastal Sedimentary Ecoregion (Table 1.2). This ecoregion is characterized by moderately-sloping, dissected mountains with medium to high gradient streams. Its Douglas-fir forests are intensively managed for timber. The mountainous Mid-Coastal Sedimentary Ecoregion lies outside of the coastal fog zone and is typically underlain by massive beds of sandstone and siltstone. Slopes are prone to failure when disturbed, particularly south of the Siuslaw River. Eastern portions of the watershed, especially the southeastern corner of the watershed, lie within the Umpqua Interior Foothills Ecoregion. The Umpqua Interior Foothills Ecoregion is a mixture of narrow valleys, terraces, and foothills. A mix of oak woodlands, Douglas-fir, ponderosa pine, and madrone intermingle with pastureland, vineyards, orchards, and row crops.

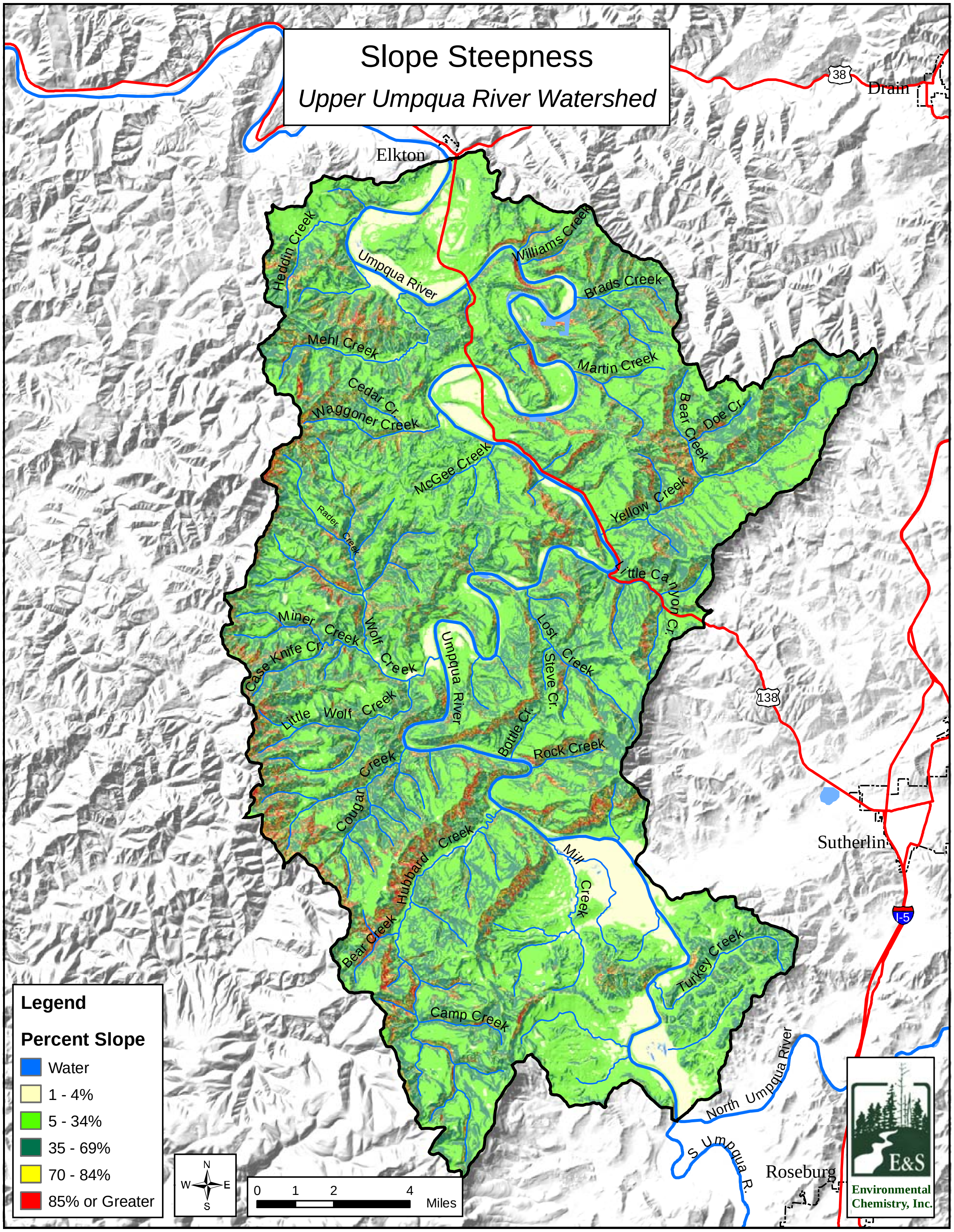
1.2.3. Topography

The Upper Umpqua River Watershed exhibits varied relief. Many of the tributary sub-watersheds are fairly steep with stream channels that dissect the landscape. The mainstem Umpqua River has fairly extensive floodplains. The largest low-relief features in the watershed are the Umpqua River floodplains south of Elkton and south of the confluence with Mill Creek.

In the Upper Umpqua River Watershed, slopes range from 0% to 4% in the floodplains along the mainstem Umpqua River. The steepest lands (greater than 85% slope) are found mainly in the western portions of the watershed adjacent to many of the tributary streams (see Map 1.3). The lowest points in the watershed lie at 75 feet above sea level. The highest point is 2,854 feet. In the Upper Umpqua River Watershed, only 4% of the land base is above 2,000 feet. Areas between 2,000 and 5,000 feet in elevation are known as the transient snow zone. Most of this area occurs in the Hubbard Creek drainage, Tyee Mountain area, and near Yellow Butte. Rain-on-snow events, in which rain falls on accumulated snow causing it to melt, are more likely to occur in these moderately-higher areas.

1.2.4. Geology

The geologic history and current setting of the watershed is critical to understanding natural resource issues within it. In particular, geologic variation throughout the watershed can influence the delivery of sediment to the stream system. This sediment is critical to maintaining suitable fish spawning habitat. In Oregon, geologic processes have created a unique and varied landscape throughout the state. In southwestern Oregon, the history of the landscape is dominated by the collision of western North America with the floor of the Pacific Ocean and fragments of earth crust lying on it. This section summarizes the geology and geomorphology of the Upper Umpqua River Watershed. Information in this section has been taken from the following documents: *Geology of Oregon* (Orr et al. 1992); *Northwest Exposures, A Geologic History of the Northwest* (Alt and Hyndman 1995); *Earth* (Press and Siever 1986); *Geologic Map of Oregon* (Walker and MacCleod 1991); and *Atlas of Oregon* (Loy et al. 2001).



Map 1.3 Percent slope for the Upper Umpqua River Watershed.

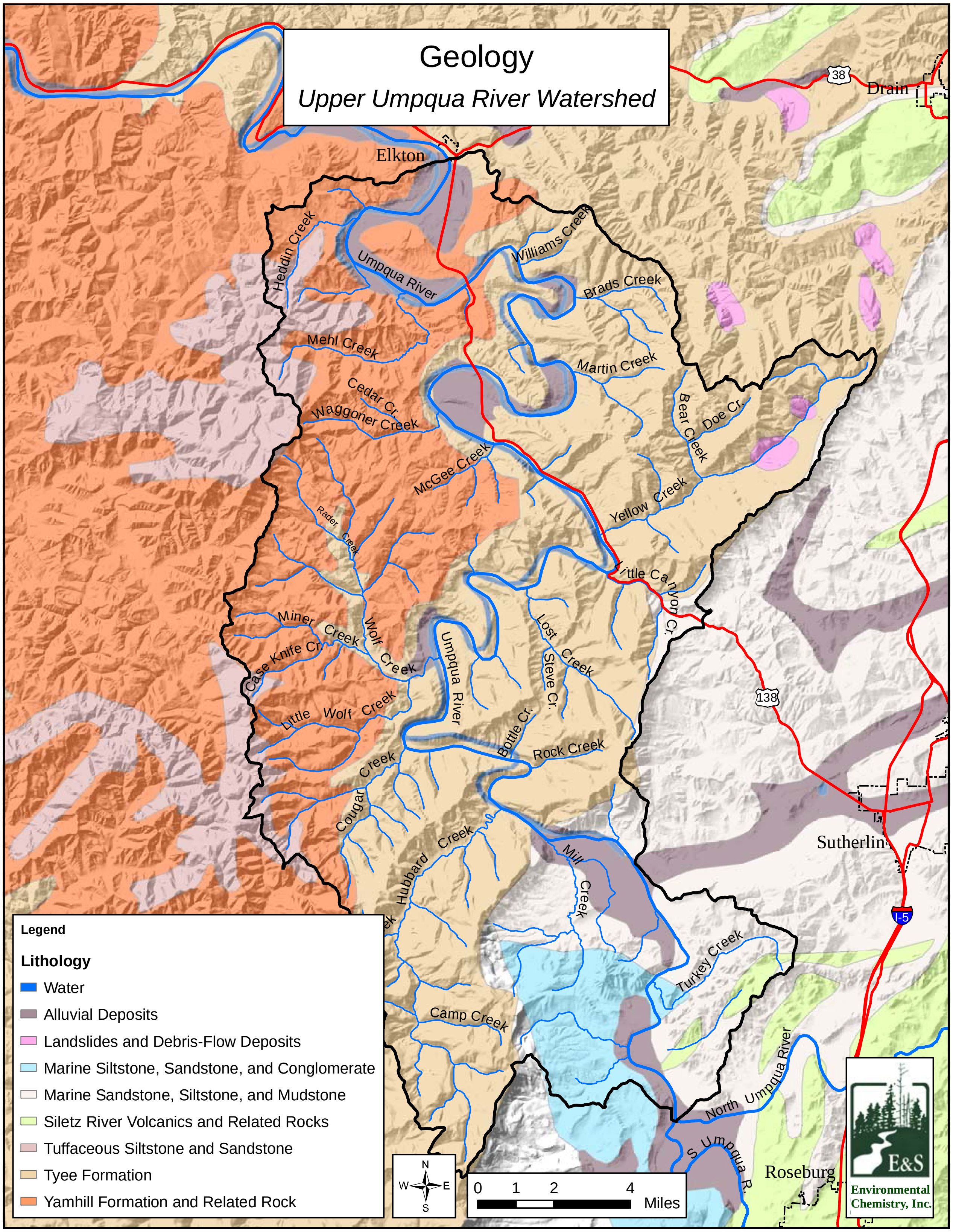
Geologic processes have created many different physiographic provinces, or areas of similar geomorphology, within the state. The Umpqua Basin lies at the intersection of three physiographic provinces: the Coast Range, the Klamath Mountains, and the Western Cascades. All of the Upper Umpqua River Watershed occurs in the Coast Range Province.
Uplifted geological strata in the watershed are largely marine sedimentary rocks, interspaced with some basalt formations (Table 1.3, Map 1.4). Marine sedimentary rocks in this region belong mainly to the Tyee and Yamhill Formations. The Tyee geological unit is composed of sandstone beds up to 30 feet thick, separated by thin deposits of mudstone (Skaugset et al. 2002). These deposits are weak in shear and tensile strength (Ryu et al. 1996). The Yamhill geological unit is comprised of muds and silts formerly deposited in shallow seas. Alluvial deposits occur in narrow bands along the mainstem river. The sedimentary rock formations are comprised of varying sequences of sandstone, siltstone, and mudstone with varying degrees of cementation and resistance to weathering and erosion. Much of the rugged terrain is attributable to the erosion resistance of many of the sandstones. Strongly cemented, massive strata of the Tyee sandstones are notable cliff formers.

Table 1.3. Geologic units in the Upper Umpqua River Watershed.

Lithology	**Area (acres)**	**Percent of Watershed**
Water	4,055	2.4
Alluvial Deposits	10,923	6.4
Landslides and Debris-Flow Deposits	751	0.4
Marine Siltstone, Sandstone, and Conglomerate	7,303	4.3
Marine Sandstone, Siltstone, and Mudstone	13,593	8.0
Marine Sandstone and Siltstone	1,089	0.6
Siletz River Volcanics and Related Rocks	1,157	0.7
Tuffaceous Siltstone and Sandstone	4,605	2.7
Tyee Formation	84,051	49.6
Yamhill Formation and Related Rock	42,148	24.9

Geologic processes govern the topography of an area, which in turn greatly influences the morphology of streams. The hydraulic conductivity, or permeability, of rock units plays a significant role in determining the groundwater inputs to streams, and groundwater can contribute to stream water quality. Generally, groundwater has a more consistently high quality than surface water. However, many streams in mountainous areas, such as the Upper Umpqua River Watershed, are naturally surface-water dominated, with groundwater playing a relatively minor role.

The topography that results from geologic processes helps to shape the steepness of slopes and their likelihood of failing. Topography also influences the local climate, causing, for instance, more rain on the western slopes of large hills than on the eastern slopes. This may influence runoff and sediment inputs locally. Geology largely governs the process of soil formation.



Map 1.4. Geologic units within the Upper Umpqua River Watershed.

Rocks provide the parent material for soil development. The minerals within rocks also influence the organisms that live within the soil. Relief and climate, both influenced by geology, also impact soil genesis. The characteristics of the resulting soil impact the contribution of sediment to streams.

There are two distinct zones of erosional processes in the watershed: the steep, forested uplands, and the broad, lowland floodplains along the mainstem river. On the steep slopes and shallow soils of the forested uplands, mass wasting is the dominant erosional system. Mass wasting includes a variety of erosional processes such as shallow landslides, rock slides, debris slides, and debris flows in steeper terrain, and earth slides and earth flows on gentler slopes. Under natural conditions, geology, topography, and climate interact to cause landslides. Slope steepness is shown in Map 1.3, giving an indication of the location of steep areas that are more prone to landslides.

Streambank erosion also naturally occurs in the uplands, most notably in the Brads Creek and McGee Creek subwatersheds. Roads in the uplands further increase the potential for erosion. Roads have been identified as the single greatest human-caused source of sediment in Oregon forest lands (Oregon Department of Forestry 1999).

Streambank cutting and sheet and rill erosion are the two primary erosional processes in the floodplain zone. Streambank erosion is the more prevalent of the two, and typically occurs in response to selective stratigraphic failure, soil saturation, or sloughing during high-flow events. Land use practices have caused stream channelization and modification of the riparian zone in some areas, thereby altering the natural patterns and rates of streambank erosion.

1.2.5. The Upper Umpqua River Watershed Stream Network

The Upper Umpqua River Watershed begins at the confluence of the North and South Umpqua rivers and extends downstream to Elkton. It includes 62 stream miles of the Umpqua River.[1] Map 1.4 shows all of the tributaries that feed into this portion of the Umpqua River that are visible on a US Geological Survey (USGS) 1:100,000 resolution map, where one inch equals 8,333.3 feet. According to this map, there are 270.4 stream miles in the Upper Umpqua River Watershed. Of the major tributaries within the Upper Umpqua River Watershed, Hubbard Creek is the largest. The lower portion of Wolf Creek (below Little Wolf Creek) is the only other sixth order stream creek within the watershed. (Calapooya Creek is examined in a separate watershed assessment.)

Streams in the watershed are characteristically “flashy.” They respond very quickly to rainfall by rapidly increasing discharge due to the steep topography in some portions of the watershed, high stream density, and intensity of precipitation. High flows typically occur between November and March and low flows from May through October.

[1] Stream miles and river 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.

Daily stream flow records have been collected for the Umpqua River near Elkton by the USGS since 1906 (Station 14321000). The annual low flow for the Umpqua River averages less than 2,000 cubic feet per second (cfs) during the months of July through October, and the annual high flow is generally near 16,000 cfs in January (Figure 1.1).

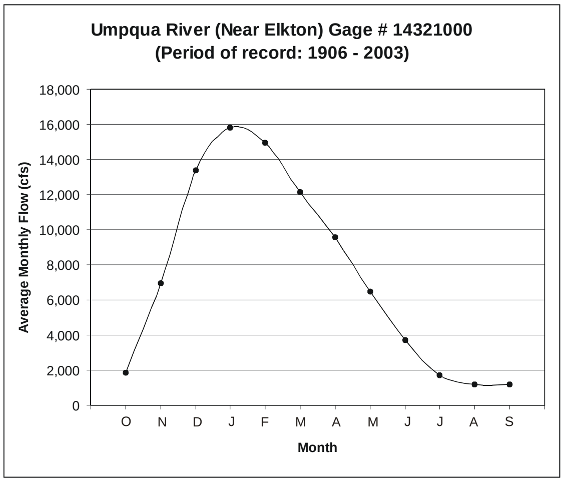


Figure 1.1. Average monthly Umpqua River discharge near Elkton.

1.2.6. Climate

The watershed is exposed to a moderate climate that is influenced by proximity to the Pacific Ocean and elevation. Westerly winds predominate and carry moisture and temperature-moderating effects from the ocean, resulting in winters that are moderate and wet, and summers that are cool and dry. Precipitation occurs mostly during the winter months (Figure 1.2). The upper reaches of the watershed generally receive over 50 inches of precipitation per year, while it is estimated that the lower reaches in the southeastern portion of the watershed receive about 35 inches. Slightly higher values occur at the higher elevations in the northern portions of the watershed. Average annual precipitation is about 53 inches along the mainstem Umpqua River at Elkton, where rainfall averages over 6 inches for each of the months of November through March and less than about 1 inch per month for June through August. A rain shadow is caused by the high ridges of the Coast Range, and

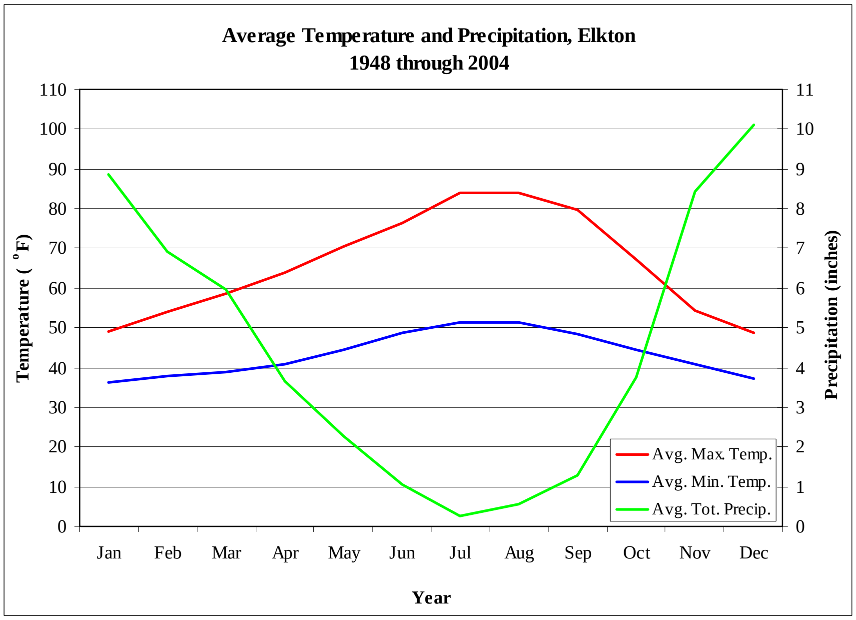


Figure 1.2. Average monthly temperature (^{o}F) and precipitation (inches) at Elkton (1948 through 2004).[2]

[2] Source: http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?orreed

precipitation is less to the east of these ridges. Intense winter storms occur periodically, accompanied by high winds and heavy precipitation. Snow falls occasionally at the high elevations during the winter, but usually melts quickly with the warm rain that is typical of Pacific winter storms.

There is a climate station at the lower end of the Upper Umpqua River Watershed at Elkton.[3] Figure 1.2 shows the average daily minimum and maximum temperatures by month for Elkton. Air temperatures in the watershed are mild throughout the year with cooler temperatures at higher elevations. Maximum temperatures in the summer are generally above 70^{o}F. Maximum temperatures can exceed 90^{o}F, but marine air generally keeps summer temperatures somewhat cooler. Minimum winter temperatures are usually just above freezing. Relatively few days in winter have temperatures below freezing.

1.2.7. Vegetation

The upland portions of the watershed are mainly forested with coniferous forest stands, especially Douglas-fir. Coniferous forests cover 66.4% of the watershed, with a good distribution of size classes (Table 1.4). Approximately forty-four percent of the coniferous forests within the watershed are comprised of trees larger than 20 inches diameter at breast height (DBH).[4] Most are found on federal lands. Hardwood forests comprise 3.1% of the watershed, and are more common along stream corridors and in some of the lower-elevation areas (Map 1.5).

Table 1.4. Landscape cover types in the Upper Umpqua River Watershed.

Type	Percent	Acres
Barren	0.2	276
Conifer (<10" DBH)	9.0	15,257
Conifer (10-19" DBH)	13.7	23,233
Conifer (20-29" DBH)	28.0	47,498
Conifer (>30" DBH)	15.7	26,699
Hardwood (10-19" DBH)	0.7	1,116
Hardwood (20-29" DBH)	2.4	4,047
Non-Forest	12.9	21,820
Urban	0.1	215
Agriculture	15.8	26,889
Water	1.5	2,626
Total	100.0	169,676

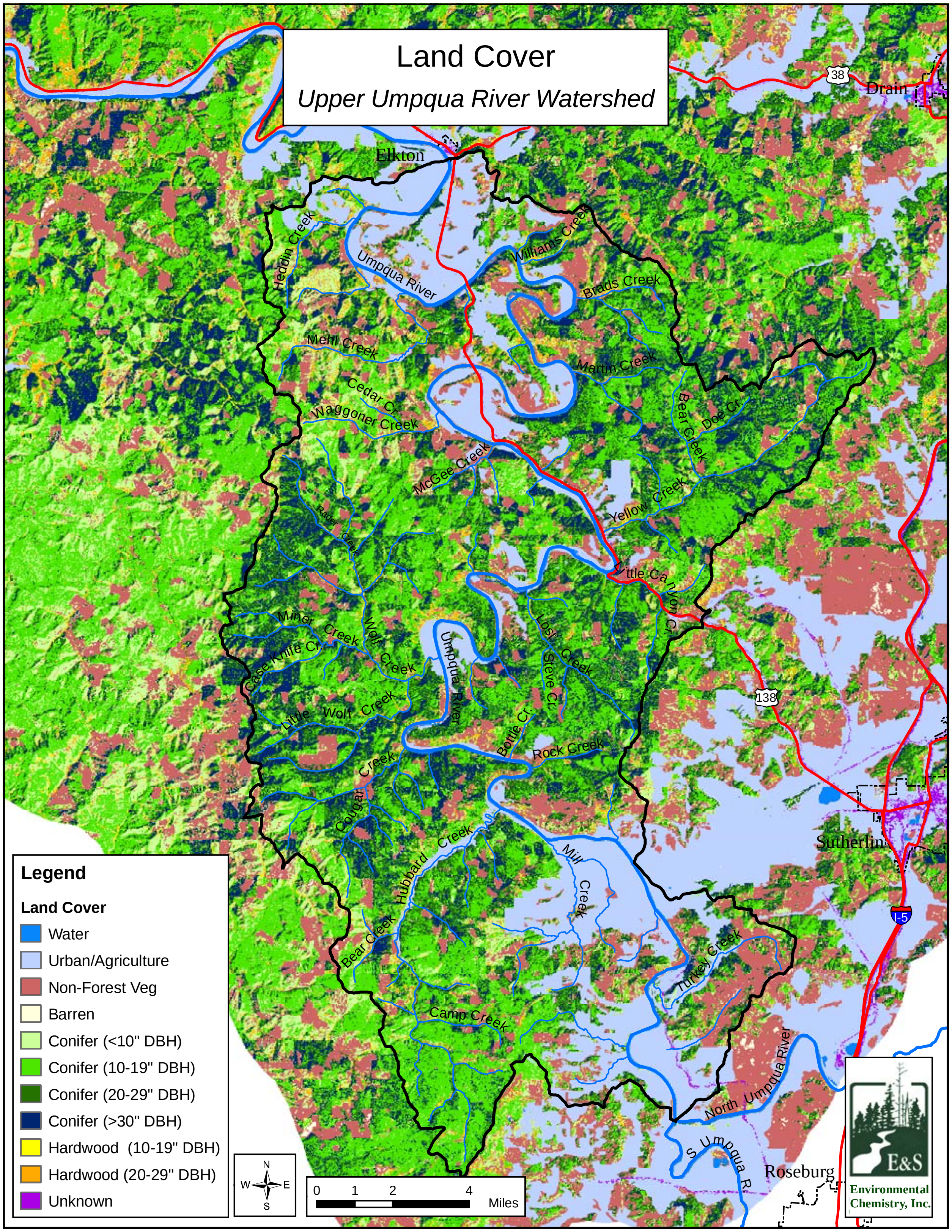
The majority of the existing early and mid-seral forest stands in the watershed resulted from clearcut harvesting prior to 1995. It is estimated that 25,000 acres of Bureau of Land Management (BLM) lands were clearcut harvested, the vast majority of these occurring between 1945 and 1995. Since 1995, approximately 290 acres of BLM lands have been regeneration harvested and approximately 60 acres have been commercially thinned.

1.3. Land Use, Ownership, and Population

1.3.1. Land Use and Ownership

Within the Upper Umpqua River Watershed, private lands are interspersed with federal lands throughout the watershed. Most of the private lands are managed as tree farms to produce wood

[3] The National Oceanographic and Atmospheric Administration (NOAA) administers this station. Data are available from the Oregon Climate Station website http://ocs.oce.orst.edu/.
[4] Diameter at breast height (DBH) indicates the measurement of the diameter of a tree trunk at approximately 4.5 feet above the ground.



Map 1.5. Landscape cover types in the Upper Umpqua River Watershed.

fiber on forest rotations of between 40 and 50 years. On BLM lands, natural stands are interspersed with younger, managed plantations.

Table 1.5 Land ownership in the Upper Umpqua River Watershed.

Ownership	Area (acres)	Percent of Watershed
Federal	57,040	33.6
Private	109,693	64.6
State	312	0.2
Water	2,631	1.6

The majority of the Upper Umpqua River Watershed is forested (approximately 70%). Agriculture constitutes about 16% of the land use, and mostly occurs in the floodplains of the lower Umpqua River and its tributary streams Mill Creek and Rock Creek. As shown on Map 1.6 and in Table 1.5, land ownership includes 64.6% private, 33.6% federal, and 0.2% state lands. Public ownership is mostly administered by the BLM. Private and BLM-administered lands are generally distributed in a checkerboard pattern. Most land adjacent to the Umpqua River is private.

There are many recreational opportunities in the watershed. These include fishing, boating, camping, picnicking, hiking, mountain biking, and sightseeing. Fishing is very popular for spring and fall chinook, winter and summer steelhead, smallmouth bass, and shad. Many anglers fish from boats, which are commonly launched at Umpqua Landing, Yellow Creek, James Wood Boat Ramp, or Osprey Boat Ramp. There are a number of take-outs, improved and primitive. Bank angling is common.

Myrtle Island was designated as a Research National Area (RNA) in 1981. It is 28 acres in size. The island contains an old-growth stand of California bay-laurel and scattered Douglas-fir, which is protected against disturbance and maintained for observation and research.

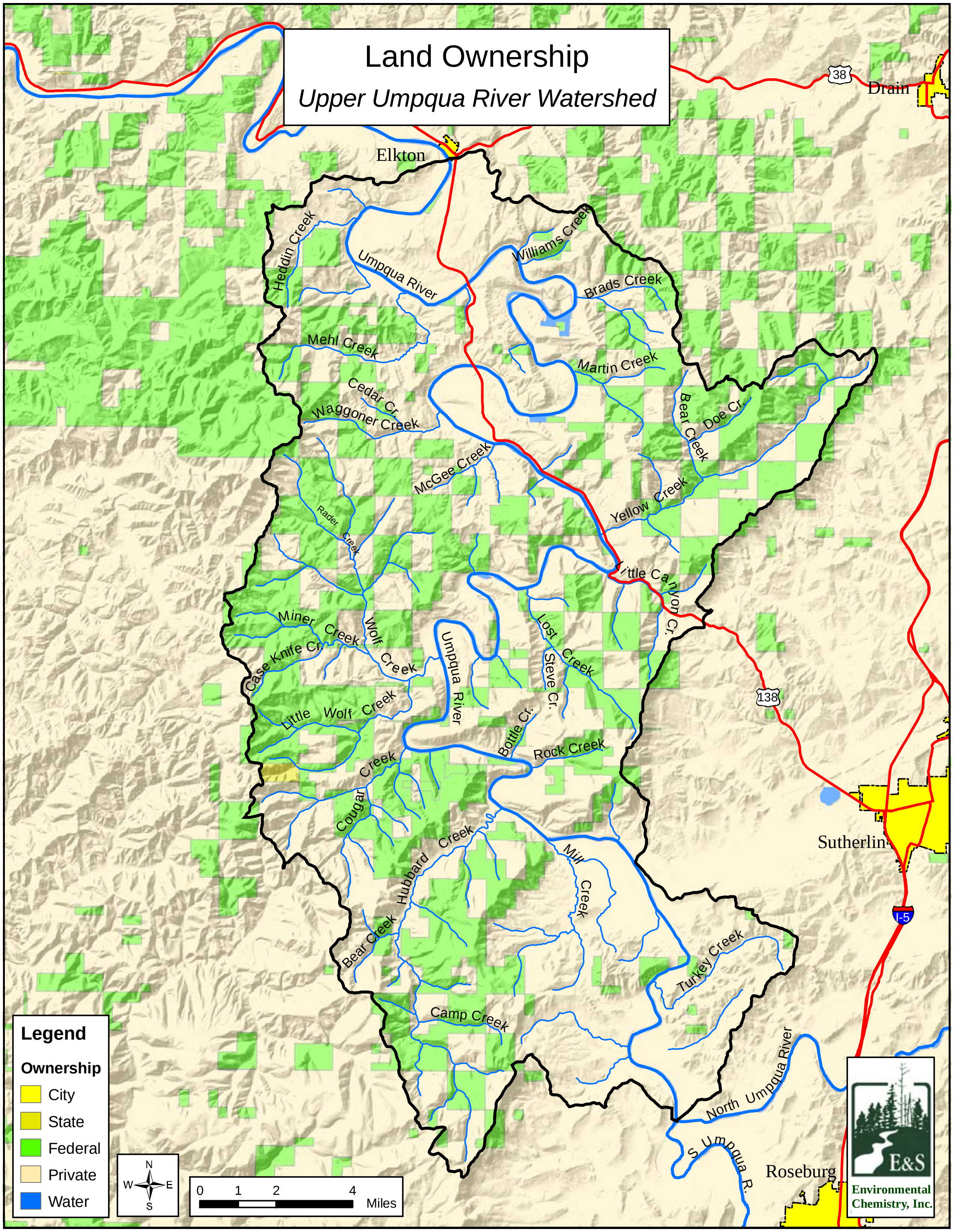
Campgrounds are available at the Tyee Recreation Site (15 sites) and the Eagleview group-use campground (10 sites and 50-person pavilion).

The Hubbard Creek off-highway vehicle (OHV) area comprises 11,700 acres. Most of this OHV area lies within the Upper Umpqua River Watershed. All of the natural surface roads and trails within the area receive OHV use, including ATVs, 4x4s, and motorcycles. The OHV use is restricted to existing roads and trails, but there are multiple maintenance and environmental problems associated with this use (BLM 2002). Heavily used areas have become dangerous to recreational riders due to very deep eroded ruts in the travel way.

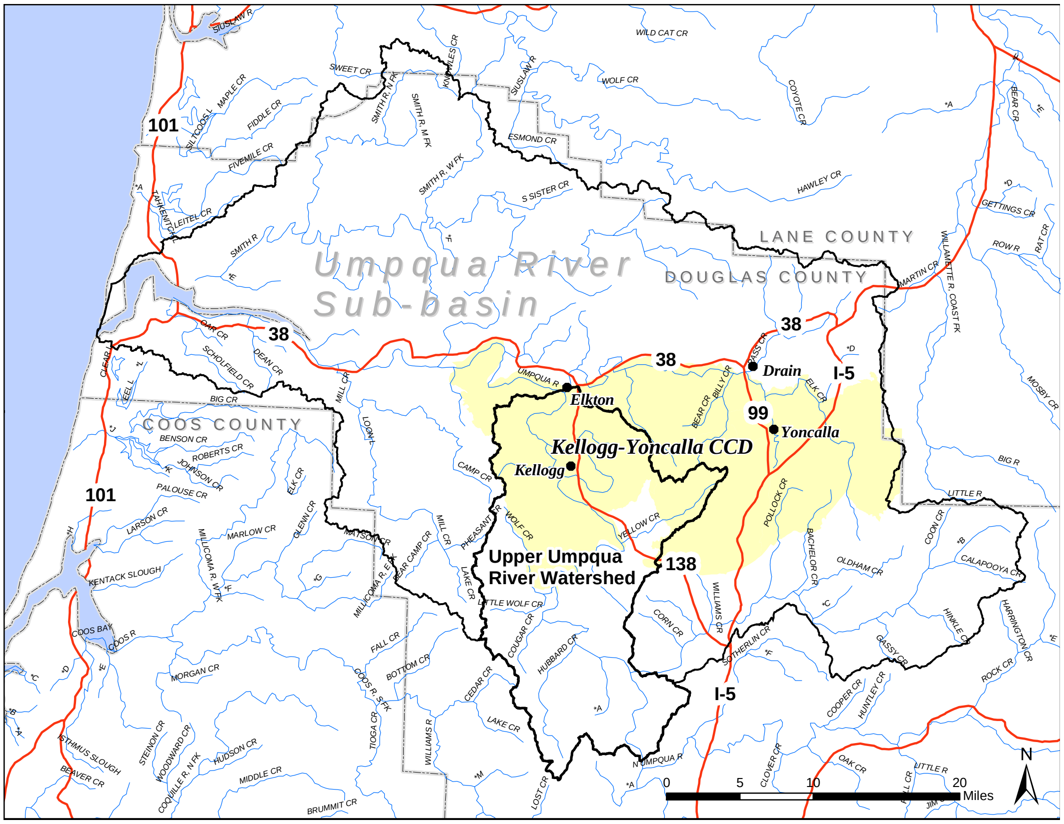
1.3.2. Population and Demographics

1.3.2.1. Population

Areas for which the US Census Bureau has population and demographic information do not correspond with the Upper Umpqua River Watershed boundary. The only population center with census data within the Upper Umpqua River Watershed is Umpqua. In 2000, its population was 682.



Map 1.6. Land ownership in the Upper Umpqua River Watershed.



Map 1.7. Location of the Kellogg-Yoncalla CCD.[5]

Part of the Kellogg-Yoncalla Census County Division (CCD) is within the watershed (see Map 1.7).[6] Data from these areas are included in this section to provide an overview of the populations that live within the Upper Umpqua River Watershed.

1.3.2.2. General Demographic Characteristics and Housing

Table 1.6 provides Census 2000 information about general demographic characteristics and housing for the Umpqua population center and the Kellogg-Yoncalla CCD; Douglas County data are provided for comparison. The median age for Umpqua is higher than both the Kellogg-Yoncalla CCD and the county. The largest racial group for all areas is white, with the next largest group being Hispanic or Latino. Average household size and family size is comparable for all three areas. The percent of owner-occupied housing ranges from 71.7% in Douglas County to 86.6% in Umpqua. Umpqua has a higher percentage of vacant housing units than the Kellogg-Yoncalla CCD and the county.

[5] This map is from the US Census Bureau's American FactFinder website: http://factfinder.census.gov.
[6] 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."

Table 1.6. 2000 Census general demographic characteristics and housing for the population center of Umpqua, the Kellogg-Yoncalla CCD, and Douglas County.

Parameter	Umpqua	Kellogg-Yoncalla CCD	Douglas County[7]
Median age (years)	49.1	43.9	41.2
Race			
White	93.8%	93.6%	93.9%
Hispanic or Latino	2.9%	1.8%	3.3%
Asian	1.5%	0.6%	0.6%
American Indian or Alaskan Native	1.3%	1.0%	1.5%
African American	0.3%	0.3%	0.2%
Native Hawaiian or Pacific Islander	0.0%	0.2%	0.1%
Households			
Avg. household size (#)	2.43	2.54	2.48
Avg. family size (#)	2.76	2.88	2.90
Owner-occupied housing	86.6%	79.8%	71.7%
Vacant housing units	11.8%	9.0%	8.0%

1.3.2.3. Social Characteristics

Table 1.7 provides information from the 2000 Census for education, employment, and income for the population center of Umpqua and the Kellogg-Yoncalla CCD; Douglas County data are included for comparison. In all Census areas, more than 80% of the adult population over age 25 has at least a high school graduate level of education, with the population of Umpqua having over 87%. The percentage of the population in the labor force is lower in Umpqua than in the Kellogg-Yoncalla CCD and the county; the percent of unemployed persons is lower in the city of Umpqua and the Elkton-Drain CCD than in the county. The top three occupations in Table 1.7 account for around 70% of the labor force in all three areas, and the top three industries employ about half of the workers. Median family income ranges from $35,000 to $45,000 in the three areas considered, with Umpqua having the highest; there are no families below the poverty level in Umpqua as compared with over 9% in both the Kellogg-Yoncalla CCD and Douglas County.

[7] In 2000, the population of Douglas County was 100,399 people.

Table 1.7. 2000 Census information for education, employment, and income for the population center of Umpqua, the Kellogg-Drain CCD, and Douglas County.

Parameter	Umpqua	Kellogg-Yoncalla CCD	Douglas County
Education – age 25+			
High school graduate or higher	87.2%	81.9%	81.0%
Bachelor's degree or higher	11.7%	12.8%	13.3%
Employment- age 16+			
In labor force	45.2%	54.4%	56.9%
Unemployed in labor force	3.3%	3.5%	4.3%
Top three occupations	(1) Service occupations; (2) Management, professional, and related occupations; AND Production, transportation, and material moving (tie)	(1) Management, professional, and related occupations; (2) Production, transportation, and material moving occupations; (3) Sales and office occupations	(1) Management, professional and related occupations; (2) Sales and office; (3) Production, transportation, and material moving.
Top three industries	(1) Educational, health and social services; (2) Agriculture, forestry, fishing and hunting, and mining (3) Construction; AND Professional, scientific, management, administrative, and waste management services (tie)	(1) Manufacturing (2) Educational, health, and social services; (3) Retail trade; AND Agriculture, forestry, fishing and hunting, and mining	(1) Educational, health, and social services; (2) Manufacturing; (3) Retail trade
Income			
Per capita income	$16,979	$15,563	$16,581
Median family income	$45,089	$34,969	$39,364
Families below poverty	0.0%	9.3%	9.6%

2. Past Conditions[8]

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 Upper Umpqua River Watershed. Sections 2.1 through 2.5 describe the history of Douglas County. Section 2.6 provides information specific to the study watershed. Most of sections 2.1 through 2.5 is based on S.D. Beckham's 1986 book *Land of the Umpqua: A History of Douglas County, Oregon*, and the *South Umpqua Watershed Assessment and Action Plan* (Geyer 2003). A complete list of citations can be found in the References 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, reaching Douglas County in the 1820s.

> Origin of the Name "Umpqua"
>
> Many ideas exist about the origin of "Umpqua." A Native American 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 tribe member interviewed in 1960 believed the term originated when white settlers arrived across the river from their village and began shouting and gesturing their desire to cross. "Umpqua," might mean "yelling," "calling," or a "loud noise" (Minter 1967, p. 16). Another Native American when asked the meaning of "Umpqua" rubbed his stomach, smiled, and said, "Uuuuuump-kwa – full tummy!" (Bakken 1970, p. 2)

2.1.1. Native Americans

The Native Americans of Douglas County used fire to manipulate the local vegetation to improve hunting success and facilitate travel. Accounts of the native Douglas County vegetation reveal extensive prairies and large trees. 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

[8] Robin Biesecker and Jeanine Lum of Barnes and Associates, Inc., contributed to this section.

described as reaching two to three foot diameters and to have a low and spreading form. Many early visitors described 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).

The diet of the native people included fish and wildlife. 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 native people along the main Umpqua River. The natives 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" (Schlesser 1973, p. 8). Wildlife was prevalent throughout Douglas County and included elk, deer, cougar, grizzly bear, beaver, muskrat, and coyote.

2.1.2. European Visitors

The Lewis and Clark Expedition provided glowing reports of the natural riches of the region and proved travel to Oregon was difficult but possible. Fur seekers, missionaries, and surveyors of the native geology, flora, and fauna were among the first European visitors to Douglas County.

Pre-settlement timeline	
1804 - 1806	Lewis & Clark Expedition
1810	John Jacob Astor establishes Pacific Fur Company in Astoria

Fur trading in Douglas County began in 1791 in the estuary of the Umpqua River. Captain James Baker traded with the local native people 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 River 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 largely trapped out and fur trading had ended along the Umpqua River (Schlesser 1973).

The travel routes of the trappers and early explorers closely paralleled many of Douglas County's current roads. The Native American trails followed the major rivers and streams of the county, including the main Umpqua and the North and South Umpqua rivers (Bakken 1970).

The population of the Umpqua Valley is estimated to have been between 3,000 and 4,000 before the arrival of Euro-American settlers (Schlesser 1973). The Europeans brought diseases that reduced the population of native people. 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 (Loy et al. 2001).

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

Settlement Period Timeline	
1849	California Gold Rush
1850	Donation Land Act
1850s	Indian Wars; Douglas County native people relocated to Grand Ronde Reservation
1860	Daily stages through Douglas County
1861	Flood
1870	*Swan* travels Umpqua River (Gardiner to Roseburg)
1872	Railroad to Roseburg
1873	Coos Bay Wagon Road completed
1887	Railroad connection to California
1893	Flood

California's Gold Rush was one factor in the early settlement of the county. The new miners demanded goods and services. "The California Gold Rush of 1849 suddenly created a market for Oregon crops and employment for Oregonians" (Loy et al. 2001). In addition, 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 later 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 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 (Loy et al. 2001; Patton 1976).

In 1840, Reverend Jason Lee inspected the lower Umpqua River and recorded in his journal:

> There is a bar at the mouth of the river, which I judge no ship can pass. The immense hills or mountains, which close in so closely upon the river as to leave it but just room to pass, are covered with dense forests to the water's edge – whole region gloomy and lonesome. (Markers 2000)

Early settlers began arriving in 1847 to make their homes in the valleys of the Umpqua. Settlement increased substantially in the 1850s. In August of 1850, a group of explorers from the Winchester Paine Company first crossed the Umpqua River bar. Nathan Scholfield, a surveyor and cartographer, described in his diary how the schooner was taken to the head of tidewater and of navigation about 30 miles from the ocean. A townsite was named Scottsburg, in honor of Captain Levi Scott who had done much early exploring of the Umpqua Valley. The next day they proceeded on foot to Fort Umpqua on the south bank of the Umpqua River 16 miles above Scottsburg. At this place, they surveyed for a town site on both sides of the Elk River (creek) at its junction, which they called Elkton. Scholfield states, "At and above this place the country is more open, with fine prairies along the rivers extending over to the swelling hills, some of which are sparsely covered with oak" (Winterbotham 1994). Land claims were established by William Slone, Eugene Fiske, and Levi Scott along the north side of the Umpqua River, and these provided the location of the first Scottsburg settlements. Fiske did not return to California on the ship, but rather remained and constructed the first cabin in Scottsburg.

Upon return to San Francisco, members of the Winchester Paine Company advertised lots for sale in Umpqua City, Scottsburg, Elkton, and Winchester, even though the company did not yet have title to the land. Three weeks later, they chartered a vessel, the *Kate Heath*, and returned with about 100 passengers who wanted to settle along the Umpqua River. Word of the fertile Umpqua region spread quickly, attracting people from far away. Even before the large influx of settlers arrived from California, many of the choice claims along the river had been taken.

The *Ortolan* was the second vessel to cross the Umpqua bar in 1850. It included the Rackliff (Rackleff) family from Maine, who selected a claim at Mary's Creek (now Mill Creek) where they built a house and a mill.

The *Bostonian*, captained by George Snelling, foundered while attempting to cross the Umpqua River bar on October 1, 1850. The crew salvaged much of the cargo, which they stored on a beach upstream that they named Gardiner, after the Boston merchant who owned most of the cargo. The Winchester Paine Company immediately set up a logging operation to obtain pilings for the San Francisco waterfront. They used the Gardiner site as their headquarters.

Development of the port of Scottsburg resulted in considerable trade with the mines of northern California and southern Oregon. The freighting business provided most of the revenue for the new ferry business, largely controlled by E.P. Drew.

Large numbers of settlers entered Douglas County between 1849 and 1855. The rich bottomland of the Umpqua Valley was attractive to the immigrants looking for farmland. As the number of settlers increased, the native population of the county decreased. Diseases continued to take a toll, as did the Indian Wars of the 1850s. Douglas County Native Americans were relocated to the Grand Ronde Reservation in the 1850s.

2.2.1. Gold Mining

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 damaged when the gravels were washed away and the stream bottom was coated with mud.

> 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 essentially 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, gold were washed away and captured downstream.

2.2.2. 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 grazed by livestock and diminished in number when the bottomlands were plowed to plant cereal crops. Deer and elk herds were decreased as the settler population increased. Native people were no longer 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.

2.2.3. Commercial Fishing

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 sturgeon 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. The fishermen constructed small dams and breakwaters. These obstructions created eddies and slow-moving water, which were ideal for capturing fish with gill nets.

The canning industry began on the Umpqua in 1875. William Dewar built the first cannery on Winchester Bay. It was later sold to Al Reed and moved to Cannery Island, across from Gardiner. A cannery was also built on the Umpqua River at Reedsport. The best fishing grounds were around Scottsburg. In 1876, the wagon road opened from Elkton over Hancock Mountain on the south side of Elk Creek. People in Elkton now had a closer market route to the railroad in Drain, and this provided an opportunity for fisherman on the Umpqua to get their fish to market (Markers 2000).

2.2.4. 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. 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. An early sawmill was built on the main Umpqua River at Kellogg.

> Splash Dams
>
> Loggers created splash dams to transport logs to the mills. A dam was built across the stream, creating a 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.

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 involved loading the stream channels 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 on page 2-5). During these log drives, the stream channels were gouged, spawning gravels were removed or muddied, and fish passage may have been affected (Markers 2000).

2.2.5. Transportation

Improvements in transportation were key to the economic development and population growth within the watershed during the early development period. Initially, there were limited transportation options into and through Douglas County. Ships came into the Umpqua River estuary and delivered goods destined for the gold miners and settlers of southern Oregon and northern California. Goods moved from the estuary inland along the Scottsburg-Camp Stuart Wagon Road. 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 US Army 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 River (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, extending the railroad into California.

The shipping business to and from Gardiner increased in the late 1890s. By 1902 the number of vessels in and out of Gardiner increased to 169 per year, of which 120 were steam-powered.

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 included 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 railroad planned to come to the Umpqua River in 1912. Warren Reed owned about 4,000 acres along the south bank of the river. He began diking and filling the lowlands with river dredgings in order to develop the townsite in preparation for the railroad. With the railroad station and potential power sites and a gravity water supply, the new town of Reedsport developed as a manufacturing seaport town (Markers 2000).

<u>1900s to the 1960s Timeline</u>

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 6th 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 5 completed

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.

Splash dams and log drives were 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; sport fishermen led the campaign against this form of log transport (Beckham 1990). Waterways used to transport logs had been scoured to bedrock, widened, and channelized in many areas. The large woody debris had been removed and fish holding pools lost. As more logging roads were built in the 1950s, fish habitat was further affected. Landslides associated with logging roads added fine 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 source of large woody debris 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.

Because of the common occurrence of very extensive log jams along some coastal waterways, the Oregon Game Commission[9] required loggers to prevent woody debris from entering streams, beginning in the 1930s. The practice of removing logs from stream channels gained emphasis when caterpillar tractors became available for logging. Stream cleaning activities were documented within the boundaries of Elliott State Forest beginning in 1956. This practice continued into the mid-1980s.

Woody debris removal was mainly conducted two ways. First, the Oregon Game Commission employed a “stream improvement” crew that drove throughout the region, identifying “obstructions” to fish passage. These were generally log jams. The crew then contacted landowners about debris removal. This program was active from about 1956 to 1976. The second tactic was the inclusion of logging debris removal in timber sale contracts on the state forest. This practice began as early as 1962, and continued until at least the mid-1980s (Biosystems 2003). Both kinds of stream cleaning often involved driving bulldozers up and down the stream channel.

In 1914, an Oregon state map was developed to show areas of commercial timber, non-timbered areas, and lands that had been burned in large fires that occurred around the turn of the century. Approximately half of all lands in the Upper Umpqua River Watershed were considered suitable for commercial timber and over 40% of the remaining acres were classified as brush or non-timbered. Over 16,000 acres or 14% of all timbered acres in the watershed were classified as “burned areas.” Many of these areas were impacted by high-severity fires prior to that time, as evidenced by the lack of tree regeneration. Many of these fires occurred in the mid to late 1800s and around the turn of the 20th century.

The disturbance history of the Upper Umpqua River Watershed on forestlands managed for wood products has a pattern similar to surrounding watersheds. The 1950s and 1960s were

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[9] The Oregon Game Commission and the Oregon Fish Commission merged in 1975 to become the Oregon Department of Fish and Wildlife.

periods of high levels of road construction and logging. Many arterial roads were typically located along and just above the major creeks. Spurs were often built into the bottom of side drainages where downhill logging or tractor logging would occur as far upslope as logging equipment could reach. Many midslope and ridgetop haul roads were also built for cable and tractor operations and were typically unsurfaced, on steep grades, and lacked adequate drainage. Side casting of cut material on steep slopes, a common practice, often fell directly into intermittent or permanent streams or later failed. Machinery operating in drainage bottoms was also common. Almost all forested lands that were harvested on slopes less than 40% were tractor yarded during this era. This resulted in a high density of skid trails with variable degrees of compaction. Some tractor yarding took place on slopes up to 70% or more, which resulted in a less dense pattern of skid trails. However, it necessitated a high percentage of skid trails being bladed, many with cuts of 10 feet or more. In many cases, the trails went directly up the slope with little attention given to adequate drainage. Spot field checks by the Bureau of Land Management (BLM) have shown most skid trails and primitive haul roads created trough-like conditions that channeled water. Compaction, mechanical soil removal, and erosion of topsoil caused by tractor yarding reduced long–term soil productivity. Approximately 9,650 acres of BLM lands were harvested during this period, and it is estimated that 30% were tractor yarded.

Both natural and management-related landslides produced large amounts of sediment during the 1950s and 1960s. The bulk of the major debris avalanches and debris flows occurred in uncut forests during high intensity storms. Many of these occurred during the December, 1964, flood event. The hardest hit was the western Cougar Creek drainage. Landslides were of greatest magnitude during the December, 1964, flood event in the higher elevations along Bateman Ridge and Rattlesnake Ridge.

2.3.3. Fisheries

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 one million 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 the Little White Salmon River. 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.

During the first decades of the 20th century, large numbers of fish eggs were taken from the Umpqua River system. "In 1910 the State took four million chinook eggs from the Umpqua; the harvest increased 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.

2.3.4. Agriculture

Crop irrigation was introduced to Douglas County farmers in 1928. J.C. Leady, who was the Douglas County Agent (predecessor of County Extension Agent), gave a demonstration of ditch blasting in 1928. The dimensions of the resulting ditch were four feet deep by six feet wide. The County Agent's report recommended this method of ditch creation in the lowlands adjoining the Umpqua and Smith Rivers (Leedy 1929).

In 1935, Douglas County Agent J. Roland Parker applied gas and electric pumps to crop irrigation. He stated that, "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 that applications for water rights and installation of irrigation systems would double in 1936.

The appropriation of water rights for agriculture left less water in the streams for fish, especially during the critical months of late summer and early fall. 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.[10]

2.4. Modern Era: 1970s to the Present

2.4.1. Logging

During the 1970s, rainfall was 10 inches above average for four years and contributed to a high incidence of road and harvest-related landslides within the watershed. Major debris flows/dam-break floods occurred in Cougar, Rader, and Lost Creeks. Most of the major arterial roads were in place prior to 1970, and the level of road construction declined thereafter. New road locations were mostly confined to upper slope and ridge top positions. However, many of the newer roads were being constructed with poor drainage features and low standards. Roads constructed from previous periods also had many locations primed to fail in response to large storm events. As a result, road-related landslide frequencies in the 1970s increased compared to the previous decade (BLM 2002).

The Oregon Forest Practices Act became effective in 1972. Standards were set for road construction and maintenance, reforestation, and maintenance of streamside buffer strips during logging operations. 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 to control stream channel changes. In 1987, riparian protection was increased by specifying the numbers and sizes of trees to be left in

<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
1994	Northwest Forest Plan results in reduced federal log supplies
1996	Flood
1999	International Paper Mill in Gardiner closed

[10] Contact the Douglas County Watermaster's office for more information on water rights.

riparian areas. New rules were added in 1994 to help to create the desired future condition of mature streamside stands. Landowner incentives were provided for stream enhancement and for hardwood conversion to conifer along certain streams (Oregon Department of Forestry 2005).

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 US Forest Service and the BLM. A housing slump in the early 1980s and a decline in federal timber in the 1990s resulted in the closure or reduction in size of many other manufacturing companies (Oregon Labor Market Information System 2002). In 2002 and 2003, increased wood product 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.[11]

From 1984 to 1994, landslides in the watershed dramatically declined in numbers. Road-related slides identified in the BLM inventory declined 82% from the previous period. Only three very large landslides were identified in the BLM landslide inventory for this period.

Surface erosion and sedimentation also declined during the 1980s. Unlike during previous decades, sediment-choked riparian zones and raw stream banks were not distinguishable on the aerial photos examined by the BLM (2002).

2.4.2. Dam Construction

During the late 1960s through 1980s several dams were constructed in Douglas County. Information on the largest ones is presented in Table 2.1.

Table 2.1. Name, location, and storage capacity of Umpqua Basin dams built since 1960.

Year Completed	Dam Name	Creek	Storage Capacity (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

2.4.3. Tourism

A rapid expansion of tourism in Douglas County followed World War II. The improving economy increased the standard of living and mobility of many Americans. The Umpqua Valley offered scenic attractions and good access roads. Interstate 5 and the connecting State Highways 38, 42, and 138, provided access to Umpqua Valley's excellent tourist areas. Tourist destination

[11] 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.

points included Crater Lake National Park, Wildlife Safari, Salmon Harbor, and the Oregon Dunes National Recreation Area. Tourism has been a growing industry in Douglas County in recent years.

2.5. Douglas County Population Growth

Figure 2.1 shows population growth data for Douglas County during the settlement period (1840s through 1890s), the onset of the modern era (1900 through 1960s), and the modern era (1970s to the present). Population growth has occurred in two phases. Slow growth occurred during the period 1860 to 1940. Subsequently, growth accelerated, slowing in the 1980s to a pace equivalent to that of pre-war years.

2.6. Historical Changes in Vegetation

Forest vegetation was somewhat different in pre-settlement times than it is today. Although there is not much information about historical vegetation in the Upper Umpqua River Watershed, studies in the nearby Elliott State Forest found that much of the forest was initiated following a large fire in 1868 (Morris 1934, Biosystems 2003). Historically, fire has played an important role in the watershed. Large stand-replacement fires caused by lightning and humans created a mosaic of age classes, even before any extensive logging began. However, historically, old-growth forest was much more prevalent than it is today. Based on the current observed relationship between age class and tree diameter and forest measurements made in the 1878 to 1893 land surveys, Biosystems (2003) concluded that the trees consumed in the 1868 fire were mostly about 185 years old. Although the cause of the fire is not known, it has been established that Native Americans in the Umpqua River Basin commonly used fire to improve browse.

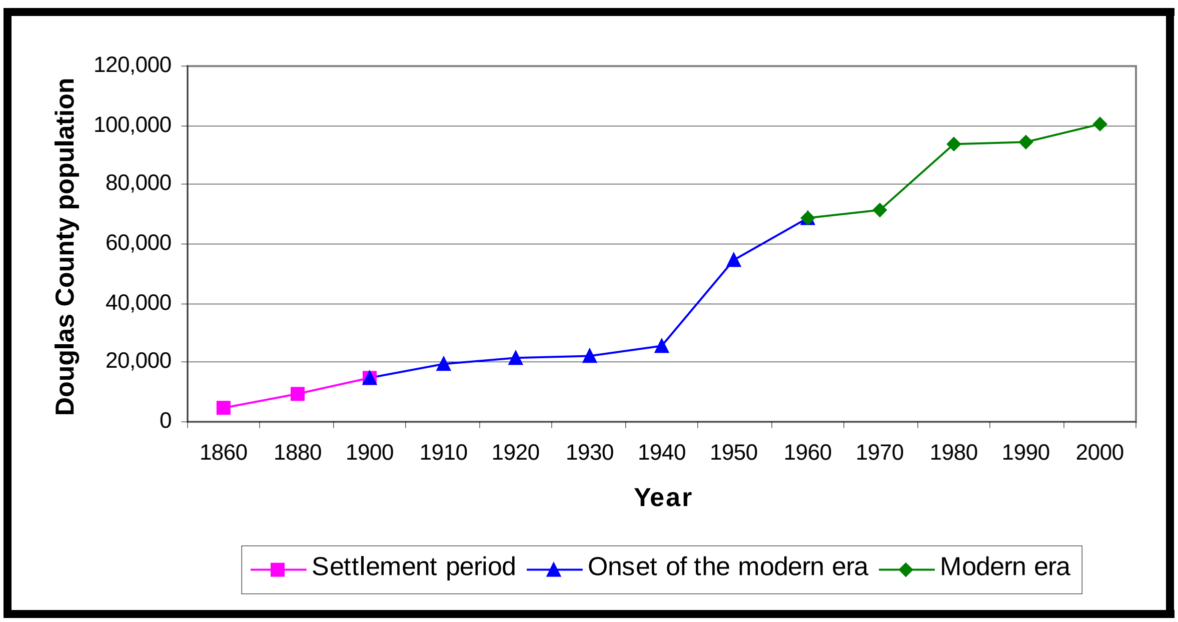


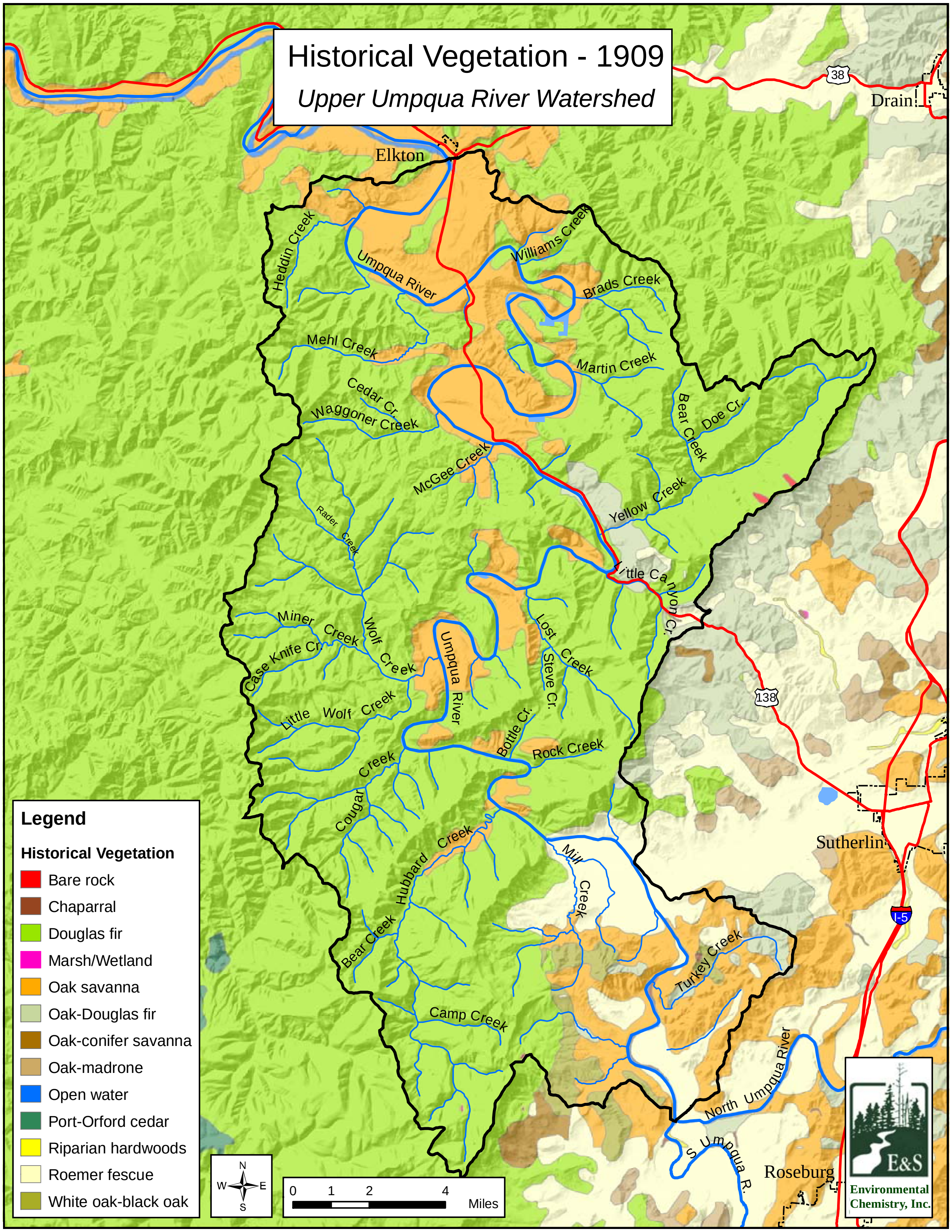
Figure 2.1. Population growth in Douglas County from 1860 through 2000.

Data are available with which to evaluate vegetation patterns in 1909 within the watershed (Map 2.1). Most upland areas were covered with coniferous forests dominated by Douglas-fir. Oak savanna vegetation occurred in many areas along the mainstem Umpqua River north of its confluence with Hubbard Creek, and along several of its tributary streams (Map 2.1). Historic vegetation was different in many areas in the eastern portion of the watershed, especially in the southeast where precipitation is lower and evaporative water loss higher. Such areas were historically covered by such vegetation types as grasslands (Roemer fescue) and Douglas-fir intermixed with oak savanna.

2.7. Major Natural Disturbances

The flood of 1961 is the largest flood on record in western Oregon, and may have exceeded a 100-year event (Taylor and Hatton 1999). Other known floods of great magnitude occurred in 1890, 1955-56, and 1964 (Weyerhaeuser 1998, Taylor and Hatton 1999). The flood of 1964 yielded the highest recorded river levels on the Umpqua River.

Extreme windstorms occurred in the Coast Range in 1880, 1951, and 1962 (Ruth and Yoder 1953, Biosystems 2003). These storms toppled trees throughout extensive areas, created canopy openings, and altered vegetation succession. During the Columbus Day storm of 1962, about 100 million board feet of timber blew down within Elliott State Forest (ODF 1993), mostly in the western half of the forest. This storm was followed by extensive road building to access downed timber for salvage harvest. Other windstorms severe enough to uproot trees along clearcut edges and uncut riparian buffer areas occurred in 1971, 1973, 1981, 1983, and 2002 (Oregon Climate Service 2003).



Map 2.1. Distribution of major vegetation types within the watershed in 1909.

3. Current Conditions

This chapter explores the current conditions of the Upper Umpqua River Watershed in terms of in-stream, 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 Bureau of Land Management (BLM), the Oregon Department of Environmental Quality (ODEQ), the Oregon Department of Fish and Wildlife (ODFW), the Douglas Soil and Water Conservation District, the US Geological Survey (USGS), and the Oregon Water Resources Department (ORWD).

Key Questions

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

3.1. Stream Function

3.1.1. Pre-Settlement Stream Channel Conditions

Stream channel conditions in the watershed prior to Euro-American settlement were notably different than they are today. Throughout the Oregon Coast Range, including the Upper Umpqua River Watershed, stream channel morphology has been greatly simplified, especially in lowland areas. Over the past 150 years, the availability of gravel, wood, riparian forest, floodplains, backwater areas, and pool habitat has declined in response to a reduction in channel complexity.

Stream channels in the lowlands have likely experienced the greatest change. Prior to Euro-American settlement, the main channel was likely more sinuous, with many braided channels, secondary channels, oxbows, and backwaters. Riparian zones in many areas were heavily wooded with a diversity of species, and many large trees were present. Loss of late-successional[12] riparian vegetation throughout the watershed has resulted in a reduction in woody debris and loss of in-stream channel complexity in the lowlands and the estuary.

Channel structure was also more complex in the uplands prior to Euro-American settlement. There were more pools, pools were deeper, and large logs and woody debris jams were common in the stream channel. Streamside vegetation included a greater diversity of species and age

[12] Late-successional forest is generally characterized by the presence of old-growth trees and understory trees of varying heights, standing snags, decomposing logs, and a diversity of shrub and wildflower species.

classes, including large conifers which provided large woody debris (LWD) to the stream channel.

3.1.2. Stream Morphology

3.1.2.1. Stream Morphology and Sediment Transport Processes

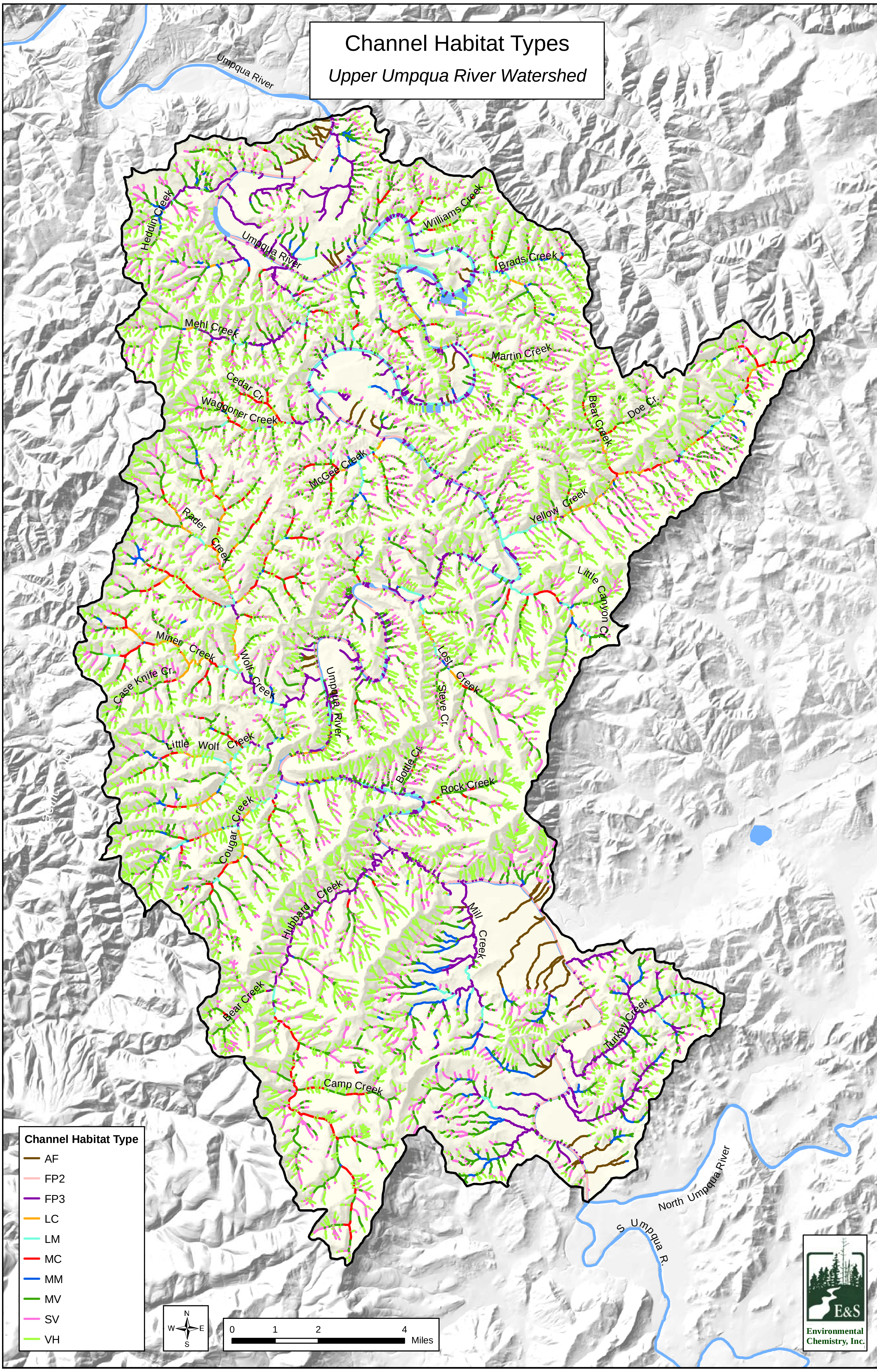
This section discusses the channel morphology of the Upper Umpqua River Watershed. Information in this section has been summarized from the following documents: *Going with the Flow: Understanding Effects of Land Management on Rivers, Floods, and Floodplains* (Ellis-Sugai and Godwin 2002), *South Umpqua River Watershed Assessment and Action Plan* (Geyer 2003), *Elliott State Forest Watershed Analysis* (Biosystems 2003), and *Upper Umpqua River Watershed Analysis* (BLM 2002).

The Oregon Watershed Enhancement Board (OWEB) developed a system for classifying streams based on physical attributes that are important to the ecology of streams. This system, called the channel habitat type system, is based on features of stream gradient, valley shape, channel pattern, channel confinement, stream size, position in drainage, and substrate. Segregating stream segments into channel habitat types (e.g., low-gradient confined, very steep headwater, alluvial fan), based on stream morphology, provides an overall indication of the distribution of various stream and associated riparian habitat characteristics throughout the watershed. Table 3.1 lists the channel habitat types that are found in the Upper Umpqua River Watershed, specific stream examples, and possible restoration opportunities as described by OWEB. Locations are shown on Map 3.1.

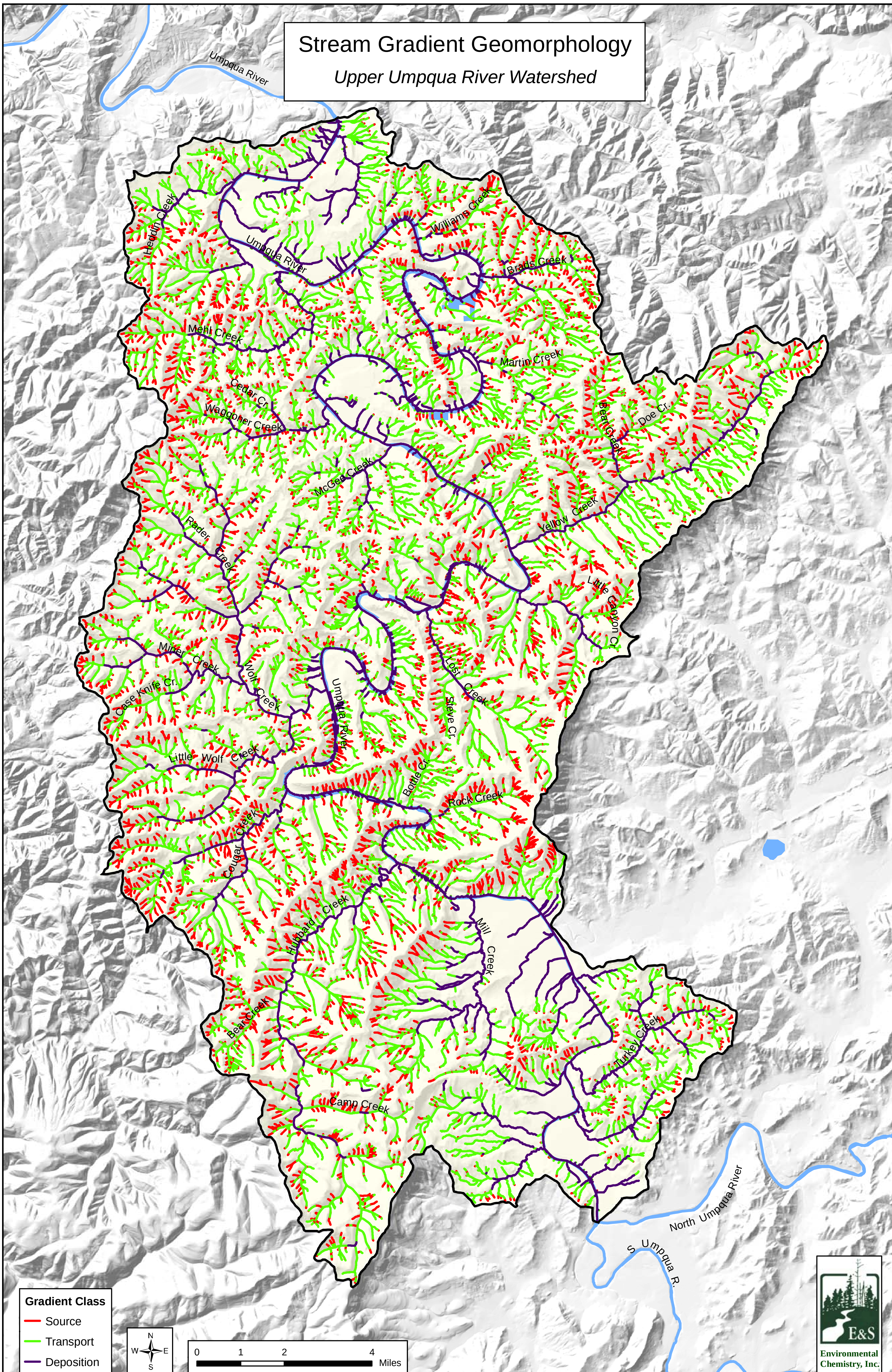
Streams in steep headwaters (often 20% slope or greater) are “source” streams, adding sediment and wood to the stream system. They have high-energy flows and no floodplain, and are prone to landslides. “Transport” streams have medium gradients, often between 3% and 20% slopes. They have small meanders and little or no floodplain. They carry sediment and wood during times of high flows and store them during low flows. “Depositional” streams lie in the downstream reaches of watersheds. The low gradients, large floodplains, and meanders of these streams dissipate the energy of the water current. As a result, sediment and wood settles out and is stored in these reaches of the streams for long periods. Depositional streams are often the most sensitive to changes in the watershed. Map 3.2 and Table 3.2 show the distribution and percent of streams within each gradient class.

Many of the tributary streams of the Upper Umpqua River within the watershed are mature streams that have incised the landscape and now have a moderate to low stream gradient. There are also many headwater reaches that have steep gradients. The steeper gradient segments are sediment and wood source streams and are above the anadromous fish zone. Projects to improve future shade conditions and the development of large conifers in the riparian zone may help improve those stream reaches.

Streams in the middle elevations of the watershed are often moderate in gradient and confinement. These reaches function as transport streams, both storing and delivering sediment and wood downstream. These streams also are located in areas where the overall landscape is



Map 3.1. **Channel habitat type (CHT) distributions within the Upper Umpqua River Watershed. See Table 3.1 for CHT code descriptions.**



Map 3.2. Stream gradient classes in the Upper Umpqua River Watershed.

Table 3.1. Channel habitat types and examples within the Upper Umpqua River Watershed.

Channel Habitat Type	Stream Miles (Percent)	Example within Watershed	Restoration Opportunities[1]
Alluvial fan (AF)	10.2 (0.7%)	Umpqua River tributaries, just north of Elkton	Alluvial fans are generally not well suited to restoration because they are highly active channels, and high sediment loads limit efforts to increase channel complexity.
Low gradient medium floodplain (FP2)	24.6 (1.8%)	Umpqua River, lower reach	Because of the migrating nature of these channels, restoration opportunities such as shade and bank stability projects on small side channels may be the best option for improvement.
Low gradient small floodplain (FP3)	77.2 (5.5%)	Mehl Creek, near mouth and middle reach	Because of the migrating nature of these channels, restoration efforts may be challenging. However, because of their small size, projects at some locations would be successful.
Low gradient confined (LC)	24.7 (1.8%)	Yellow Creek, lower to middle reach	Though these channels are not often responsive, riparian planting projects may improve water temperature and erosion issues.
Low gradient moderately confined (LM)	50.4 (3.6%)	Lower reaches of Little Wolf Creek	These channels can be very responsive to restoration efforts. Adding large wood to channels in forested areas may improve fish habitat, while stabilizing stream banks in non-forested areas may decrease erosion.
Moderate gradient confined (MC)	33.9 (2.4%)	Hubbard Creek, middle to upper reaches	Though these channels are not often responsive, riparian planting projects may improve water temperature and erosion issues.
Moderate gradient moderately confined (MM)	19.6 (1.4%)	Mill Creek, middle reach tributaries	These channels are among the most responsive to restoration projects. Adding large wood to channels in forested areas may improve fish habitat, while stabilizing stream banks in non-forested areas may decrease erosion.
Moderately steep narrow valley (MV)	199.8 (14.3%)	Camp Creek, lower, middle, and upper reaches	Though these channels are not often responsive, riparian planting projects may improve water temperature and erosion issues.
Steep narrow valley (SV)	321.9 (23.1%)	Yellow Creek, upper reaches of tributaries	Though these channels are not often highly responsive, the establishment of riparian vegetation along stable banks may address water temperature problems.
Very steep headwater (VH)	633.2 (45.4%)	Hubbard Creek, tributary headwaters	Though these channels are not often highly responsive, the establishment of riparian vegetation along stable banks may address water temperature problems.
TOTAL	1395.5 (100.0%)		

[1] From WPN 1999

Table 3.2. Upper Umpqua River Watershed stream miles within each gradient class.		
Gradient Class	**Stream Miles in the Watershed**	**Percent of Total**
Source	551.4	39.5
Transport	646.1	46.2
Deposition	199.3	14.3
Total	1396.8	100.0

fairly steep, increasing debris flow hazards.[13] Adding large wood, stabilizing banks by planting trees, and improving shade in these reaches may be helpful for the stream system.

The Upper Umpqua River and the lowermost sections of Wolf Creek and Mill Creek have significant floodplains. The floodplain of the Upper Umpqua River broadens considerably in both the northern and the southern portions of the watershed. These broad, low-gradient reaches lend themselves to complex aquatic habitat with large wood, coarse sediment, pools, bars, and side channels. However, these reaches are difficult to enhance, as the meandering nature of the streams makes bank stabilization projects likely to fail. Therefore, special care should be given to project selection and planning.

Large wood such as logs, large branches, and root wads are the primary determinants of channel form in small streams (Bilby and Bisson 1998), and play an important role in the formation of side-channel areas along larger streams. Wood in the stream channel largely determines gravel capture and retention, pool size and frequency, and the occurrence of cold water refuges. The riparian forest is the most important source of large wood. Large trees in headwall[14] areas may also play an important role in large wood transport to the stream through natural landslides (Biosystems 2003).

The alluvial valley width is highly variable, averaging approximately 1,000 feet but reaching a maximum of two miles in width. Over 90% of the floodplain is in private ownership. Approximately 40% is currently used for agriculture (Figure 3.1).

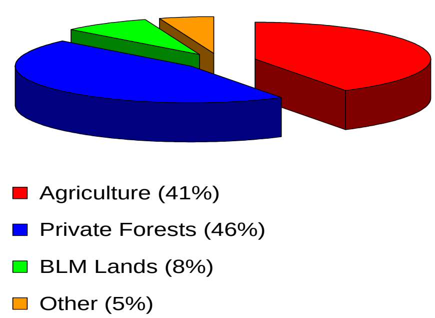


Figure 3.1. Mainstem land use within 500 feet of the river. (Source: BLM 2002)

3.1.2.2. 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 has been to gather basic data about Umpqua Basin streams, and to compare current stream conditions to the habitat needs of salmonids and other fish. In recent years, 100.4 stream miles were surveyed in the Upper

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[13] Debris flows are rapidly-moving landslides that enter a stream channel transporting a large volume of water, sediment, rocks, boulders, and logs. Debris flows generally scour the streambed to bedrock, depositing the transported material at the end of their pathways.

[14] A headwall is a very steep concave slope at the top of a stream channel, generally near the ridgeline.

Umpqua River Watershed. Each stream was divided into reaches based on channel and riparian habitat characteristics for a total of 115 reaches averaging 0.9 miles in length. Information concerning the distribution or condition of in-stream habitat units within the mainstem Upper Umpqua is currently unavailable. Off channel features including secondary channels, backwater pools, and wetlands were generally not evident in aerial photos (BLM 2002).

For each stream, surveyors measured a variety of pre-determined habitat variables. Since a primary purpose of the stream habitat surveys was to evaluate the stream's current condition with regard to fish habitat needs, ODFW developed habitat benchmarks to interpret stream measurements that pertain to fish habitat. This assessment includes nine measurements that have been grouped into four categories: pools, riffles, riparian areas, and large in-stream woody material. Table 3.3 provides the habitat measurements included in each category.

Stream habitat benchmarks rate the values of the components of the survey in four categories: excellent, good, fair, and poor. For the purpose of this watershed assessment, "excellent" and "good" have been combined into one "good" category. Table 3.3 provides parameters used to develop the benchmark values.

For this assessment, we simplified the stream data by rating the habitat categories by their most limiting factors. For example, there are two components that determine the "pool" rating: percent area in pools and residual pool depth. If a reach of a small stream had 50% of its area in pools, then according to Table 3.3, it would be classified as "good" for "percent area in pools." If average pool depth on the same reach was 0.4 meters in depth, this reach would rate "fair" in "residual pool depth." This reach's classification for the "pool" habitat category would therefore be "fair." Most habitat categories need a combination of components to be effective, and therefore are rated by the most limiting factor, which is "pool depth" in this example.

The benchmark ratings should not be viewed as performance values, but as guides for interpretation and further investigation. Streams are dynamic systems that change over time, and the stream habitat surveys provide only a single picture of the stream at one particular point in time. For each habitat variable, historical and current events must be considered to understand the significance of the benchmark rating. Take, for example, a stream reach with a poor rating for in-stream large wood. Closer investigation could determine that this stream is located in an area that historically never had any large riparian trees. Failing to meet the benchmark for in-stream large wood might not be a concern because low in-stream wood levels might be the stream's normal condition.

The river basin systems within the Upper Umpqua River Watershed originate in numerous steep, small headwater streams that are fed by snowmelt, rain events, or ground water springs. Although these streams are not specifically addressed through ODFW Aquatic Habitat Surveys or inhabited by fish, they are important because they carry cool water, nutrients, and organic matter downstream. These first order streams come together to form larger streams (second order) with gradients low enough for some fish (sculpin, dace, etc.), but not usually anadromous species. It is within the third order streams (two or more second-order streams combine to form a third-order stream) and larger streams that the habitat has developed for spawning and as nurseries for the larger fish species such as salmon and trout (salmonid) species.

Table 3.3. Stream habitat survey benchmarks.

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 pieces**[1] 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

[1] Minimum size is 6-inch diameter by 10-foot length or a root wad that has a diameter of 6 inches or more.

3.1.2.3. Overview of Conditions

Summary results of ODFW stream habitat surveys are presented in Table 3.4 and Maps 3.3 through 3.6. Based on OWEB methods, we look for patterns in habitat conditions relative to benchmark values both within the whole watershed and along the stream length. The objective is to provide a broad view of the stream system and help determine issues that might be of greatest concern.

Of the 115 surveyed stream reaches, only six rate as fair or good in all four categories (5.2%). Eighty stream reaches (69.6%) have at least two categories rated as poor. Looking at Table 3.4, nearly three-quarters (73.0%) of surveyed streams were rated as poor for riffle conditions, and about half were rated as poor for large woody debris conditions and for pool conditions. Very few surveyed streams were rated good for either pool conditions (2.6%) or riffle conditions (7.8%). Ratings by stream reach are provided in Table 3.4.

Pool conditions were predominantly rated as fair along many of the mainstem tributary streams within the watershed (i.e., Hubbard Creek, Little Wolf Creek, Mehl Creek, Yellow Creek). Others, including Little Canyon and Wolf Creek, were more heavily dominated by poor pool conditions. The upper reaches of many of the tributary systems were primarily rated as poor for pool conditions. Only one reach (on McGee Creek) was rated as good (Map 3.3).

Riffle conditions were uniformly rated as poor along Hubbard Creek and its tributaries. Similarly, poor riffle conditions dominated the surveyed stream reaches in the Wolf, Waggoner, Mehl, Brads, and Martin Creek systems. Riffle conditions were best in some of the upper reaches of Cougar, Doe, and Little Canyon Creeks (Map 3.4).

Riparian conditions were rated as poor throughout the mainstem Hubbard Creek tributary system. In most other tributary systems, riparian conditions were rated primarily or entirely as fair. There were a handful of reaches rated as good, and these were mainly scattered throughout the uppermost tributary systems (Map 3.5).

Large woody debris (LWD) conditions showed a lot of spatial diversity. Conditions were generally somewhat better on Cougar Creek than they were along the other tributaries. In general, conditions tended to be slightly better in the upper reaches, as compared with the mainstem tributary systems (Map 3.6).

The lack of large wood in the stream channel can be attributed to past logging practices and the fisheries “stream cleaning” ideology of the 1960s, 1970s, and 1980s. In addition, between 1970 and 1980, most timber sales included provisions to clear the streams of all logs in order to “benefit” fish passage. Many of the Riparian Reserves on BLM land were harvested before receiving the Reserve designation instituted by the 1994 Aquatic Conservation Strategy. Therefore, approximately 44% of streamside forest vegetation on BLM land within the watershed is younger than 80 years (BLM 2002). Because of the importance of the large wood component in providing habitat structure for fisheries, the lack of large wood within the Upper Umpqua stream corridors is an indicator of lost aquatic habitat structure. Therefore, components of the analysis used by the BLM (2002) to evaluate the Upper Umpqua stream reaches included LWD and a Recruitment Index proportional to the number of large (>240 DBH) conifers per stream mile.

Table 3.4. Upper Umpqua River Watershed stream habitat conditions (see Map 3.3 for stream locations).

Stream	Reach	Pools	Riffles	Riparian Area	Large Wood
Bear Creek (Trib of Hubbard Cr)	1	•	•	•••	•
Bear Creek (Trib of Hubbard Cr)	2	•	•	•••	••
Bear Creek (Trib of Hubbard Cr)	3	••	•	••	•••
Bear Creek (Trib of Yellow Cr)	1	••	••	••	•
Bear Creek (Trib of Yellow Cr)	2	••	••	••	••
Bear Creek (Trib of Yellow Cr)	3	•	•	••	•••
Bear Creek (Trib of Yellow Cr)	4	•	••	••	••
Bottle Creek	1	••	•	•	•
Bottle Creek	2	••	•	••	•
Brads Creek	1	•	•	••	•
Brads Creek	2	•	•	••	•
Brads Creek	3	•	•	••	•••
Brads Creek Trib A	1	••	•	•	•
Brads Creek Trib A	2	••	••	•	•
Brads Creek Trib A	3	••	•	•	•••
Brads Creek Trib A	4	•	•	•	•••
Brads Creek Trib A	5	•	•	•	•••
Buffalo Creek	1	•	•	•	•
Buffalo Creek	2	••	•	••	•
Camp Creek	1	••	•	••	•
Camp Creek	2	••	•	•••	••
Camp Creek	3	••	•	••	••
Case Knife Creek	1	•	•	••	•
Cougar Creek	1	•	•	••	••
Cougar Creek	2	•	•	••	••
Cougar Creek	3	••	•	••	•••
Cougar Creek	4	•	•••	•••	•••
Cougar Creek	5	•	••	••	•
Cougar Creek	6	•••	•	•	•••
Cougar Creek	7	•	•	•	•
Cougar Creek Trib. #1	1	••	•	••	•••
Cougar Creek Trib. #1	2	••	•••	••	••
Cougar Creek Trib. #1	3	••	•••	••	•••
Cougar Creek Trib. #1	4	••	•	••	•••
Cougar Creek Trib. #1	5	•	•••	••	••
Doe Creek	1	••	•••	••	••
Doe Creek	2	•	•••	••	•••
Doe Creek	3	•	•••	•••	••

• Poor •• Fair ••• Good

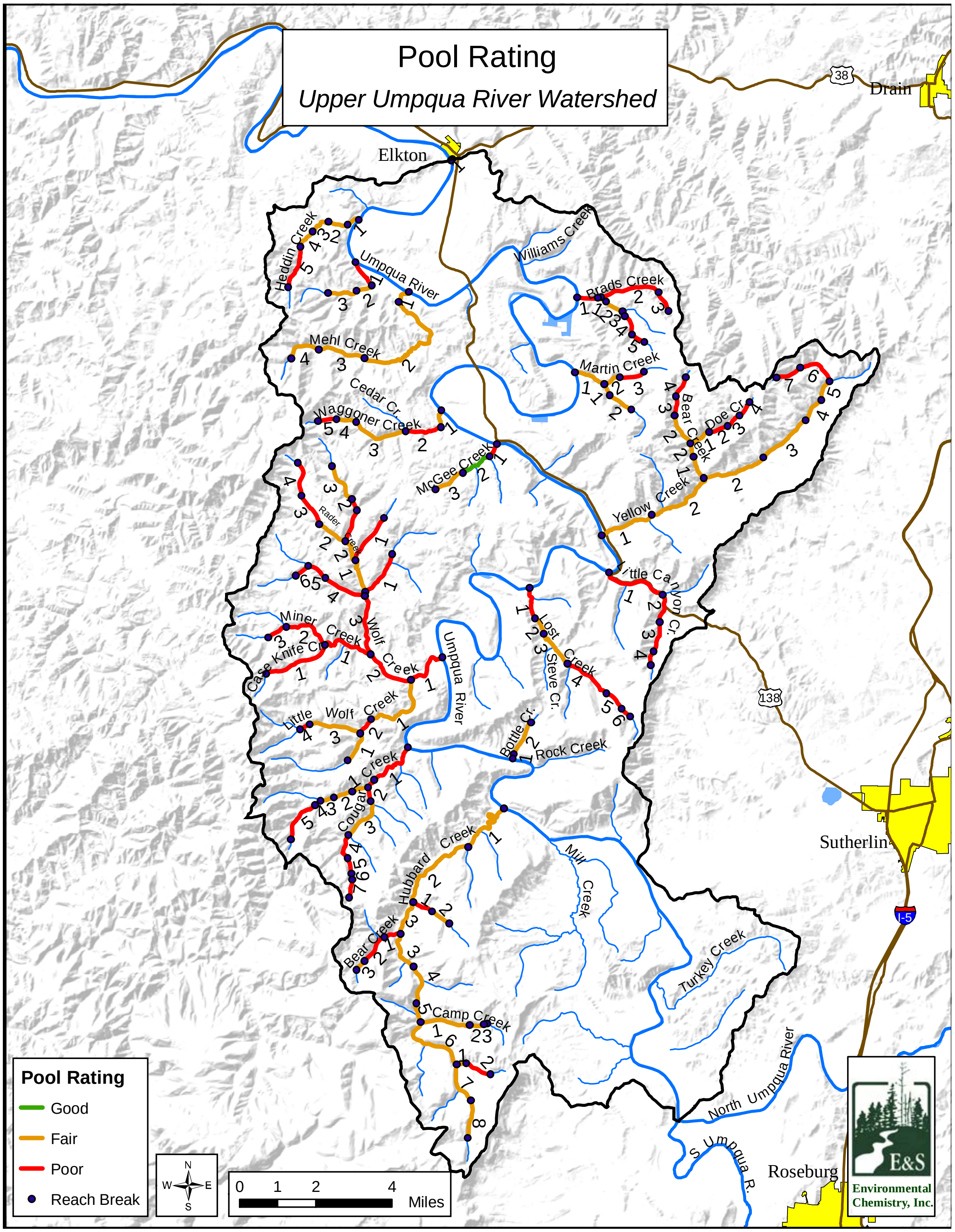
Table 3.4. Continued.

Stream	Reach	Pools	Riffles	Riparian Area	Large Wood
Doe Creek	4	•	•••	•••	•
Elk Creek	1	•••	•	••	•
Fitzpatrick Creek	1	•	•	••	••
Fitzpatrick Creek	2	••	•	••	•
Fitzpatrick Creek	3	••	•	••	•••
Heddin Creek	1	••	••	••	•
Heddin Creek	2	••	•	••	•
Heddin Creek	3	••	•	••	•
Heddin Creek	4	••	•••	••	•
Heddin Creek	5	•	•	••	•••
Hubbard Creek	1	••	•	•	•
Hubbard Creek	2	••	•	•	•
Hubbard Creek	3	••	•	•	•
Hubbard Creek	4	••	•	•	•
Hubbard Creek	5	••	•	•	•••
Hubbard Creek	6	••	•	•	•
Hubbard Creek	7	••	•	•	••
Hubbard Creek	8	••	•	•	•••
Hubbard Creek Trib. #1	1	••	•	••	••
Hubbard Creek Trib. #1	2	•	•	•••	•••
Little Canyon Creek	1	•	••	••	•
Little Canyon Creek	2	•	•••	••	•
Little Canyon Creek	3	•	•••	••	•••
Little Canyon Creek	4	•	••	••	•••
Little Wolf Creek	1	••	•	••	•
Little Wolf Creek	2	•	•	••	•
Little Wolf Creek	3	••	•	••	•
Little Wolf Creek	4	•	•	••	•
Little Wolf Creek Trib #1	1	••	•	••	••
Lost Creek	1	•	••	••	•
Lost Creek	2	••	••	••	•
Lost Creek	3	••	•	••	•
Lost Creek	4	•	•	••	•••
Lost Creek	5	•	•••	••	••
Lost Creek	6	•	•••	••	•••
Martin Creek	1	••	•	••	•
Martin Creek	2	••	•	••	•••
Martin Creek	3	•	•	••	••
Martin Creek Trib. #1	1	••	•	••	•••
• Poor •• Fair ••• Good					

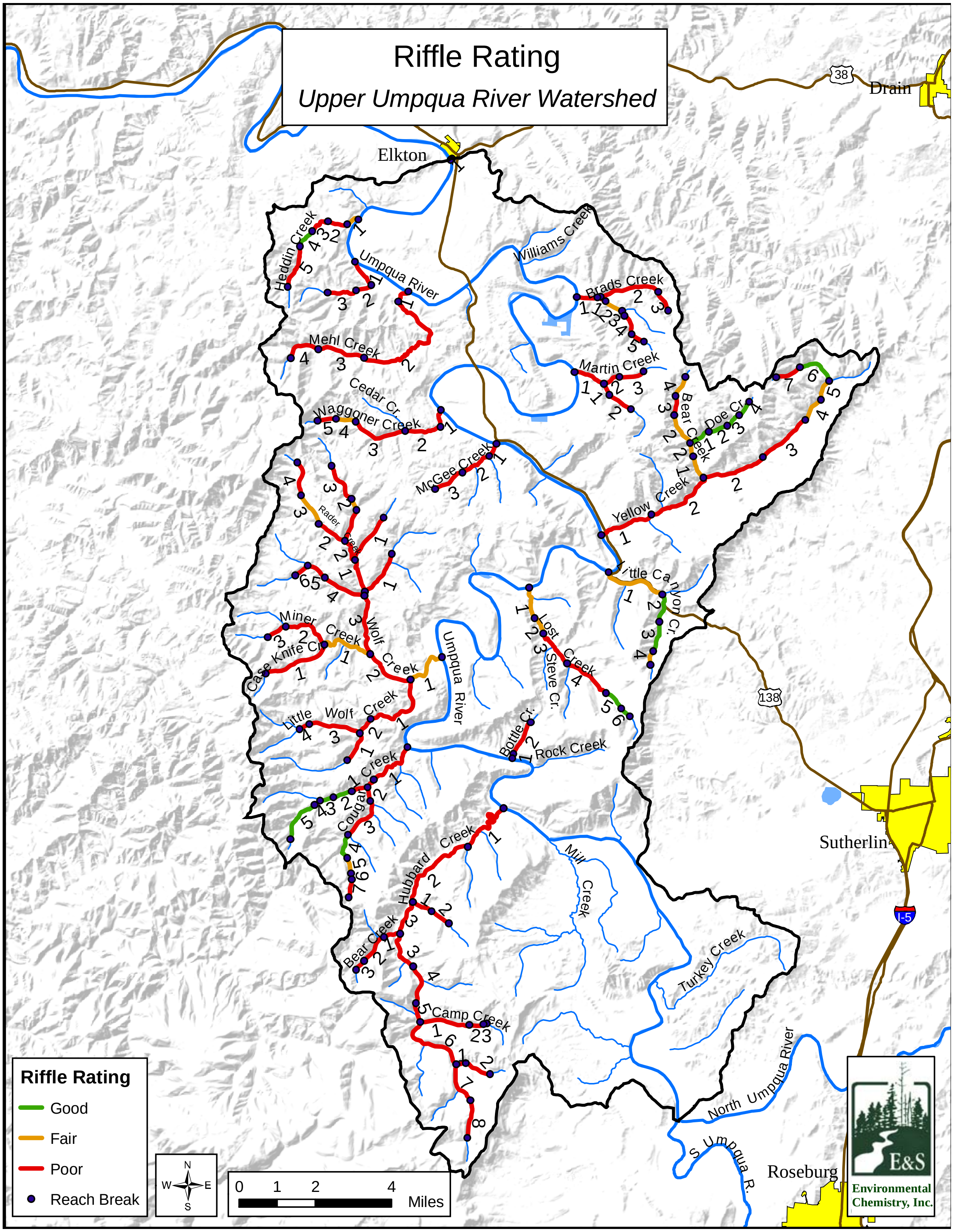
Table 3.4. Continued

Stream	Reach	Pools	Riffles	Riparian Area	Large Wood
Martin Creek Trib. #1	2	●●	●	●●	●
Mcgee Creek	1	●	●	●	●
Mcgee Creek	2	●●●	●	●	●
Mcgee Creek	3	●●	●	●●	●●
Mehl Creek	1	●●	●	●●	●
Mehl Creek	2	●●	●	●●	●
Mehl Creek	3	●●	●	●●	●
Mehl Creek	4	●●	●	●	●●
Miner Creek	1	●	●●	●●	●
Miner Creek	2	●	●	●●	●●
Miner Creek	3	●	●	●●	●●
Rader Creek	1	●●	●	●●	●
Rader Creek	2	●●	●	●●	●
Rader Creek	3	●	●●	●●	●●
Rader Creek	4	●	●	●●	●
Rader Creek Trib #1	1	●	●	●	●●
Rader Creek Trib #2	1	●	●	●●	●●
Rader Creek Trib #3	1	●	●	●●	●
Rader Creek Trib #3	2	●	●●	●●	●●
Rader Creek Trib #3	3	●●	●	●●	●
Waggoner Creek	1	●●	●	●●	●
Waggoner Creek	2	●	●	●●	●
Waggoner Creek	3	●●	●	●●	●
Waggoner Creek	4	●●	●●	●●	●●
Waggoner Creek	5	●	●	●●	●
Wolf Creek	1	●	●●	●●	●
Wolf Creek	2	●	●	●●	●
Wolf Creek	3	●	●	●●	●
Wolf Creek	4	●	●	●●	●
Wolf Creek	5	●	●	●●	●●
Wolf Creek	6	●	●	●	●●
Yellow Creek	1	●●	●	●	●
Yellow Creek	2	●●	●	●●	●
Yellow Creek	3	●●	●	●●	●●
Yellow Creek	4	●●	●●	●	●●
Yellow Creek	5	●●	●●	●●	●●
Yellow Creek	6	●	●●●	●●●	●●
Yellow Creek	7	●	●	●●●	●●●

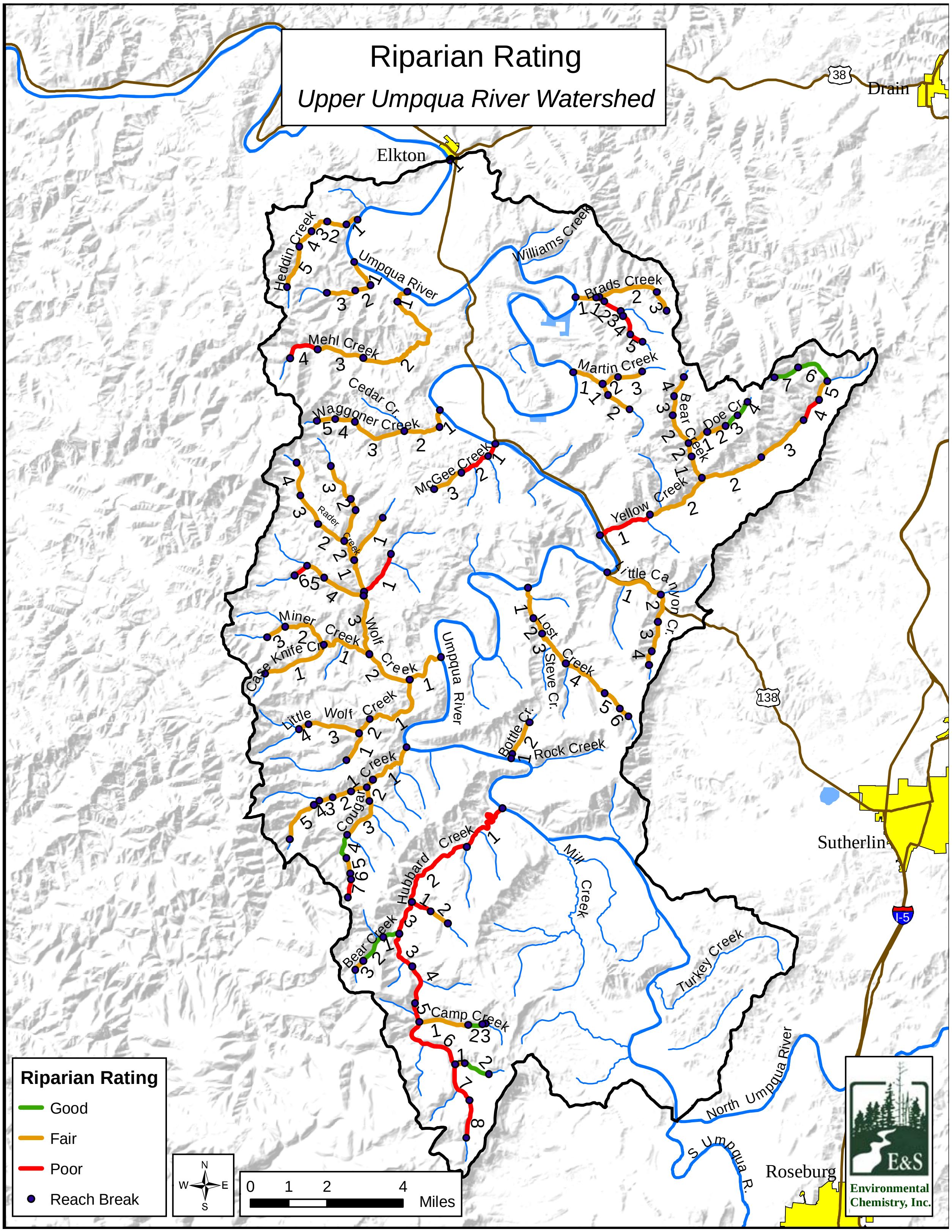
● Poor ●● Fair ●●● Good



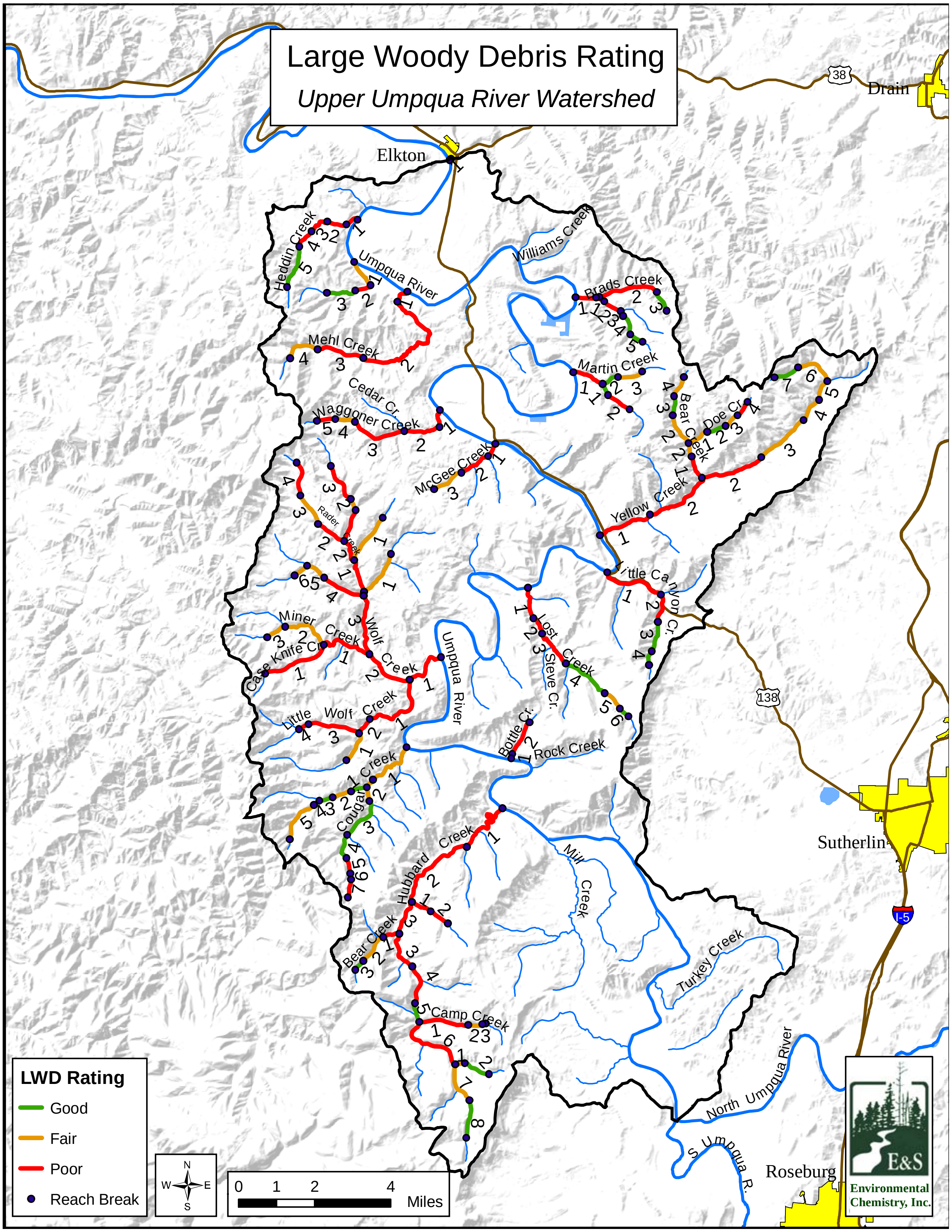
Map 3.3. Overall pool rating of Upper Umpqua River Watershed stream reaches surveyed by ODFW, based on results for percent area in pools and residual pool depth. Numbers correspond to the reach numbers in Table 3.4. Some reaches are intersected by tributary junctions. In such cases, the reach number is shown both upstream and downstream of the tributary junction.



Map 3.4. Overall riffle rating of Upper Umpqua River Watershed stream reaches surveyed by ODFW, based on results for percent gravel and percent fine sediments in riffles and also on riffle width to depth ratio. Numbers correspond to the reach numbers in Table 3.4.



Map 3.5. Overall riparian rating of Upper Umpqua River Watershed stream reaches surveyed by ODFW, based on dominant riparian species (hardwood or conifer) and percent of the creek that is shaded by riparian vegetation. Numbers correspond to the reach numbers in Table 3.4.



Map 3.6. Overall in-stream large wood condition rating of Upper Umpqua River Watershed streams surveyed by ODFW, based on number of wood pieces and volume of wood per unit stream length. Numbers correspond to the reach numbers in Table 3.4.

ODFW Aquatic Habitat Survey data have been used to identify reference, or relatively unimpacted, stream reaches. These data were summarized by the BLM (2002) into five components and analyzed by a computer model to calculate a variable baseline for each component. The components included riparian and in-stream woody debris and recruitment potential, pool and riffle condition indices, and a channel incision index. All the stream reaches within the Upper Umpqua River Watershed were then compared to the referenced baseline. The greater the deviation from the reference baseline, the higher the score rating because of the greater "Need for Action." For example, where there is less LWD in the stream reach compared to the reference streams, there is greater need for action and therefore a higher score (BLM 2002).

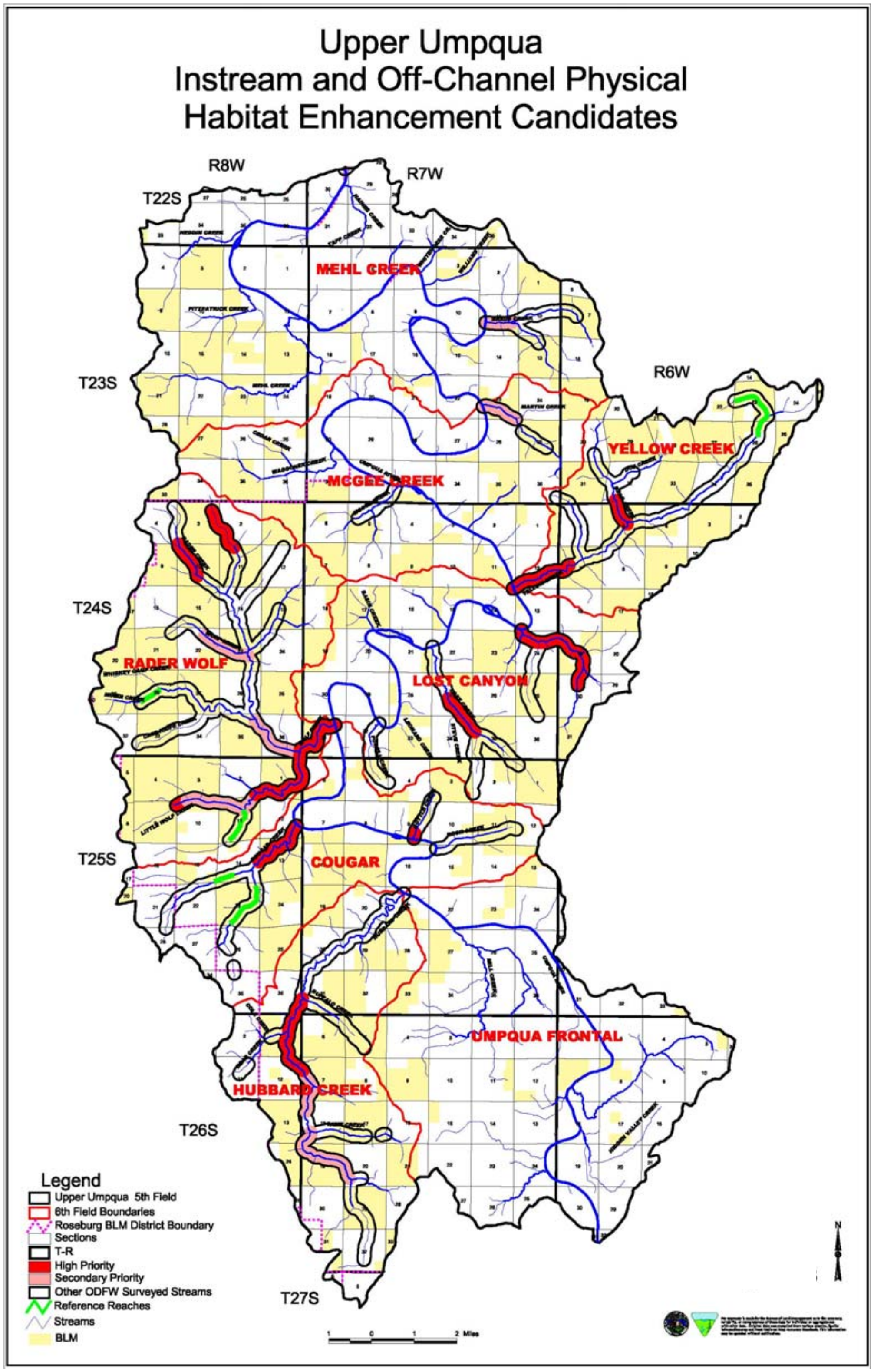
In many situations, reaches have been degraded beyond a practicable point of enhancement. Therefore, to evaluate which stream reaches would be maximized through enhancement projects, the potential of each reach was assessed by both the stream reach's existing characteristics and the expected potential for improvement. Six components were established to evaluate the reach potential: Riparian Habitat Density, Riparian Road Density, Percent Secondary Channels, Floodplain Connectivity Index, Hardwood Mix Index, and Percent Harvest.

Separate scores reflecting the restoration potential and the need for action were calculated by the BLM for each stream reach within the analysis area using the component indices and methods described above. Final candidate physical habitat enhancement sites are those with the highest combined habitat potential and need for action. Preferred candidate reaches (totaling 30 stream miles) are displayed in Map 3.7 and Table 3.5. The stream reaches indicated as high priority sites for physical habitat rehabilitation are those reaches that have the highest need and highest potential for enhancement. Reference reaches within Upper Umpqua are indicated in green on Map 3.7.

3.1.3. Stream Connectivity

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

For this assessment, fish passage barriers are structures that are believed to 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 of all fish, 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.



Map 3.7. Prioritized stream reaches for habitat enhancement in the Upper Umpqua River Watershed. (Source: BLM 2002)

Table 3.5. Prioritized enhancement stream reaches in the Upper Umpqua River Watershed. (Source: BLM 2002)

Stream Name	ODFW Reach ID	Stream Name	ODFW Reach ID
Highest Priority		**Secondary Priority**	
Bear Creek	1	Bottle Creek	1
Cougar Creek	1	Brads Creek	1
Little Wolf Creek	1	Hubbard Creek	3
Little Wolf Creek	2	Hubbard Creek	4
Little Wolf Creek	4	Hubbard Creek	6
Lost Creek	3	Little Canyon Creek	1
Rader Creek	3	Little Canyon Creek	2
Rader Creek Trib #3	3	Little Wolf Creek	3
Wolf Creek	1	Martin Creek	1
Yellow Creek	1	Wolf Creek	2
		Wolf Creek	4

3.1.3.1. Irrigation Ditches

Irrigation ditches without fish wheel screens are primarily a problem for juvenile fish.[15] 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 Upper Umpqua River Watershed had been identified as significant juvenile fish obstacles.

3.1.3.2. Dams and Natural Barriers

In addition to the fish barrier culverts, there are numerous natural barriers that limit anadromous fisheries habitat access within the watershed. Waterfalls, debris jams, and excessive water velocities may impede migrating fish. Falls that are insurmountable at one time of the year may be passed, however, by migrating fish at other times when flows are different.

In the Umpqua River Basin, many dams on larger streams are push-up dams used to create pools to pump irrigation water.[16] These dams are typically only used during the summer months, and therefore 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 (the “drop”) is too far for fish to jump. Whether or not a fish can overcome this distance depends on three factors: the size and species 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. As pool depth decreases or height increases, fish have difficulty jumping high enough to pass over. The ODFW Fish Passage

[15] Fish wheel screens are self-cleaning screens that prevent fish from entering an irrigation ditch while passing floating debris that may prevent water flow.
[16] Some landowners may have dams on small tributaries to provide water for wildfire control, livestock, or landscape aesthetics.

Barrier database lists one dam in the Upper Umpqua River Watershed that is a barrier or obstacle to adult or juvenile fish passage (Grier Reservoir Dam).

3.1.3.3. Culverts

Culverts can be either barriers or obstacles to fish passage, especially if the distance from the downstream water surface to the culvert outfall is too far for fish to jump. Culverts can also block fish access by creating high velocity in the pipe. A drop of two feet can cause problems for adult cutthroat trout, whereas adult steelhead can jump five feet or more. Even a drop of one foot or less can impede passage of juvenile fish. Oregon Forest Practices rules require that new culverts generally have a gradient no more than 0.5% and no more than a six inch drop at the outlet. Higher gradients are allowed for culverts having baffles installed in the culvert bottom.

Various culvert conditions that can block fish passage may consist of one or more of the following: water velocity too great, water depth in culvert too shallow, no resting pool below culvert, and/or jump too high (Evans and Johnston 1980). In a joint study by the Oregon Department of Forestry and Oregon Department of Fish and Wildlife, single vertical jumps of above 12 inches could be barriers to adult salmon and above 6 inches for juvenile salmonids.

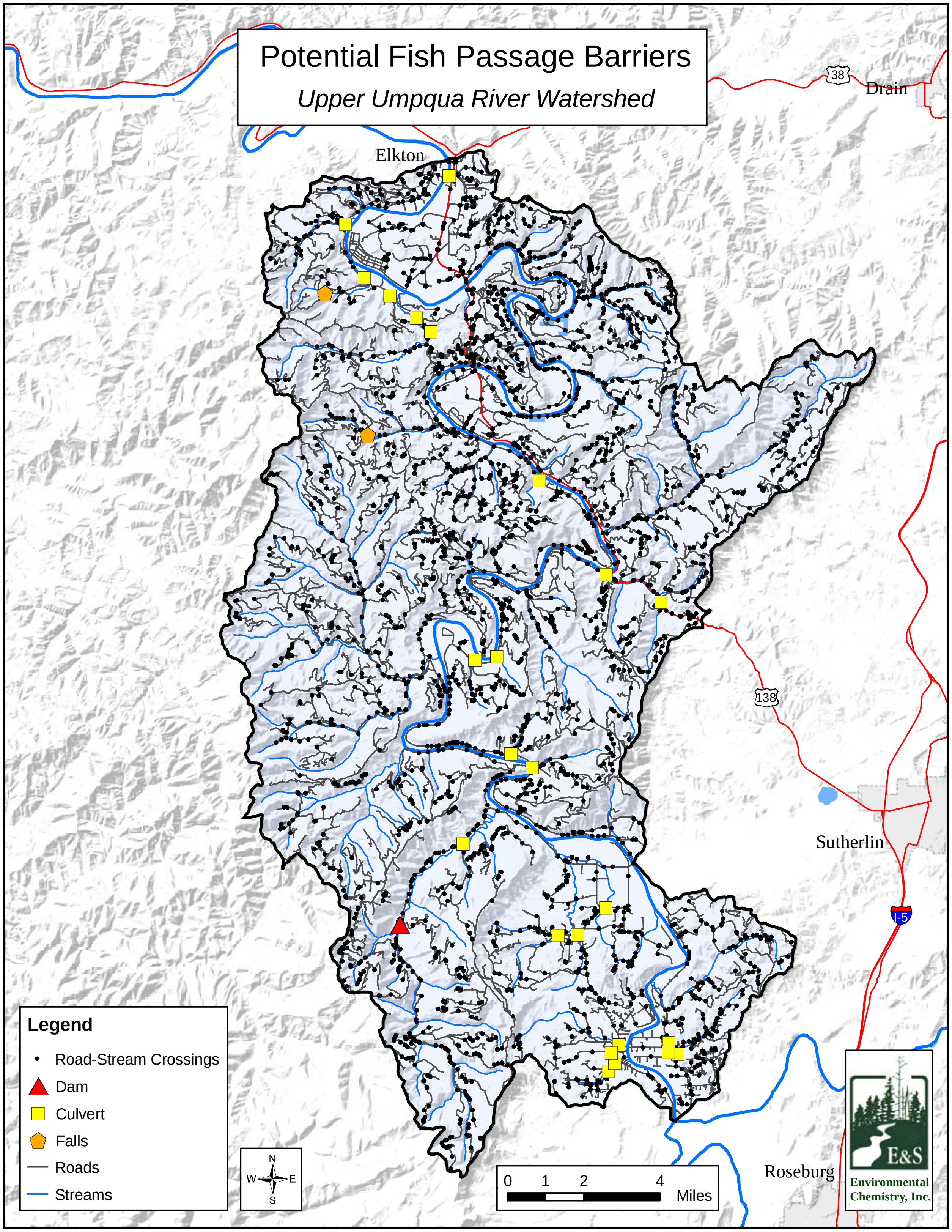
In natural stream systems, fish are able to navigate high velocity waters by periodically resting behind rocks and logs or in pools. Smooth-bottomed culverts offer no such protection, and water velocities can prevent some or all fish from passing through the pipe. Fish may face an additional velocity barrier 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 it is possible for culverts to 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, in some cases, 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 impassable.

Map 3.8 shows road/stream crossings within the Upper Umpqua River Watershed. Most of these crossings contain culverts. A culvert is the most common method of passing a road over a stream; however, bridges and hardened crossings are used as well.

Within the BLM road system of the Upper Umpqua River Watershed, there are approximately 24culverts identified by BLM (2002) that are restricting access to anadromous fisheries habitat. BLM (2002) shows where these culverts and the low gradient (#6%) stream reaches above those culverts are located. Seven are total barriers preventing access to approximately 4.2 miles of potential fish habitat. The remaining fish barrier culverts are partial barriers to adult passage and/or total fish passage barriers to juvenile salmonids. The 32 fish barrier culverts within the watershed restrict access to approximately 31 miles of potential fish habitat, about two-thirds of which occurs in the Rader Wolf subwatershed.

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



Map 3.8. Potential fish passage barriers identified by ODFW, including road-stream crossings, in the Upper Umpqua River Watershed.

public and private land throughout 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. More information will be available later this year.

3.1.4. Channel Modification

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 installation of riprap along the bank, dredging, or other "non-restorative" activities. 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 necessarily alter the stream's path. As such, in-stream 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 normal 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 modification projects can only be done with a permit.[17] History has shown that channel modification activities are often detrimental to nearby aquatic ecosystems and to other reaches of the same stream. Streams naturally meander; 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 often be done with a permit, obtaining a permit can be a lengthy process.

Past removal of wood from streams has seriously altered stream morphology. Large logs, stumps and root wads affect stream morphology by creating debris dams and pools, trapping sediment, and providing physical complexity. These functions create critical habitat for aquatic organisms (Reeves et al. 2002). We did not find specific information regarding such stream "cleaning" activities that occurred historically in the Upper Umpqua Watershed. Nevertheless, recent surveys of the stream system by ODFW indicate a lack of LWD and related physical complexity throughout most of the watershed.

3.1.4.1. Historical Channel Modification Projects

Quantifying historical channel modification activities is difficult because in many cases no permits were issued, and the evidence is often hidden. Many involved removing gravel bars from the stream or 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. In general, a gravel bar that has no grass or other vegetation is very unstable, and during every flood event gravel is washed away and replaced by upstream materials. Consequently, a gravel bar in the same location was often removed every year.

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[17] 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.

Human activities that have influenced stream morphology in the past include log drives, yarding in channels during timber harvest, road construction, beaver eradication,[18] reservoir construction, and stream cleaning. Log drives historically occurred most frequently along the mainstem river. It is unknown exactly how far upstream log drives were conducted. Logs were stored on the banks until high flows, and then pushed into the rivers and transported downstream to be milled. Impacts associated with log drives included bank erosion, damage to riparian vegetation, mechanical erosion of channel substrate, and sediment removal. In the lower watershed, additional human alterations of stream morphology may have included channelization, straightening, bank armoring, diking, and dredging. Unfortunately, the specific locations of these activities are not well documented.

During the salvage logging following the Columbus Day storm in 1962, road construction likely impacted stream channels, although specific locations in the watershed were not determined. Many roads were constructed near streams at that time, resulting in sedimentation of the streams by sidecast material (Levesque 1985). Sedimentation conditions associated with old roads have improved, and active management of roads to reduce erosion is ongoing.

Bank stabilization involves adding material to the stream bank to prevent or minimize erosion and stream meandering. The term “riprap” refers to large rock material used for bank stabilization. Frequently, riprap becomes buried by sediment only to be exposed years later when a stream alters its path. During the 1996 floods, riprap and debris from many past bank stabilization projects were exposed along the Umpqua River as sediment was washed away.

3.1.4.2. Recent Channel Modification Projects

We are not aware of any recent channel modification projects in the Upper Umpqua River Watershed. However, landowners and stream restoration professionals report that non-permitted channel modification activities still occur throughout the Umpqua Basin. In many cases, the people involved are unaware of the regulations and fines associated with non-permitted channel modification projects and the effects on aquatic systems.

3.1.5. Stream Function Key Findings and Action Recommendations

3.1.5.1. Stream Morphology Key Findings

- A wide variety of stream channel habitat types are found in the watershed, and several enhancement opportunities exist.
- Stream habitat surveys suggest that lack of large woody material, poor riffles, and poor or fair pools limit fish habitat in surveyed streams.

3.1.5.2. Stream Connectivity Key Findings

- Dams and culverts that are barriers and/or obstacles to fish reduce stream connectivity, affecting anadromous and resident fish productivity in the Upper Umpqua River Watershed. The density of road/stream crossings is high, providing many opportunities to

[18] According to ODFW, beavers were nearly eliminated throughout much of North America by the mid-1800s. Extensive transplanting efforts in Oregon have assisted in the recovery of beaver populations in many streams.

block fish access. BLM has identified 32 culverts that are currently restricting access to anadromous fish habitat.

3.1.5.3. Channel Modification Key Findings

- There are few examples of permitted channel modification projects in the Upper Umpqua River Watershed.
- Many landowners may not understand the detrimental impacts of channel modification activities or may be unaware of active stream channel regulations.

3.1.5.4. Action Recommendations

- Where appropriate, improve pools and riffles while increasing in-stream 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.[19]
- 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 area conditions.
  - 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 high quality fish habitat.
- Increase landowner awareness and understanding of the effects and implications of channel modification activities through public outreach and education.

[19] Thirty feet is the maximum stream width for which in-stream log and boulder placement projects are permitted.

3.2. Riparian Zones and Wetlands

3.2.1. Riparian Zones

For the purpose of this assessment, the riparian zone is the vegetation immediately adjacent to a stream. 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 limit stream meandering. Trees and limbs that fall into streams can increase fish habitat complexity and create pools. Insects that thrive in streamside vegetation are an important food source for fish.

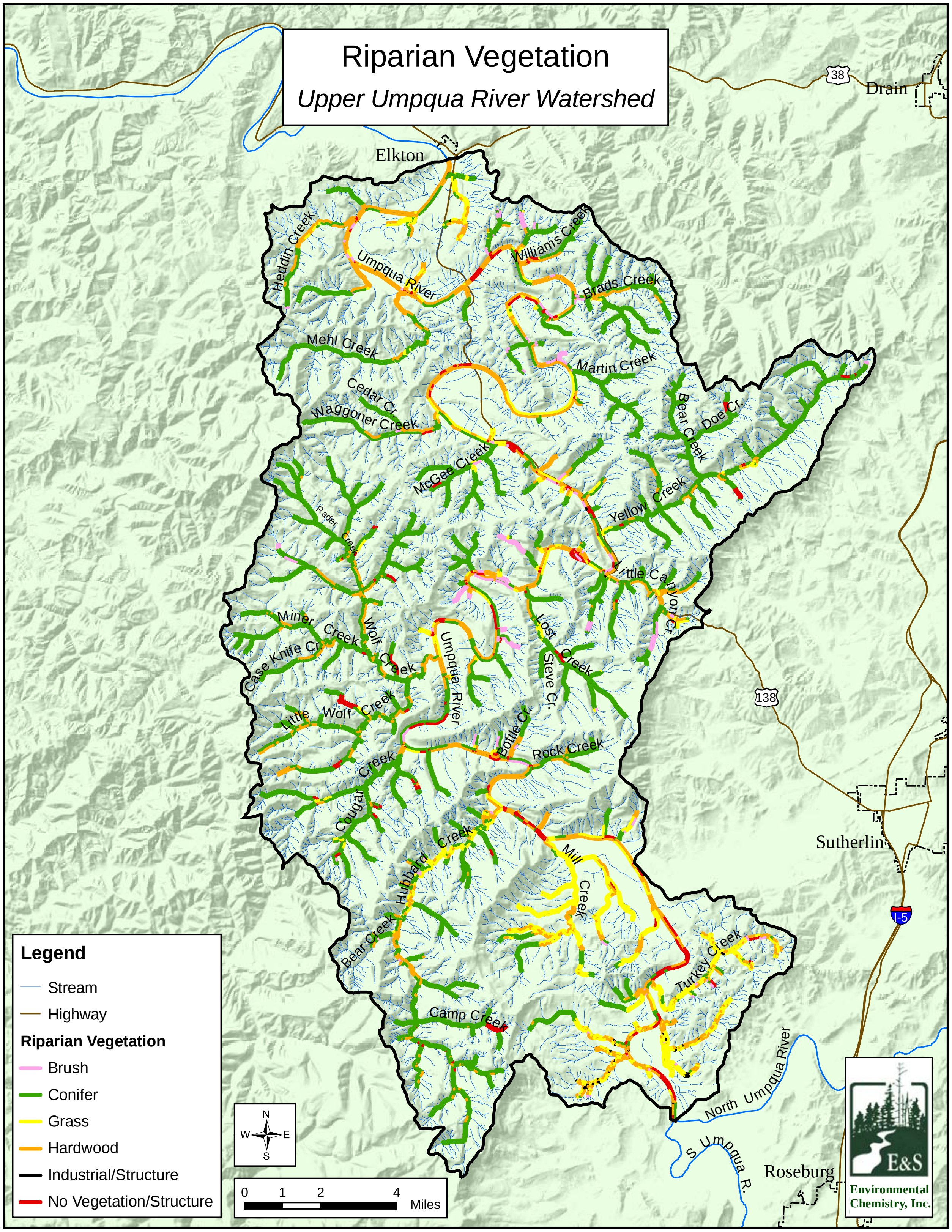
The "health" of the riparian area is dependent on many factors. Although large diameter conifers are especially important in providing shade and woody debris, many streams flow through areas that do not normally support large conifers. In some areas, current land uses may not permit the growth of "ideal" 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 primarily as a guide for interpretation and further investigation.

Riparian vegetation in the watershed was primarily (58%) conifer, followed by hardwood forest (20%), and grass (14%; Table 3.6). This suggests reasonable potential to develop future large wood sources to the stream system. Riparian conifers were found mostly in the upper tributary stream systems, throughout much of the watershed except in the southernmost sections (Map 3.9). Interspersed with the conifer-dominated riparian areas were some stretches of riparian zone that were devoid of vegetation, possibly associated with recent logging activities and/or steep terrain.

Riparian vegetation along the mainstem river was mostly hardwood forest and grass. Areas of the tributary streams that were dominated by hardwood forest or grasses were generally found in the lower reaches of the tributaries, especially Turkey, Mill, and Hubbard creeks (Map 3.9). Overall, riparian vegetation in the watershed provides only a moderate degree of shade-producing cover.

Table 3.6. Aerial photo interpretation of riparian vegetation in the Upper Umpqua River Watershed.

Vegetation Type	Left Bank (Miles)	Right Bank (Miles)	Left Bank (Acres)	Right Bank (Acres)	Total (Acres)	Total (Percent)
Brush	10.4	12.2	189.3	222.4	411.7	3.2
Conifer	207.1	198.9	3,764.6	3,615.8	7,380.4	57.9
Grass	49.4	46.2	897.2	839.7	1,736.9	13.6
Hardwood	65.5	76.9	1,190.7	1,397.3	2,588.0	20.3
Industrial	0.5	0.8	9.5	14.6	24.1	0.2
No Vegetation/Bare	18.0	15.9	327.1	288.6	615.7	4.8
Total	350.9	350.9	6,378.4	6378.4	12756.8	100



Map 3.9. Distribution of riparian vegetation classes throughout the Upper Umpqua River Watershed.

Only two-thirds of the riparian areas were classified as having high cover (Figure 3.2). In wide streams, such as the mainstem Umpqua River, streamside vegetation cannot shade the entire water surface. The smaller tributary streams are more heavily shaded in most areas. The grass and open hardwood vegetation of the Turkey Creek subwatershed provides relatively little stream shading.

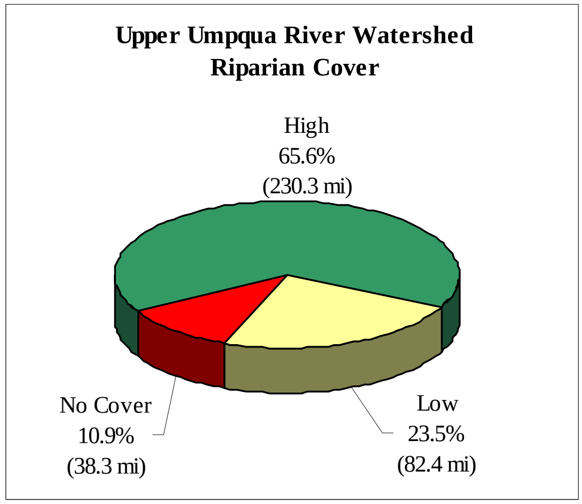


Figure 3.2. Results of aerial photo interpretation of riparian cover.

3.2.2. Wetlands[20]

The hydrology of wetlands is often complex and interconnected with the stream system. The purpose of this section is to review current wetland locations and attributes, and to discuss opportunities for wetland restoration. Background information for this section was compiled from the *Tidal Wetland Prioritization for the Umpqua Estuary* (Brophy and So 2004), the *South Umpqua River Watershed Assessment and Action Plan* (Geyer 2003), and the following groups' documents, websites, and specialists: Oregon Division of State Lands (DSL), US Environmental Protection Agency (EPA), US Fish and Wildlife Service (USFWS), and Wetlands Conservancy. Additional information was compiled from *Wetland Plants of Oregon and Washington* (Guard 1995).

3.2.2.1. Overview of Wetland Ecology

What is a wetland?

Wetlands are transitional areas between terrestrial and aquatic ecosystems, where the water table is usually at or near the surface of the land, or the land is covered by shallow water. The following three attributes must be found together to establish the existence of a regulated wetland.

1. Under normal circumstances there is inundation or saturation with water for two weeks or more during the growing season.[21]
2. The substrate is predominantly undrained hydric soil as indicated by the presence of features such as dull colored or gleyed (gray colors) soils, soft iron masses, oxidized root channels, or manganese dioxide nodules.
3. At least periodically, the land supports predominantly hydrophytic (water-loving) vegetation.

Function and values

In the past, wetlands were regarded as wastelands. As early as 1849 with the enactment of the Swamp Act, wetlands removal was encouraged by the US government. Wetlands were feared as

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[20] Jeanine Lum of Barnes and Associates, Inc., contributed material for section 3.2.
[21] The growing season in Douglas County is approximately from March 1 through October 31.

the cause of malaria and other waterborne diseases. However, research over the years has led to a greater appreciation of the many important ecological functions that wetlands perform. These include:

- Flood prevention and water retention - wetlands are able to absorb water from runoff during storms and gradually release the water that would otherwise flow quickly downstream.
- Water filtration - wetlands improve water quality by trapping sediment and removing excess nutrients such as phosphorous and nitrogen.
- Groundwater recharge - water that is held in wetlands can move into the subsurface soil, thus recharging the groundwater.
- Stream bank stabilization - wetlands and associated vegetation slow the movement of water and help reduce erosion of stream banks.
- Fish and wildlife habitat - many species of fish and other aquatic organisms depend on wetlands for food, spawning and rearing habitat.

<u>Background on the Clean Water Act and National Wetlands Inventory</u>

Section 404 of the federal Clean Water Act of 1972 requires that anyone planning to place dredged or fill material into waters of the United States, including wetlands, must first obtain a permit from the US Army Corp of Engineers. Established (ongoing) and normal farming, ranching, and forestry activities are exempt. The Emergency Wetlands Resources Act of 1986 requires the USFWS to inventory and map wetlands in the United States. This mapped inventory is called the National Wetlands Inventory (NWI).

Nationally, an estimated 46 million acres, or 50%, of the original wetlands areas have been lost to clearing, filling, draining, and flood control since the 1600s. In 1997, the USFWS reported an 80% reduction in wetlands loss during the period 1986 to 1996, as compared to the decade prior. Although the nation has not met the goal of no net loss of wetlands, it has slowed the rate of wetlands loss.

<u>Types of wetlands</u>

A wetland that holds water all year round is the easiest wetland to recognize and the one most people understand as a wetland. Another type of wetland is the ephemeral wetland, or a wetland that holds water for only a few weeks or months during the year. The timing and duration of water holding are important factors that dictate which plants and wildlife will inhabit a particular wetland.

The NWI classifies wetlands based on guidelines established by Cowardin et al. (1979). The "palustrine" classification includes all nontidal wetlands dominated by trees, shrubs, emergents (erect, rooted, non-woody plants), mosses, or lichens. It groups the vegetated wetlands traditionally called by such names as marsh, swamp, bog, fen, and prairie pothole. The palustrine wetland type also includes the small, shallow, permanent or intermittent water bodies often called ponds. Bodies of water that are lacking such vegetation and are less than 20 acres in size are included in this category. The "riverine" classification includes wetlands within a stream channel, except those dominated by trees, shrubs, and persistent emergents.[22] "Upper perennial" refers to riverine wetlands along perennial streams in the upper portion of the drainage basin. NWI data are displayed in Map 3.10 and Table 3.7.

3.2.2.2. Description of Current Wetlands in the Upper Umpqua River Watershed

Based on the current NWI wetlands data, riverine systems, which include only upper perennial wetlands, account for 73% of the wetlands found in the Upper Umpqua River Watershed. These riverine wetlands are found only along the riparian zones of the mainstem Umpqua River throughout the length of the watershed (Map 3.10). Palustrine systems comprise the remaining 27% of the wetlands in the watershed. They are found mainly in the southeastern corner of the watershed near Mill Creek.

3.2.2.3. Restoration Opportunities in the Upper Umpqua River Watershed

There is little specific reference in historical records to wetlands in the Upper Umpqua River Watershed. However, it is believed that about 53% of the original wetlands acreage in western Oregon has been lost to development or converted to other uses (Wetlands Conservancy 2003). We expect that wetland loss within the Upper Umpqua River Watershed has also been substantial.

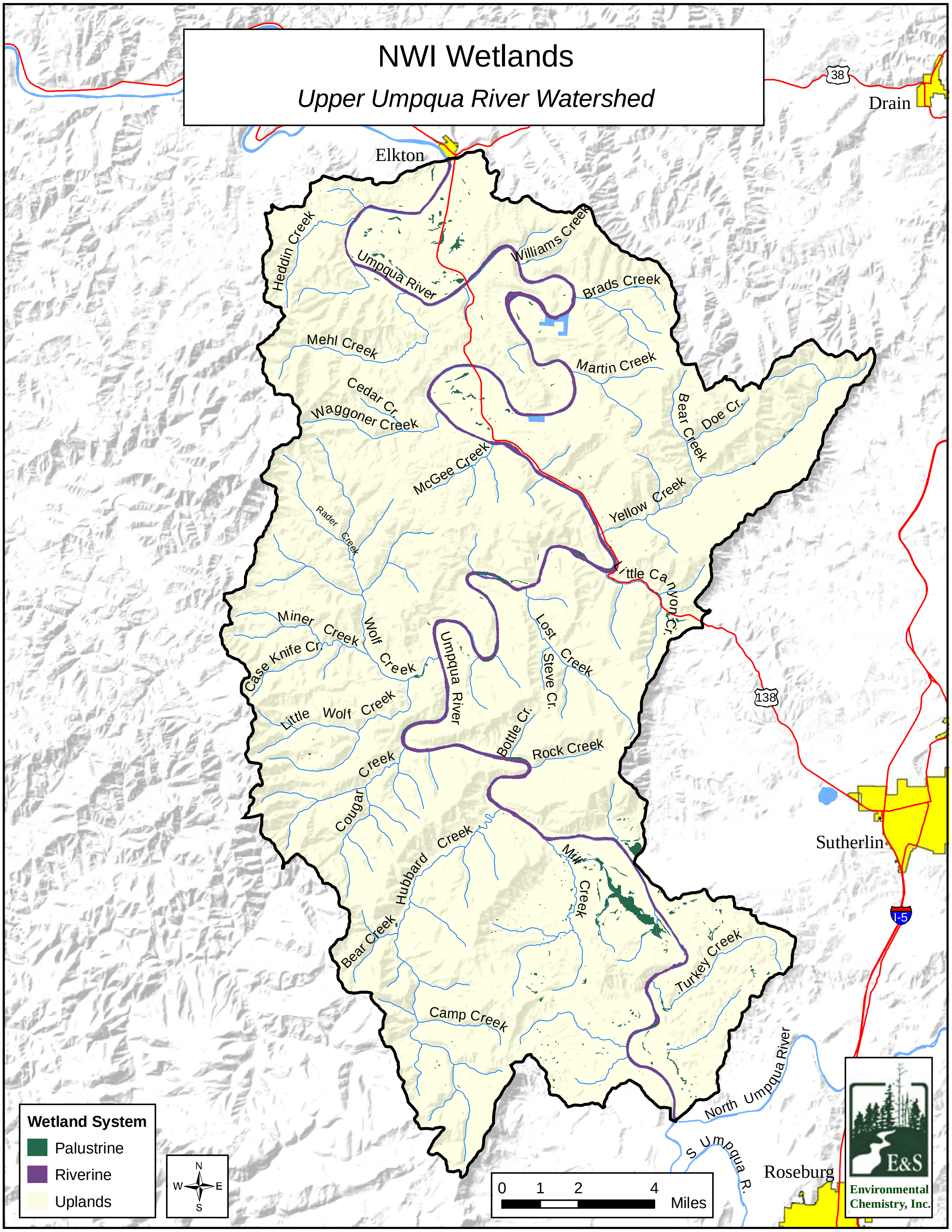
Wetland loss and degradation is caused by human activities that change wetland water quality, quantity, and flow rates; increase pollutant inputs; and change species composition as a result of disturbance and introduction of non-native species. Although one of the functions of wetlands is to absorb pollutants and sediments from runoff water, there is a limit to their capacity to do so.

The primary agricultural use of wetlands in the watershed is grazing of domestic animals that often congregate in riparian zones and wetlands during dry and hot periods. Best management practices can reduce the impact of livestock in the wetlands and riparian areas. Off-channel watering, hardened crossings, irrigation, livestock exclusion (part or all of the year), and providing shade away from these areas are examples of improvements that can be implemented to minimize damage to wetlands.

There are many opportunities for landowners to participate in incentive, cost-share, and/or grant awarding programs that encourage good land stewardship and benefit wetlands. Although programs vary in terms of incentives and eligibility, landowners share these common concerns:

- Lack of awareness of available programs
- Overwhelming program choice
- Concern about hidden agendas and "fine print"
- Anxiety over bureaucracy and contracts
- Fear of the loss of privacy, increased regulation, or the discovery of threatened or endangered species on the property.

[22] Persistent emergents are present for more that one growing season. Nonpersistent emergents are annuals, or perennials that disappear above ground each season.



Map 3.10. Upper Umpqua River Watershed wetlands.

Table 3.7. Upper Umpqua River Watershed wetlands and deepwater habitat classification.		
Wetland Type	**Wetland Area**	
	Acres	**Percent**
Palustrine		
Aquatic Bed - Semipermanently Flooded	18.2	0.4
Aquatic Bed - Permanently Flooded	9.4	0.2
Emergent - Temporarily Flooded	12.7	0.3
Emergent - Saturated	692.2	16.2
Emergent - Seasonally Flooded	109.0	2.6
Emergent - Semipermanently Flooded	7.6	0.2
Forested - Temporarily Flooded	40.7	1.0
Forested - Saturated	9.8	0.2
Forested - Seasonally Flooded	52.5	1.2
Scrub/Shrub - Temporarily Flooded	5.3	0.1
Scrub/Shrub - Saturated	17.3	0.4
Scrub/Shrub - Seasonally Flooded	133.4	3.1
Unconsolidated Bottom - Semipermanently Flooded	4.6	0.1
Unconsolidated Bottom - Permanently Flooded	42.7	1.0
Unconsolidated Bottom - Seasonally Flooded	0.8	0.0
Total	**1,156.2**	**27.0**
Riverine -		
Upper Perennial - Rocky Shore	603.1	14.0
Upper Perennial - Unconsolidated Shore	2,527.0	59.0
Total	**3,130.1**	**73.0**
	4,286.3	100.0

3.2.3. Riparian Zones and Wetlands Key Findings and Action Recommendations

3.2.3.1. Riparian Zones Key Findings

- Conifers dominate 58% of the riparian zone, mainly along tributary streams.
- Few conifers occur along the mainstem river or along the lower reaches of tributaries in the southernmost portion of the watershed.
- Only two-thirds of the stream length in the watershed was classified as having high cover. There are good opportunities to increase stream shading, especially along the mainstem Umpqua River.

3.2.3.2. Wetlands Key Findings

- Historical settlement, development, and long-term agricultural use of the Upper Umpqua River Watershed have probably affected the original wetland hydrology and resulted in loss of wetland areas.
- Most of the remaining wetlands in the Upper Umpqua River Watershed are found on private land along the mainstem river.
- Landowner "buy-in" and voluntary participation must be fostered if wetland conservation is to be successful in the watershed.
- There are opportunities for enhancement and protection of wetlands, including an area of palustrine wetlands in the vicinity of Mill Creek, and riverine wetlands along the mainstem Umpqua River throughout the length of the watershed.

3.2.3.3. Riparian Zones and Wetlands Action Recommendations

- Where canopy cover is less than 50%, establish 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 grass and blackberry and convert these areas to native trees (preferably conifers) and/or shrubs, depending on local conditions.
- Where possible, maintain riparian zones that are two or more trees wide and provide more than 50% cover.
- Encourage best management practices that limit wetland damage, such as off-channel watering, hardened crossings, livestock exclusion (part or all of the year), and provide stream shade.
- Develop opportunities to increase awareness of what defines a wetland and its functions and benefits. This is a fundamental step in creating landowner interest and developing landowner appreciation for wetland conservation.
- Identify or establish various peer-related demonstration projects as opportunities to educate stakeholders.
- Establish an approachable clearinghouse to assist landowners in enrolling in programs that can benefit wetlands and meet landowner goals. A friendly and "non-governmental" atmosphere can reduce some of the previously identified landowner concerns. A central site can identify and coordinate partners, streamline landowner paperwork, and facilitate securing funding and in-kind services often needed for a successful project. Combining local programs with national programs maximizes flexibility and funding. For example, a landowner could receive a tax exemption under the local Wildlife Habitat Conservation and Management Program, receive technical assistance in planning and cost share from the Natural Resources Conservation Service, and receive grant money from Partners for Wildlife and Ducks Unlimited.

3.3. Water Quality

This section describes the condition of water quality in the Upper Umpqua River Watershed, with a focus on six important water quality parameters. Background information for this chapter was compiled from the following sources: the *Oregon Watershed Assessment Manual* (Watershed Professionals Network 1999), *Upper Umpqua River Watershed Analysis* (BLM 2002), *Elliott State Forest Watershed Analysis* (Biosystems 2003), and the *South Umpqua River Watershed Assessment and Action Plan* (Geyer 2003). Additional information and data are from the following groups' documents, websites, and specialists: the Oregon Water Resources Department (OWRD), Oregon Department of Environmental Quality (ODEQ), the Bureau of Land Management (BLM), and the Natural Resource Conservation Service (NRCS).

3.3.1. Pre-Settlement Water Quality

Water quality conditions in the watershed at the time of Euro-American settlement are undocumented. However, based on descriptions of the landscape at the time, it is likely that water temperatures in the mainstem reaches of the Umpqua River and its tributaries were lower than they are today. Early records indicate that the tributary streambanks and some of the lowland floodplains were mostly wooded, with many large trees present to provide adequate shade to moderate streamwater temperature.

Bacterial conditions are less certain. In the mainstem Umpqua River, current bacterial levels exceed water quality standards probably because of agricultural, urban, and rural residential sources of contamination. Beaver ponds have been associated with high levels of fecal coliform bacteria in smaller tributary streams. Beaver ponds probably occurred throughout the watershed in pre-settlement times.

Chronic turbidity and suspended sediment concentrations were probably somewhat lower in pre-settlement times than they are today. This was largely because of the absence of roads and to a lesser extent the absence of other anthropogenic watershed disturbances. However, large episodic disturbance events, such as fires and floods, would have resulted in periodic spikes in turbidity and suspended sediment levels.

Primary sources of nutrient loading in the streams prior to Euro-American settlement included decaying salmon carcasses subsequent to spawning and nitrogen fixation associated with plants such as red alder in the riparian zone. The timing of nutrient input has been altered, and the pulse of nutrients subsequent to spawning has been reduced. Nitrogen and phosphorus loading due to salmon mortality were higher historically and have been replaced by other sources of nutrient loading.

3.3.2. Stream Beneficial Uses and Water Quality Impairments

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 3.8 lists beneficial uses for streams and rivers in the Umpqua Basin.

Table 3.8. Stream beneficial uses in the Umpqua Basin, including the Upper Umpqua River Watershed.

Public Domestic Water Supply[1]	Resident Fish and Aquatic Life
Private Domestic Water Supply[1]	Wildlife and Hunting
Industrial Water Supply	Fishing
Irrigation	Boating
Livestock Watering	Water Contact Recreation
Anadromous Fish Passage	Hydropower
Salmonid Fish Rearing	Aesthetic Quality
Salmonid Fish Spawning	

[1] With adequate pretreatment (filtration and disinfection) and natural quality to meet drinking water standards

In order to protect the beneficial water uses, ODEQ has established water quality standards. These standards determine the acceptable levels or ranges for water quality parameters. ODEQ monitors streams and stream reaches throughout Oregon, and streams or reaches that are not within the standards are identified as "water quality limited" or "impaired."[23] Section 303(d) of the Clean Water Act of 1972 requires each state to submit this list of impaired streams to the US Environmental Protection Agency (EPA). This is commonly referred to as the "303(d) list." ODEQ is then required to determine the maximum amount of pollution, or "load", that each impaired steam can receive without violating water quality standards. This is referred to as the "total maximum daily load", or "TMDL."[24] A TMDL document is currently being completed for streams in the Umpqua Basin, and will be available later this year. 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.

3.3.3. 303(d) Listed Parameters

To evaluate water quality in the Upper Umpqua River Watershed, six water quality parameters are reviewed in this section. These parameters are temperature, pH, DO, nutrients, bacteria, and sedimentation/turbidity. Most of the emphasis in this section is placed on temperature and bacteria, the water quality parameters that are known to be problematic in this watershed.

Water quality criteria are provided in Table 3.9, based on Oregon Watershed Enhancement Board (OWEB) and EPA guidelines. In this assessment, we evaluate available data in the Upper Umpqua River Watershed relative to these indicator values. OWEB recommends evaluating water quality impairment on the basis of the percent of samples that exceeded the various criteria values (Table 3.10).

[23] ODEQ can also use data collected by other agencies and organizations to evaluate water quality.
[24] TMDL plans are limits on pollution developed when streams and other waterbodies do not meet water quality standards. TMDL plans consider both human-related and natural pollution sources.

Table 3.9. Water quality criteria and evaluation indicators.[1]

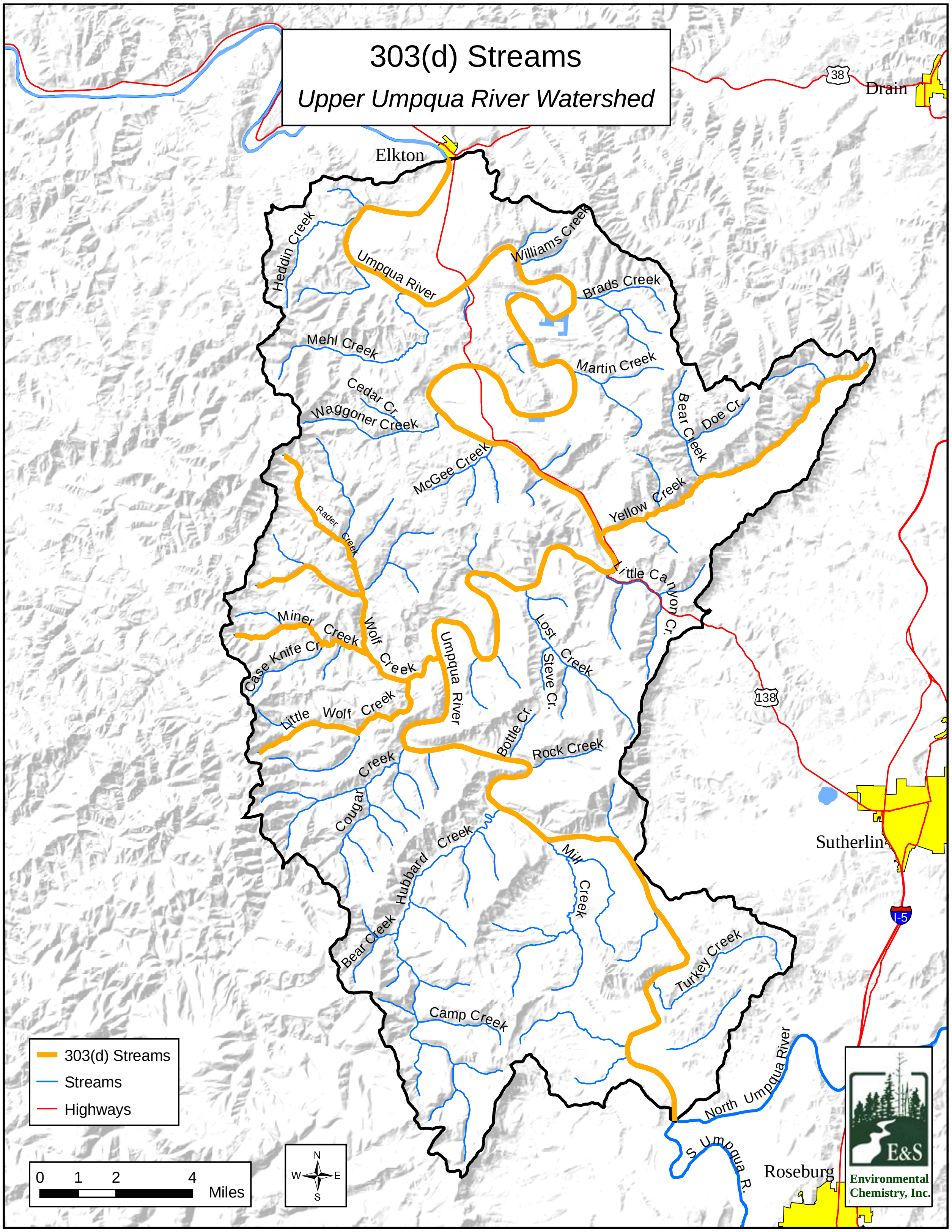
Water Quality Attribute	Evaluation Criteria
Temperature	Daily maximum of 64EF (17.8EC) during summer months (7-day moving average)
Dissolved Oxygen	8.0 mg/L salmonid rearing, 6.5 mg/L estuarine
pH	Between 6.5 and 8.5
Nutrients Total Phosphorus Total Nitrogen	 8.75 : g/L 0.10 mg/L
Bacteria	<u>Water-contact recreation</u> 126 *E. coli*/100 ml (30-day log mean, 5 sample minimum) 406 *E. coli*/100 ml (single sample maximum)
	<u>Marine water and shellfish areas</u> 14 cfu/100 ml (median) 43 cfu/100 ml (not more than 10% of samples)
Turbidity	50 NTU maximum (fish feeding impaired) 10 NTU adverse aesthetic effect

[1] Based on WPN 1999, EPA recommendations, and ODEQ water quality standards.

Table 3.10. Criteria for evaluating water quality impairment. (Source: WPN 1999)

Percent of Data Exceeding the Criterion	Impairment Category
Less than 15%	No impairment
15 to 50%	Moderately impaired
More than 50%	Impaired
Insufficient data	Unknown

Map 3.11 and Table 3.11 show the streams identified for inclusion on the 303(d) list. The entire length of the mainstem Umpqua River, as well as five tributary streams, were placed on the Oregon 303(d) list due to documented violations of water quality standards. The most important water quality concerns in the watershed are fecal coliform bacteria and water temperature. The affected beneficial uses are resident fish and aquatic life, salmonid fish spawning and rearing, and water contact recreation. However, this may not be a comprehensive evaluation of all water quality concerns in the Upper Umpqua River Watershed. There are streams and stream segments that have not been monitored by ODEQ, or for which additional information is needed to make a listing determination.



Map 3.11. 303(d) listed streams within the Upper Umpqua River Watershed.

Table 3.11. Upper Umpqua River Watershed 303(d) listings.

Location		Parameter(s)
Umpqua River	Little Mill Creek to North/South Fork	Bacteria, Rearing Temperature
Little Wolf Creek	Mouth to Headwaters	Rearing Temperature
Miner Creek	Mouth to Headwaters	Rearing Temperature
Rader Creek	Mouth to Headwaters	Rearing Temperature
Wolf Creek	Mouth to Headwaters	Rearing Temperature
Yellow Creek	Mouth to Headwaters	Rearing Temperature

3.3.4. Temperature

3.3.4.1. 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 salmonid fish. When temperature exceeds tolerance levels, cold-water organisms become physically stressed and have difficulty obtaining enough oxygen.[25] Stressed fish are more susceptible to predation, disease, and competition from temperature-tolerant species. 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, and consequently 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) during summer months. Salmonids commonly live in streams that are warmer than 64°F, although physiological stress and behavioral changes occur when temperatures approach 70°F. Temperatures 77°F (25°C) or higher are considered lethal.

3.3.4.2. Available Stream Temperature Data

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. In the Upper Umpqua River Watershed, the mainstem river was 303(d) listed for temperature throughout the watershed, and five tributary streams were also listed (Table 3.11)

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

In 1999, the Umpqua Basin Watershed Council (UBWC) undertook a study of stream temperature for the entire Lower Umpqua River sub-basin to determine temperature trends for the Lower Umpqua River and its tributaries, including streams in the Upper Umpqua River Watershed (Smith 1999).[26] Continuously sampling sensors were placed at 119 locations within the sub-basin. During 2000, 48 temperature loggers were deployed. On average, the daily fluctuation in temperature at a given site was 8.3°F. Tributary streams tended to be about 10°F cooler than the Umpqua River, with smaller streams generally cooler than larger streams. Maximum temperature of the coldest streams suggested that stream temperature increased about 10°F every 10 miles, but some streams were warmer than would be suggested by this relationship.

Measured temperature during 2000 is illustrated in Figure 3.3 for the Umpqua River above McGee Creek. Also shown are 7-day average maximum and mean temperature values during the monitoring period. Available stream temperature data are summarized in Table 3-12 and Map 3-12 for nine monitoring sites within the watershed. Results are highly variable depending on location. Mehl Creek and McGee Creek exhibited relatively few temperature exceedences above the 64°F standard, whereas the mainstem Umpqua River exceeded the standard continuously during the summer to early fall monitoring period.

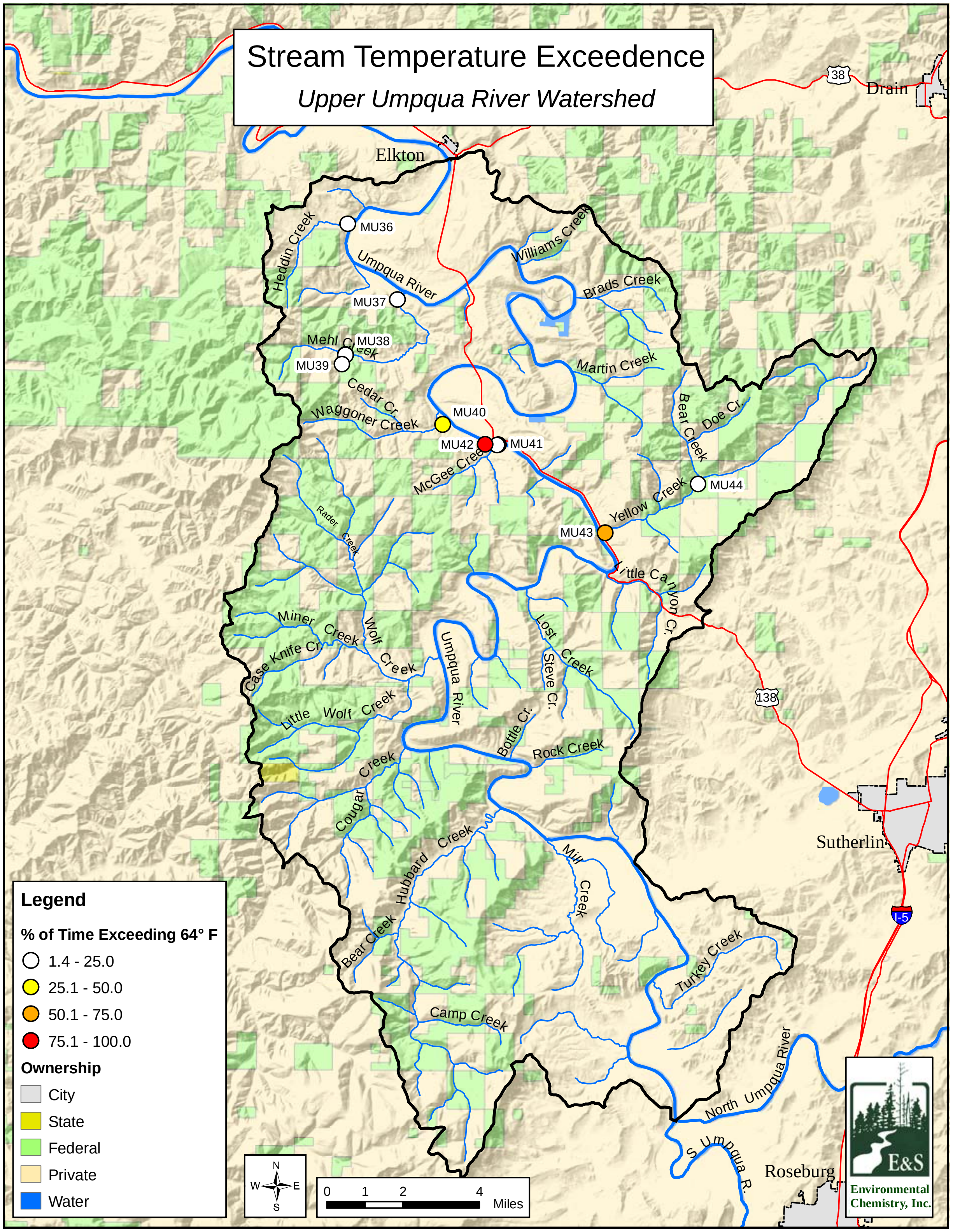
Table 3.12. Percent of time during the summer to early fall monitoring period that streamwater temperature exceeded the 64°F standard, based on UBWC monitoring data.

Site Name	**Site No.**	**Percent Exceeded**
Heddin Creek at bridge	MU36	11.2
Mehl Creek at bridge	MU37	9.6
Upper Mehl Creek	MU38	22.5
South tributary Upper Mehl Creek	MU39	1.4
Waggoner Creek at bridge	MU40	37.9
McGee Creek at mouth	MU41	5.1
Umpqua River above McGee Creek	MU42	100.0
Yellow Creek at mouth	MU43	51.3
Upper Yellow Creek below Bear Creek	MU44	12.2

3.3.4.3. Influences on Stream Temperature

The ultimate source of stream heat is the sun, either by direct solar radiation or by ambient air and ground temperatures around the stream, which are also a result of solar energy.[27] Groundwater is not exposed to solar energy, and therefore is at the coolest temperature (near 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 as it flows downstream 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. Stream temperature at a given location is influenced mainly 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.

[26] Copies of this study, "Lower Umpqua Watershed Temperature Study, 1999" by Kent Smith, are available at the UBWC office.
[27] Friction adds a very small amount of heat to streams. Geothermal heat is a minor factor in the Umpqua Basin.



Map 3.12. Water temperature exceedences at UBWC monitoring site locations in the Upper Umpqua River Watershed.

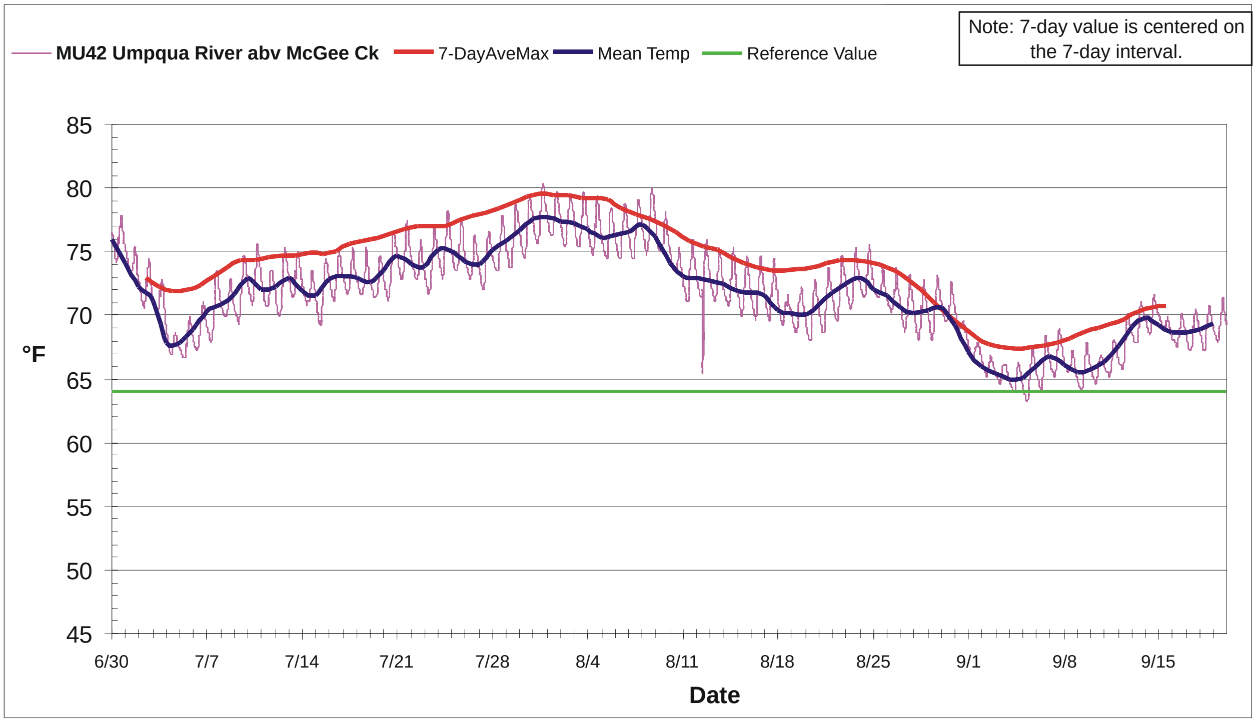


Figure 3.3. Measured stream temperature during the summer to early fall period for the Umpqua River above McGee Creek.

Data reported by Biosystems (2003) indicate that streams in the Elliot State Forest within the nearby Lower Umpqua River and Mill Creek watersheds generally maintain-stream temperatures below 70°F, even at distances of 20 miles from the drainage divide (Biosystems 2003), where riparian shade is greater than 80%. Even with full shading, however, it is highly likely that stream temperatures will warm to above the 64°F temperature standard during the summer months within a certain distance from the drainage divide. For example, Biosystems (2003) presented stream temperature data for 13 sites along the West Fork Millcoma River in the Coos Bay River Basin. They found that stream temperature increased, on average, to above 64°F about 3.4 miles below the drainage divide under existing shade conditions. When they added a variable to reflect stream shading (average percent shade within two miles upstream from the site), the stream temperature would be predicted to exceed 64°F at a distance of 10 miles below the drainage divide even under 100% shade conditions. If average shade was only 80%, then stream temperature was predicted to exceed 64°F at distances greater than 2.2 miles below the drainage divide. Thus, the amount of stream shading can have a large impact on temperature standard exceedences, but temperatures can exceed the standard even with the full shading. This relationship also suggests that for streams with 70% shade that are within 20 miles of the drainage divide, a 10% loss of shade would result in an increase in stream temperature of about 2.4°F.

Although shade and distance from the drainage divide are clearly important in regulating stream temperature, other factors can also be important. Localized groundwater influx and tributary flow can reduce stream temperature. When groundwater enters a stream, it mixes with the warmer 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 the flow in a small stream. Cooler flow from small tributaries entering larger streams can, like groundwater influx, reduce stream temperature. 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 mainstem, 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. This suggests that re-introduction of large woody debris, which will increase the amount of gravel retained in the stream channel, may help to cool streamwater. Local restoration projects that improve shade and gravel conditions may be effective in improving stream temperature conditions in many small streams in the Umpqua Basin. However, it is not likely that any work within the Upper Umpqua River Watershed would have any appreciable impacts on the temperature of the mainstem Umpqua River. This is because the mainstem river is already too warm when it reaches the Upper Umpqua River Watershed and because riparian shading is less effective in preventing the heating of a large river. The river is too wide for streamside trees to shade much of the river surface. In addition, the large volume of water in the mainstem resists temperature change, especially cooling effects.

3.3.5. Surface Water pH

The hydrogen ion concentration of a liquid, which determines acidity or alkalinity, is expressed as pH. A logarithmic scale that ranges from 1.0 to 14 measures pH. On this scale, a pH of 7.0 is neutral, more than 7.0 is alkaline, and less than 7.0 is acidic. Unpolluted rainwater is normally slightly acidic due to the presence of carbonic acid, which is derived from carbon dioxide present in the atmosphere.

The beneficial uses affected by high or low pH levels are resident fish and aquatic life, and water contact recreation. When pH levels exceed the stream's normal range, 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.

In an attempt to differentiate between the natural variability of surface water pH and the changes caused by other factors, ODEQ 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.

Available data for three tributary streams within the watershed suggest that pH values are consistently within the acceptable range (Table 3.13). There is no reason to believe that these values are impacted by human activities.

Table 3.13. Upper Umpqua River Watershed water quality data. (Source: Umpqua SWCD)

Stream	Site	Date	pH	Dissolved Oxygen (mg/L)	Turbidity (NTU)
Compton Creek	High	8/1/2002	7.11	8.14	8.62
		9/17/2002	6.52	7.16	195.00
		7/7/2003	6.86	8.08	5.85
		8/12/2003	7.00	8.26	8.88
		9/17/2003	6.71	8.92	5.58
		7/13/2004	6.52	8.04	17.00
		8/19/2004	6.69	6.88	15.90
		9/14/2004	6.58	7.69	7.77
	Low	8/1/2002	7.48	8.42	3.44
		9/17/2002	7.19	7.43	69.60
		7/7/2003	7.13	8.47	6.79
		8/12/2003	7.10	8.37	7.51
		9/17/2003	7.00	8.49	8.88
Haines Creek	High	8/1/2002	7.44	4.40	N/A
		9/16/2002	7.19	4.27	8.97
		7/7/2003	7.07	8.93	3.69
		8/12/2003	7.10	5.01	7.69
		9/17/2003	6.85	6.39	4.28
		7/13/2004	6.86	8.49	4.20
		8/19/2004	6.70	5.69	4.53
		9/14/2004	6.91	5.75	3.52
	Low	8/1/2002	7.17	7.65	3.16
		9/16/2002	7.02	5.84	4.36
		7/7/2003	6.81	8.95	2.16
		8/12/2003	7.13	7.75	6.01
		9/17/2003	6.81	7.01	4.84
Mehl Creek	High	7/22/2002	7.53	8.46	1.21
		9/13/2002	7.35	6.66	1.59
		7/22/2002	6.88	8.12	1.27
		7/8/2003	7.32	8.25	1.28
		8/18/2003	7.12	7.26	0.71
		9/18/2003	6.65	8.91	0.92
	Low	7/22/2002	6.88	8.12	1.27
		7/8/2003	7.34	8.40	1.35
		8/18/2003	7.04	7.65	1.05
		9/18/2003	6.69	8.69	1.27
		7/13/2004	7.00	8.40	1.21
		8/19/2004	6.60	7.41	1.30
		9/14/2004	6.66	7.62	1.06

3.3.6. Dissolved Oxygen

In the Umpqua Basin, cold-water aquatic organisms are adapted to waters with high amounts of dissolved oxygen (DO). Salmonid eggs and smolts are especially sensitive to DO levels. If levels drop too low for even a short period of time, eggs, smolts, and other aquatic organisms can die. Therefore, the beneficial uses most affected by DO 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 dissolve in water. Flowing water has more DO than still water. Aquatic organisms produce oxygen through photosynthesis and use oxygen during respiration. As a result, DO 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 during the night.

Since oxygen content varies depending on many factors, ODEQ has many DO criteria. ODEQ's standards specify oxygen content of streamwaters during different stages of salmonid life cycles and for gravel beds. Standards change based on differences in elevation and stream temperature. During months when salmon are spawning, ODEQ uses 11.0 mg/L as the DO standard for freshwaters in the Upper Umpqua River Watershed. For the rest of the year, the standard is 8.0 mg/L.

Table 3.13 shows DO sampling results within the watershed for 2002 through 2004. At the sites sampled, DO levels were frequently below the 8 mg/L water quality standard, especially in Haines Creek. No streams are 303(d) listed for DO in the Upper Umpqua River Watershed. However, available data suggest DO might be an important water quality concern in Haines Creek. DO data available from EPA include about 250 samples, mostly from the Umpqua River. Median values of DO were generally well above the 8 mg/L standard, and fewer than 2% of the Umpqua River samples violated the criterion.

3.3.7. Nutrients

The beneficial uses affected by nutrients are aesthetics or "uses identified under related parameters" (ODEQ 1998). This means that a stream may be considered water quality limited for nutrients if nutrient levels adversely affect related parameters, such as DO, that negatively impact one or more beneficial uses, such as resident fish and aquatic life. Possible nutrient sources include feces and urine from domestic and wild animals, wastewater treatment plant effluent, failing septic system waste, fertilizers, and nitrogen fixation associated with certain plant species, especially red alder. High nutrient levels during the summer encourage the growth of algae and aquatic plants. Excessive algal and vegetative growth can result in little or no DO, and interfere with aesthetics and water contact recreation. Also, some species of algae produce by-products that are toxic to humans, wildlife, and livestock, as occurred in Diamond Lake in the summer of 2002.[28]

[28] Diamond Lake is within the Umpqua National Forest in the extreme eastern portion of the Umpqua Basin.

Currently, there are no Umpqua Basin-based ODEQ values for acceptable stream nutrient levels and no streams that are 303(d) listed for nutrients in the Upper Umpqua River Watershed. Therefore, this assessment used the OWEB recommended standards for evaluating nutrient levels in the watershed (Table 3.9).

Table 3.14 shows total nitrate and phosphorus sampling locations and results available from EPA for monitoring sites within the Upper Umpqua River Watershed since about 1960. In general, the nitrate data suggest no impairment (Tables 3.14). However, phosphorus measurements in the Umpqua River, and less commonly in several tributary streams, were consistently well above the guideline value of 8.75 µg/L. The source of these high phosphorus concentrations is not known, but might be from small outcroppings of high-phosphorus bedrock in the watershed.

3.3.8. Bacteria

The indicator bacterium used by ODEQ for assessing bacterial contamination for recreational waters changed in 1996 from the general class of fecal coliform bacteria to *Escherichia coli*, a species associated with gut organisms of warm-blooded vertebrates. In general, *E. coli* are a subset of fecal coliform bacteria. This change was made in part because *E. coli* is a more direct reflection of contamination from sources that also carry pathogens harmful to humans and is more closely correlated with human disease. Fecal coliform bacteria are still used as the indicator for protection of human health in assessing water quality in commercial and recreational shellfish harvesting areas.

Rivers and streams in the Umpqua Basin are water quality limited due to fecal coliform bacteria affecting water contact recreation and shellfish harvest. Bacteria impair the recreational use of rivers if concentrations exceed those determined through epidemiological studies to cause illness through body contact at a rate of eight or more cases per 1,000 swimmers. Bacterial levels in estuarine shellfish harvesting waters must be lower than those used for body contact, because shellfish filter large volumes of water and accumulate bacteria and pathogens at concentrations higher than found in ambient water. In the standards for both water contact recreation and shellfish harvest, there is an average concentration target and an extreme concentration target. The standards for water contact recreation are 126 colony forming units (cfu)/100 ml on average, with an extreme target of no more than 10% of the samples exceeding 406 cfu/100 ml. In the estuary, the standards to protect shellfish harvesting are 14 cfu/100 ml on average, with no more than 10% of the samples exceeding 43 cfu/100 ml (Table 3.9). The estuary refers to the tidally influenced portion of the Umpqua River, from its mouth to approximately river mile 27.0 (Scottsburg). Although fresh waters within the Upper Umpqua River Watershed are only required to meet the freshwater standard for contact recreation, it is important to note that the stricter shellfish standard applies immediately downstream in the estuary. So, although the estuary is many miles downstream of the Upper Umpqua River Watershed, in order to meet TMDL objectives it may be helpful to reduce bacteria contribution throughout the Umpqua River sub-basin.

Table 3.14. Upper Umpqua River Watershed water quality data available from EPA. Also provided is the percent of samples below the dissolved oxygen criterion of 6.5 mg/L and above the turbidity criterion of 50 NTU.

Parameter Name	Station Description	Year	Number of Samples	Median	Percent Below Criterion[1]
Dissolved Oxygen (mg/L)	Heddin Creek	2001	1	4.300	NA
	Umpqua River at Bullock Bridge	1959-1968	22	10.100	0
	Umpqua River at Elkton Bridge	1959-2005	187	10.400	2
	Umpqua River at Kellogg Bridge	1959-1977	40	10.300	0
	Wolf Creek at River Mile 3.68 (Umpqua)	2000-2004	4	9.300	25
	Yellow Creek at River Mile 3.12	1993	1	9.200	NA
	Yellow Creek at River Mile 3.9	1993	1	9.200	NA
					Percent Exceeding Criterion[1]
E. coli (cfu/100 ml)	Umpqua River at Elkton Bridge	1995-2005	72	15.500	4
	Umpqua River at Tyee Access Road	2001-2002	6	4.500	0
	Umpqua River at Yellow Creek Boat Ramp	2001-2002	5	1.000	0
	Umpqua River below Yellow Creek at Hwy 138 MP # 12	2001	1	2.000	NA
Fecal coliform (cfu/100 ml)	Umpqua River at Bullock Bridge	1968-1967	2	3,511.500	NA
	Umpqua River at Elkton Bridge	1967-2002	139	32.000	31
	Umpqua River at Kellogg Bridge	1967-1977	14	45.000	29
	Umpqua River at Tyee Access Road	2001	1	8.000	NA
	Umpqua River below Yellow Creek at Hwy 138 MP # 13	2001	1	17.000	NA
Nitrate as N (mg/L)	Heddin Creek	2001	1	0.005	NA
	Lost Creek	2002	2	0.044	NA
	Umpqua River at Bullock Bridge	1965-1968	7	0.001	0
	Umpqua River at Elkton Bridge	1960-2005	197	0.003	13
	Umpqua River at Kellogg Bridge	1965-1977	25	0.020	8
	Wolf Creek at River Mile 3.68 (Umpqua)	2000-2004	6	0.054	17
	Yellow Creek at River Mile 3.10	1993	1	0.020	NA
	Yellow Creek at River Mile 3.13	1993	1	0.002	NA

Table 3.14. Continued

Parameter Name	Station Description	Years	Number of Samples	Median	Percent Exceeding Criterion[1]
Phosphorus (: g/L)	Heddin Creek	2001	1	110.000	NA
	Lost Creek	2002	2	35.000	NA
	Umpqua River at Elkton Bridge	1982-2005	108	40.000	100
	Wolf Creek at River Mile 3.68 (Umpqua)	2000-2004	12	25.000	100
	Yellow Creek at River Mile 3.9	1993	2	50.000	NA
Turbidity (NTU)	Haines Creek between Hwy 138 and Azalea Drive (Umpqua)	2001	3	5.000	NA
	Haines Creek near Elkton	2001	3	11.000	NA
	Heddin Creek	2001	1	7.000	NA
	Lost Creek	2002	2	1.000	NA
	Mehl Creek at River Mile 0.6 (Umpqua)	2001	3	3.000	NA
	Umpqua River at Elkton Bridge	1977-2005	155	3.000	6
	Umpqua River at Kellogg Bridge	1977	6	4.000	0
	Umpqua River at Tyee Access Road	2002	8	5.500	13
	Umpqua River at Yellow Creek Boat Ramp	2002	3	9.000	NA
	Wolf Creek at River Mile 3.68 (Umpqua)	2000-2004	6	1.000	0
	Yellow Creek at River Mile 3.11	1993	1	2.000	NA
	Yellow Creek at River Mile 3.14	1993	1	3.000	NA

[1] NA - Not enough samples were gathered to accurately determine whether water quality conformed to the criterion.

The Umpqua River is included on the 303(d) list for bacteria for the winter, spring, and fall seasons from river miles 25.9 to 109.3, which includes the entire length of the Umpqua River in this watershed (Map 3.11). The determination that the Umpqua River is water quality limited was based on fecal coliform bacteria concentrations measured in the river at the community of Umpqua (river mile 102.7) between October, 1986 and October, 1992. At Umpqua, 17% (7 of 42) of the samples exceeded the freshwater standard. Since 1992, ODEQ has not routinely collected bacteria samples at this site. Based on the more recent *E. coli* data collected from the Umpqua River at Elkton (river mile 48.7) and at Umpqua, the river does not appear to exceed the current bacteria standards. Nonetheless, the Umpqua River cannot be removed from the 303(d) list until more samples are collected showing that water quality standards are being met.

In response to 303(d) listings for bacteria, ODEQ prepared a draft TMDL analysis for the entire Umpqua Basin in April, 2004. The TMDL target utilized by ODEQ, in both cases, is the average concentration target. This target was chosen because it represents chronic risk and is a more stable indicator of fecal contamination. The loading capacity for the Umpqua River was determined one mile upstream of Reedsport, which is the approximate upstream boundary of shellfish beds. The shellfish standard (14 cfu/100 ml) was used to determine the loading capacity. Upstream of these locations, the less restrictive water contact recreation standard applies. The loading capacity was estimated by multiplying the standard by the volume of water. The TMDL identifies the loading capacity for different times of the year based on the expected volume of water. ODEQ concluded that the amount of bacteria in the river (the “load”) would need to be reduced by 64% in order to meet the TMDL during the wet season. Some of this load reduction might be achieved by reducing bacterial concentrations in the mainstem river within the Upper Umpqua River Watershed. No reduction in loading was judged to be necessary during the dry and low-flow periods.

In general, fecal coliform bacteria loading in the Umpqua Basin appears to be dominated by nonpoint sources, although point sources also impact the estuary on occasion. Nonpoint source pollution comes from diffuse sources such as agricultural and urban runoff, as opposed to point source pollution, which is discharged by individual facilities through a pipe into a waterbody. There are facilities that treat domestic sewage and discharge effluent to water bodies in the Umpqua Basin, but ODEQ concluded in 2004 that wastewater treatment facilities should not cause or contribute to bacteria water quality standard violations in the Umpqua Basin when operating properly. The most common sources of nonpoint source pollution include wildlife and livestock waste, failing residential septic systems, rural residential runoff, and urban runoff.

3.3.9. Sedimentation and Turbidity

3.3.9.1. Overview of Sedimentation and Turbidity

Natural resource scientists refer to sediment as any organic or inorganic material that enters the stream and settles to the bottom. This means that, in addition to small particles of clay or silt, sediment also includes larger particles such as sand, gravel and boulders as well as branches and logs. When considering water quality and aquatic habitat, this assessment specifically refers to two different aspects of sediment delivery to the stream and transport within the stream channel. Very fine particles of organic or inorganic material have the potential to form streambed “sludge.” This excessive accumulation of fine sediment (small particles, such as clay and silt) within the stream channel causes deterioration of aquatic habitat quality. The other important aspect of sediment delivery and transport is the delivery of gravel to the stream (generally from landslides) and subsequent movement of that gravel within the stream channel. Availability of gravel in the streambed is important for salmonid spawning. Thus, sediment contribution to the stream channel can have both negative (fine sediment) and positive (coarse sediment) effects on in-stream habitat quality.

The beneficial uses affected by sediment delivery and transport 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 excess fine sediment accumulation restricts water circulation through the redd and can suffocate salmonid eggs. Although there are many aquatic organisms that require gravel beds, others, such as the larvae of the Pacific lamprey (*Lampetra tridentata*), thrive in streams having large amounts of fine sediment.

Turbidity is closely related to sediment dynamics because it is a measurement of water clarity. In many cases, high turbidity indicates a large amount of suspended fine sediment in a stream. Small particles of silt and clay will stay suspended in solution for the longest amount of time. Therefore, streams flowing through 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 rise during storm events. This is because rapidly moving water has greater erosional energy than slower water. During storms, streambanks erode and some upland material can be washed into the stream from surface flow, which adds additional fine sediment to the stream 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. 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.

Suspended sediment is considered to be water quality limiting if beneficial uses are impaired. ODEQ determines impairment by monitoring changes in aquatic communities (especially macroinvertebrates, such as aquatic insects), and fish populations, or by using standardized protocols for evaluating aquatic habitat and fish population data. Currently, ODEQ monitors streams for total suspended solids. However, neither ODEQ nor OWEB has established criteria for this parameter. There are currently no streams in the Upper Umpqua River Watershed that are 303(d) listed for sedimentation.

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 ODEQ, 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 release or irrigation. There are no streams in the Upper Umpqua River Watershed that are 303(d) listed for turbidity.

3.3.9.2. *Erosion and Sediment Delivery Processes*[29]

Erosion is a naturally-occurring process, which is primarily determined by climate, geology, soils and topography. In the Upper Umpqua River Watershed, there are two distinct zones of erosional activity: the steep, forested upland, and the broad, lowland floodplain. On the steep slopes and shallow soils of the forested uplands, landslides, including debris slides and debris flows, account for the majority of erosion. In lowland areas, the dominant erosional processes include streambank erosion and erosion associated with livestock and agricultural practices.

The majority of erosion and sediment movement occurs during infrequent, large flood events, which often result from an intense rainstorm that melts a pre-existing snowpack, causing extremely high flows in the streams and rivers. Over the past half-century there have been two unusually large flood events in western Oregon (December, 1964 and February, 1996). Exceptionally high rates of erosion occur when a severe wildfire is followed by a large flood in the subsequent winter, triggering numerous landslides.

Landslides are the primary erosional process and are responsible for depositing sediment and woody debris into streams. A landslide from a forested hillside will generally contain soil, gravel, organic material, and a substantial amount of woody debris. This mixture causes significant changes in the affected stream reach. In the short term, a landslide or debris flow can scour a channel and remove beneficial prey (i.e. stream insects) and channel structures, depositing large amounts of silt, gravel, boulders, and wood downstream. Over the long term, these events maintain the balance of woody debris, organic matter, and gravel that are requirements of productive aquatic habitat.

Native fish and aquatic organisms are adapted to natural levels of erosion and sediment deposition. However, the additional erosion attributed to human activities can result in an excess of fine sediment in the stream system. Increased erosion can be harmful to many aquatic organisms, including threatened salmon species because excessive amounts of fine sediment can decrease sunlight penetration, leading to reduced photosynthesis, decreased DO levels, and increased siltation of spawning gravels.

The highest risk areas for slope failure are in headwalls and on steep slopes with soils that are thin and extremely fragile. All headwalls and most other sites of the extremely fragile soils on BLM land within the watershed are incorporated into the Riparian Reserve network and the Late-Successional Reserves, which are excluded from most timber management activities. The remaining sites with extremely fragile soils on Matrix land (areas designated for active timber management) are administratively withdrawn from the timber base. As a result, a continuous vegetative cover is maintained, to the extent practical, on those sites. Thus, tree cover and down wood are retained on these sites until a slope failure transports those components to the riparian zones and streams where they take on new structural and habitat roles. Roads intercept many landslides, acting as benches that slow or completely stop slope failure processes that are critical for the recruitment of coarse material. Currently, Oregon forest management laws do not allow the transfer of the landslide debris over the road prism and into the channel. Consequently the slide material, which would have entered the stream had there been no road, is removed from the site during post-storm cleanup, thus eliminating a critical natural gravel recruitment process.

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[29] Kristin Anderson, Tim Grubert, and John Runyon of BioSystems, Inc., contributed portions of the introductory text for this section.

The constituent materials delivered to streams by erosional processes range in size from clay particles to boulders. On entering a stream these materials are sorted by the flow. The silt and clay particles are almost entirely swept out of the stream system as suspended sediment during high winter flows. This suspended material increases turbidity and affects related habitat conditions, but is not well represented in the sediment of the channel bed and bars. The coarser materials either are deposited on the floodplain or settle out on the channel bottom to be intermittently moved downstream as bedload. Channel geometry, and obstructions like large wood and boulders, cause differences in flow rates that in turn result in storage of part of the bed load within the channel.

Large wood provides the in-stream structure that retains gravel. The most important processes for large wood recruitment are stream bank erosion, other forms of individual tree mortality, intense storm events, and stand replacement fire and associated landslides. The relative importance of each of these processes depends on fire return rate, topography, and lithology (Benda et al. 1999). In the absence of debris torrents, large wood in first and second order draws is randomly located where it initially falls because these streams have insufficient flow to redistribute or transport large wood down stream. Third through fifth order streams are large enough to redistribute large wood and form distinct accumulations. In sixth order and larger streams, large wood is generally thrown on islands and banks where the wood has little influence on the stream except during high flow conditions (Swanson and Lienkaemper 1978). Prior to the early 1970s, removing large wood from throughout the stream system was a common practice. This was often done to salvage merchantable timber or to "clean" the stream to improve fish habitat conditions. The widespread loss of large in-stream wood has reduced the gravel storage capacity of many streams. As a result, gravel is quickly flushed out of the system, and gravel levels are lower now than they were historically.

Bedrock-dominated channels and a shortage of in-stream gravel were identified as limiting habitat for many stream dwelling organisms by the late 1970s. This not only limits spawning habitat, but also limits habitat for aquatic invertebrates and in-channel water storage, which in turn affects summer low flows and water temperature. The processes that deliver gravel and boulders to the streams also deliver fine sediment. Gravel production is not a limiting factor for streams below steep landslide-prone areas with sandstone parent material. Most in-stream structures below such sites back-fill with gravel in the one to two winters following installation. This indicates that retention of gravels is a greater problem than recruitment for reaches downstream from the sandstone-dominated geologic formations. However, low strength and rapid weathering do limit gravel production in those formations characterized by mudstone or siltstone. Durability and retention of the gravels and cobbles, once they enter the stream, are the limiting factors in this watershed regardless of parent material. In wide stream reaches, large boulders delivered by landslides and rock falls can provide structures that retain gravel and wood.

3.3.9.3. Impacts on Erosional Processes and Sediment Production

Although landslides occur under natural conditions, human activities have been shown to influence the timing or rate of erosion throughout western Oregon. Poor road construction and inadequate road maintenance can result in increased erosion and sedimentation, adversely impacting the stream system. Vegetation removal, such as by logging or wildfire, may also increase the likelihood of landslide occurrence. Sedimentation can also be associated with urban development. However, with proper management, impacts associated with land use activities can be minimized.

Changes in road construction methods over the past several decades have improved road conditions. If roads are well constructed and maintained, erosion and sedimentation can be minimal. The extent of the impact of a road on the stream system is dependent on many factors, including road location, proximity to stream, slope, and construction techniques. Ridge top roads on slopes less than 50% generally have little impact on streams. Valley bottom and mid-slope roads, especially those on steep slopes or near streams, can affect sediment delivery to streams. Road design issues include the road surface type, ditch infeed lengths, proximity to nearest stream channel, road condition, 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 road-to-stream proximity and slope of roaded areas to determine the likely relative impacts of roads on sediment delivery to streams.

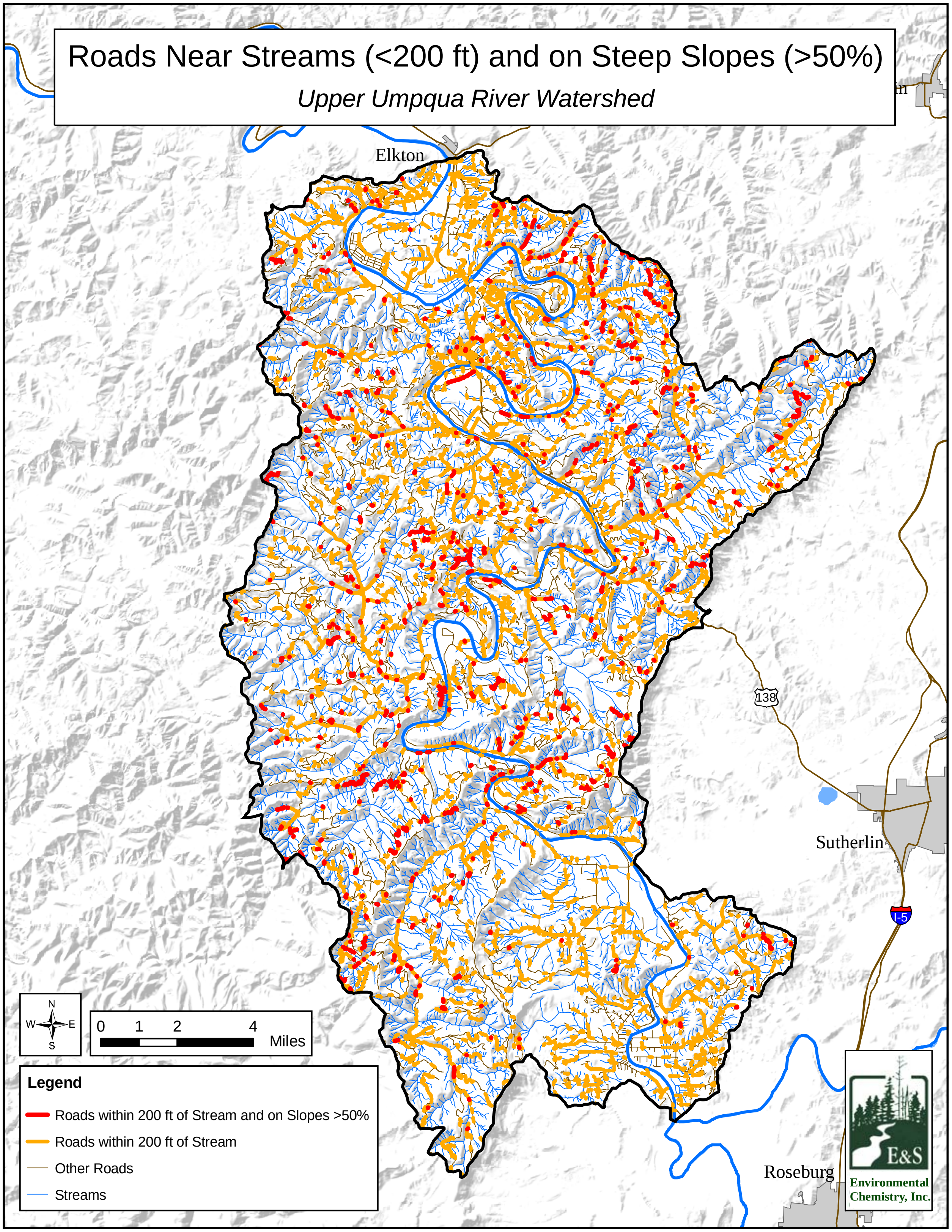
The closer a road is to a stream, the greater the likelihood that road-related runoff contributes to sedimentation. In the Upper Umpqua River Watershed, there are 454 miles of roads (38% of 1,201 total miles) within 200 feet of streams (see Map 3.13).

Roads on steep slopes have a greater potential for erosion and/or failure than roads on level ground. There are approximately 33 miles of roads (3% of 1,201 total miles) located on a 50% or greater slope and within 200 feet of a stream (see Map 3.13). An analysis of road conditions near streams is necessary to estimate how much stream sedimentation is potentially attributable to road conditions. Information on road surface types and conditions are available for BLM lands in the Upper Umpqua River Watershed (Table 3.15). Seventy-three percent of the BLM roads are rocked, and only 8% are paved. The roads that have a natural surface (19% of total) in general are those most likely to contribute to stream sedimentation. The area with the highest concentration of potential road erosion and sedimentation problems is the south portion of the Hubbard Creek subwatershed on the gentle to moderately-sloped Tyee formation. It long has been a popular area for recreational off-road vehicle use. Many old skid trails and natural-surfaced logging roads receive frequent use during the wet season. There are now many segments with severely eroded and rutted surfaces and with deeply entrenched roadbeds (roadbeds situated below the natural surface on both sides).

Table 3.15. Total miles of BLM road surfacing categories.

	Total BLM Roads, Surface Types		
Subwatershed	**Natural**	**Rocked**	**Paved**
Cougar	5	28	1
Hubbard Creek	13	31	0
Lost Canyon	7	35	0
McGee Creek	8	33	5
Mehl Creek	10	30	9
Rader Wolf	15	64	11
Umpqua Frontal	2	8	2
Yellow Creek	10	32	1
TOTAL	70	261	29

Like roads, culverts can contribute to stream sedimentation when they are failing. Culverts often fail when the pipe is too narrow to accommodate high streamflows, or when the pipe is placed too high or too low in relation to the stream surface. 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. The Umpqua Basin Fish Access Team (UBFAT)



Map 3.13. Upper Umpqua River Watershed roads within 200 feet of a stream and on slopes greater than 50%.

is currently evaluating culverts throughout the Umpqua Basin, but results were unavailable at the time of writing. See Section 3.1.3 for a discussion of the effects of culverts on fish populations.

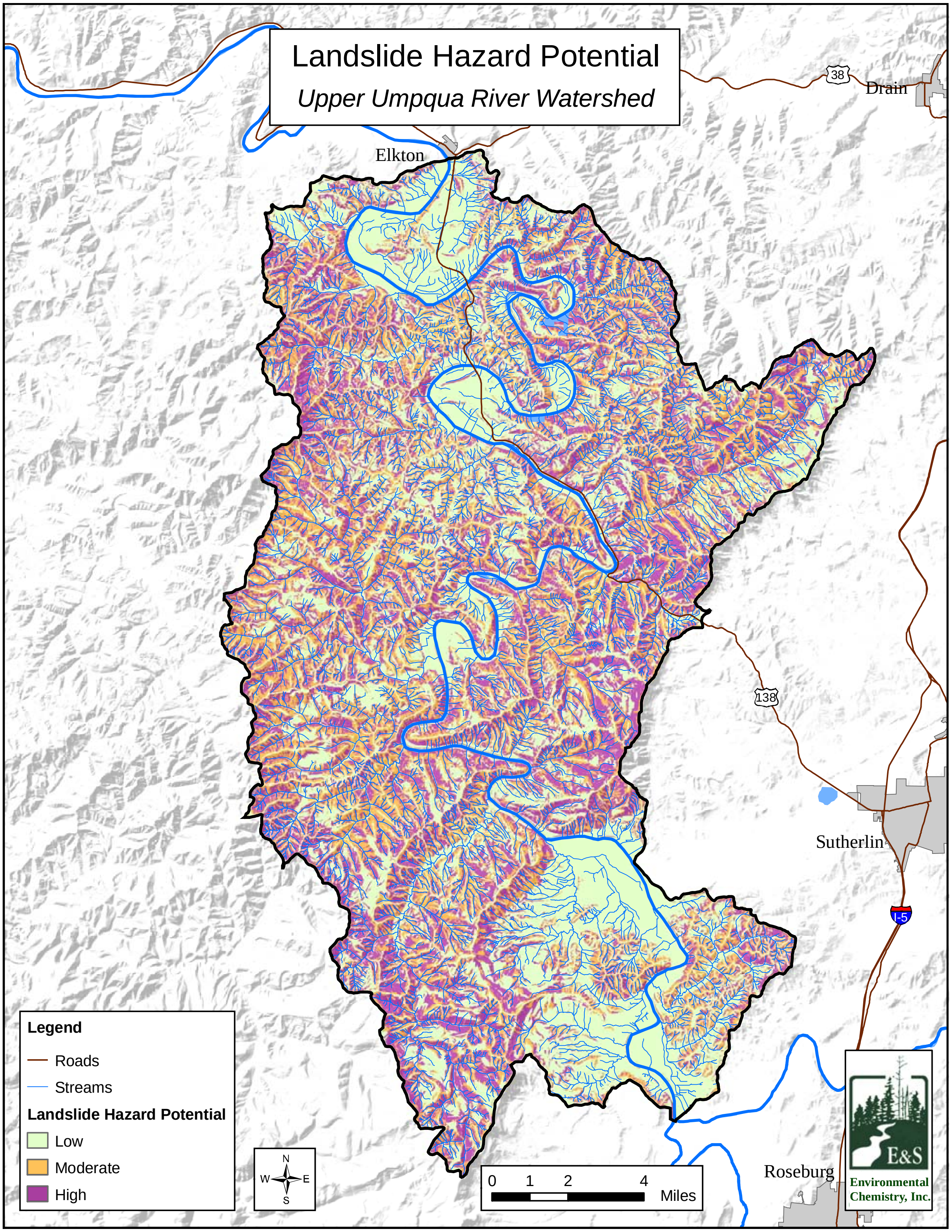
Steep slopes provide greater energy to runoff and therefore have more power to deliver sediment to streams. Slope is an important factor in determining sediment delivery to streams, both in long-term erosion processes and in catastrophic events. Map 1.3 on page 1-7 shows the slope throughout the watershed. There are scattered areas having steep slope throughout the watershed.

The slope will influence the hazards for landslide and mass sediment delivery downslope. Physical characteristics of geologic units have also been shown to influence the occurrence of debris flows. The Oregon Department of Forestry (ODF 2000) identified areas that may be naturally prone to debris flows. Using slope steepness, geologic units, stream channel confinement, geomorphology, and historical information on debris flows, they created coarse-scale maps of moderate, high, and extreme natural debris flow hazards. While this information is not intended for localized management decisions, it is a tool to locate areas where further field investigations may be pertinent when determining management plans.

Natural debris flow hazards in the Upper Umpqua River Watershed are shown in Map 3.14. Hazard potential was derived from an empirically-based landslide initiation model developed by the Coastal Landscape Analysis and Modeling Study (CLAMS), a collaborative project of the USDA Forest Service, ODF, and Oregon State University. Landslide density was modeled from a 10-meter digital elevation model and ranges from 0 to 25 landslides per square kilometer (0 to 64.7 landslides per square mile). High landslide potential was defined for this assessment as greater than 1.5 landslides per square kilometer (3.9 landslides per square mile). Moderate landslide potential was defined as 0.1 to 1.5 landslides per square kilometer (0.26 to 3.9 landslides per square mile), and low landslide potential less than 0.1 landslides per square kilometer (0.26 landslides per square mile).

Mass movement following a fire can transport tremendous amounts of sediment and wood debris to stream channels. Reeves (1996) concluded that mass movement following fire can deposit so much material that 6 or 12 feet of sediment and coarse debris can still remain in the channel 100 years after the event. Many terrace-like features next to mountain streams are depositions of debris avalanche transported material that the stream subsequently cut through. The accelerated erosion associated with intense fire, compared with normal background levels, may cause a five-fold increase in sediment yields. The recovery to pre-fire sediment yields may take 20 to 30 years (Swanson 1981). In the Coast Range, very large stand-replacement fires have a return rate of about 240 years (Ripple 1994). Based on that return rate, elevated sediment levels are observed 8% to 12% of the time when periods long enough to include stand replacement fires are considered. Smaller fires and less severe fires would have caused additional smaller spikes of fire-associated sediment.

The fire regime is a function of both fire frequency and fire intensity. As part of the Late Successional Reserve (LSR) analysis, fire histories were investigated by BLM (2002) for three sub-watersheds on BLM land in southwestern Oregon. The Tioga Creek LSR #261 had average fire frequencies at the drainage scale calculated between 50 and 75 years (prior to the advent of fire suppression). Upper Umpqua LSR #263 is located in close proximity to the Tioga Creek



Map 3.14. Natural debris flow hazard areas in the Upper Umpqua River Watershed.

area, only 12 air miles away. These adjacent areas can be expected to have very similar fire frequencies. Perhaps more telling is the frequency of the more destructive stand-replacement fire events. Throughout the southwest Oregon BLM assessment area, the time since the last major stand-replacement fire ranges from 31 years for the Oxbow Burn area to more than 439 years for one site in the South Tioga Creek headwaters. Based on a broad analysis of changes in forest age classes between 1850 and 1940 in the Oregon Coast Range, Teensma (1991) concluded that stand-replacing fires occurred irregularly, at intervals ranging from 150 to 350 years. Teensma speculated that many of the fires were of human origin, both prior to and during European settlement. The Upper Umpqua River Watershed has had irregularly-occurring stand-replacement events at intervals of up to 350 years.

In 1914, an Oregon state map was developed to show areas of commercial timber, non-timbered areas, and lands that had been burned in large fires occurring near the turn of the 20th century. Approximately half of all lands in the Upper Umpqua River Watershed were considered suitable for commercial timber, and over 40% of the remaining acres were classified as brush or non-timbered. Over 16,000 acres, or 14% of all timbered acres in the watershed, were classified as "burned areas" at that time. Many of these areas were impacted by high severity fires prior to that time as evidenced by the lack of tree regeneration. Many of these fires occurred in the mid to late 1800s and around the turn of the 20th century. These large fires impacted a large percentage of the Pacific Northwest during the same time frame, when little or no fire suppression occurred.

Fire frequency is based on the number of fire starts in the analysis area. BLM records from 1967 through 2001 show 58 wildfires occurring on BLM-managed lands during that period (Table 3.16). Many more wildfires occurred on private and industrial forest lands. Over this 35-year period, lightning was the predominant fire cause (64%), with human causes responsible for the other fires. Lightning occurrence levels for the BLM lands are considered low, on average only one fire per year resulted from this ignition source. The majority of all fires were confined to less than one acre in size. The largest fire on BLM ground was 29 acres, the result of an escaped slash burn. BLM records for a 25-year period beginning in 1967 show 164 additional fires occurring on private lands in the watershed. "Human caused and miscellaneous fires" accounted for 77% of these private fire starts; lightning-caused fires were only 13% of the total. On average, approximately eight fires per year occurred on all lands in the watershed (BLM 2002).

Table 3.16. Summary of BLM fires within the Upper Umpqua River Watershed from 1967 to 2001.

Cause of Fire	Number of Fires	Percent of Total Fires
Lightning	37	64
Timber management activities	7	12
Other human activities	9	16
Other	5	8

3.3.9.4. Recent Sedimentation Records

The Oregon water quality standard for turbidity does not specify a numerical value. OWEB recommends using 50 NTU as the turbidity evaluation criteria for watershed assessments. At this level, turbidity may interfere with sight-feeding aquatic organisms. Two of the 38 available Upper Umpqua River tributary turbidity samples exceeded 50 NTU, both from Compton Creek (Table 3.13). Most measured values were less than 10 NTU. Turbidity data are also available for the 172 samples collected from the Umpqua River; 6 of those samples had turbidity higher than 50 NTU, and the median value was about 3 NTU (Table 3.14). Thus, there are no data suggesting that turbidity is currently a problem in this watershed.

Both natural and management-related landslides produced large amounts of sediment in the watershed prior to 1970. Many debris avalanches and debris flows occurred during high intensity storms, especially the December, 1964, flood event. Landslides were of greatest magnitude during this flood event in the higher elevations along Bateman Ridge and Rattlesnake Ridge and in the western Cougar Creek drainage.

In four winters during the period 1971 to 1983, rainfall was 10 inches above average and contributed to a high incidence of landslides. Major debris flows/dam-break floods occurred in Cougar, Rader, and Lost creeks. Landslide frequencies were greater during the 1970s and early 1980s compared to the previous decade (BLM 2002).

From 1984 to 1994, the number of landslides declined dramatically. Road-related slides identified in the BLM landslide inventory declined 82% from the previous period. Only three very large landslides were identified in the landslide inventory for this period. Surface erosion and sedimentation also declined during the 1980s. Unlike the previous periods, sediment-choked riparian zones or raw stream banks were not distinguishable on aerial photos (BLM 2002).

A series of exceptionally wet years (1995 to 1999) with high intensity storms saw a three-fold increase in landslide activity (on a per year basis) over the previous period. The exceptionally high intensity November, 1996 storm was followed by intense precipitation in December, 1996, and January, 1997. The November storm produced record 24-hour precipitation totals, but it was not a rain-on-snow event in the watershed. Although erosion and mass wasting from previously-built BLM roads within the Upper Umpqua River Watershed were higher than in the past decade, erosion rates were not near the magnitude of those of the 1950s through 1983 (based on aerial photo interpretation). One of the largest landslides identified by BLM originated in a 1990/1991 BLM clearcut as a debris avalanche in the Lost Creek drainage and became a debris flow/dam-break flood combination. Its run-out distance was about 7,900 feet. It began at the zone of convergence of a large, steep Tyee headwall at the inception of a first order stream. Possible conditions contributing to failure include the upper part of the headwall having shallow soils and rock outcrop, and the soils at the zone of convergence being deep. While still in this first order stream, the debris flow cut through 900 feet of old-growth riparian habitat before blocking the flow of a second order tributary of Lost Creek and generating a dam-break flood (BLM 2002).

Landslides have covered roughly 1% of the Upper Umpqua River Watershed in the past 45 years. Based on estimates by the BLM from the aerial photo inventory, about 50% of the landslides reached streams. A higher percentage of the larger landslides reached third-order and greater streams. Few of their scars are still contributing sediment to streams in appreciable amounts (based on aerial photo interpretation, some field observations, and the analysis done in the Tom Folley Watershed Analysis). Most of the landslides still contributing appreciable sediment to streams likely occurred in the moist 1995 to 1999 period. Included in the landslides contributing sediment is an extremely large and growing slump-earth flow in the Little Wolf drainage.

Debris flows and dam-break floods (both natural and management-related) that first appeared in the 1960s have had substantial widespread effects on the streams in the Upper Umpqua River Watershed. Short-term effects include a large infusion of fine sediment into the system. Long-term effects include channel incision, the removal or addition of large woody debris and rock fragments, and the removal of standing conifers that are replaced with alder. Additional long-term effects include fine sediment deposition that buries pools and channels, which then act as reservoirs of fine material as channel baselines are re-established.

In Upper Cougar Creek and its west fork, a portion of Lost Creek, and Waggoner Creek, among other areas, the larger sized debris flows/dam-break flood activity in the past 45 years contributed to stream structure conducive for fish habitat. In Hubbard Creek, Rader Creek and a major tributary, a portion of Lost Creek, and Case Knife Creek, the larger sized debris flows/ dam-break flood events appear to have contributed to existing poor stream structure. However, this second conclusion is clouded by possible management influences apart from the debris flow/dam-break flood events (BLM 2002). Stream cleaning practices in the past also undoubtedly account for some of the current lack of stream structure. The smaller-sized debris flow activity appears to have had a more neutral effect.

3.3.9.5. Role of Soils in Sedimentation Processes[30]

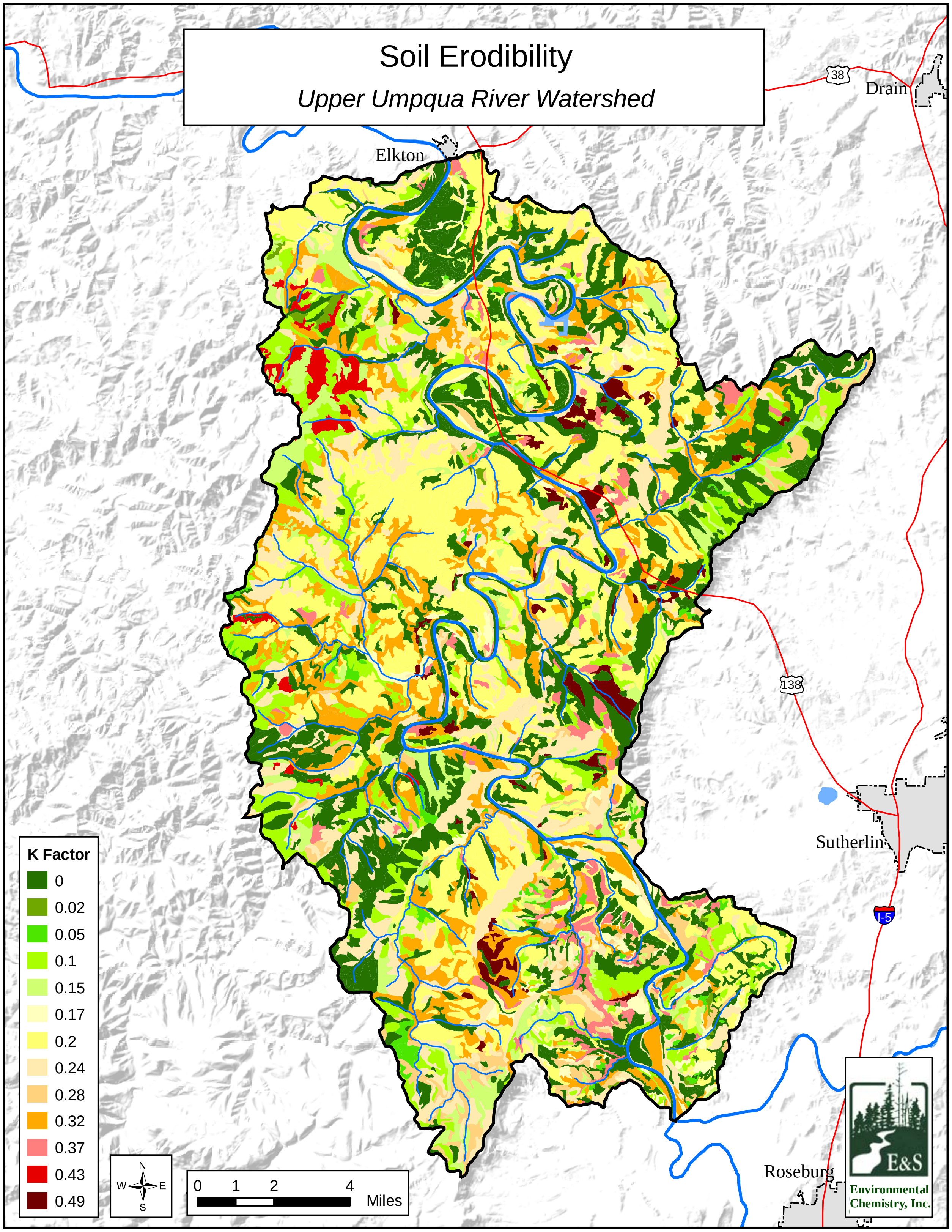
Certain characteristics of soils within the watershed play important roles in erosion and storm runoff, both of which impact the stream. Rapid runoff from rain events can cause pulses of sediment throughout stream systems. Both erosion potential and hydrologic soils grouping reflect qualities of soils that can give some indication of areas prone to erosion that may negatively impact stream characteristics.

The K-factor, or soil erodibility, is a measure of detachability of the soil, infiltration, runoff, and the transportability of sediment that has been eroded from the soil. Texture (the relative percentage of different grain sizes within the soil), organic matter, structure, and permeability of the soil determine the K-factor value assigned to a soil. In general, soils with high infiltration rates (and thus low runoff rates), low detachability, and low transportability are least likely to erode, and are given low K-factor values. K-factor values typically range from zero to 0.6 (Pacific Northwest National Laboratory 2003) and are determined in the Natural Resources Conservation Service's (NRCS) soil survey process.

Map 3.15 depicts the K-factor within the Upper Umpqua River Watershed. A small portion of the watershed has high erosion potential, with the most erosive areas scattered throughout a few of the uppermost tributary systems (Map 3.15). The least erosive areas are generally located in the Cougar Creek and Yellow Creek drainages (Map 3.15). Twenty-seven percent of the watershed has been assigned a K-factor of 0, whereas only about 15% of the watershed has been assigned a K-factor greater than 0.3 (Table 3.17).

Hydrologic soil groups (HSG) provide a categorization of soils by their runoff potential and infiltration capacity. In these groupings, group A represents soils with the lowest runoff potential and the highest infiltration rate, while group D is on the opposite end of the spectrum, having high runoff potential and a low infiltration rate. The runoff potential and infiltration rate

[30] Kristin Anderson and John Runyon of BioSystems, Inc., contributed some of the material for this section.



Map 3.15. Soil erosion potential and K-factor for the Upper Umpqua River Watershed.

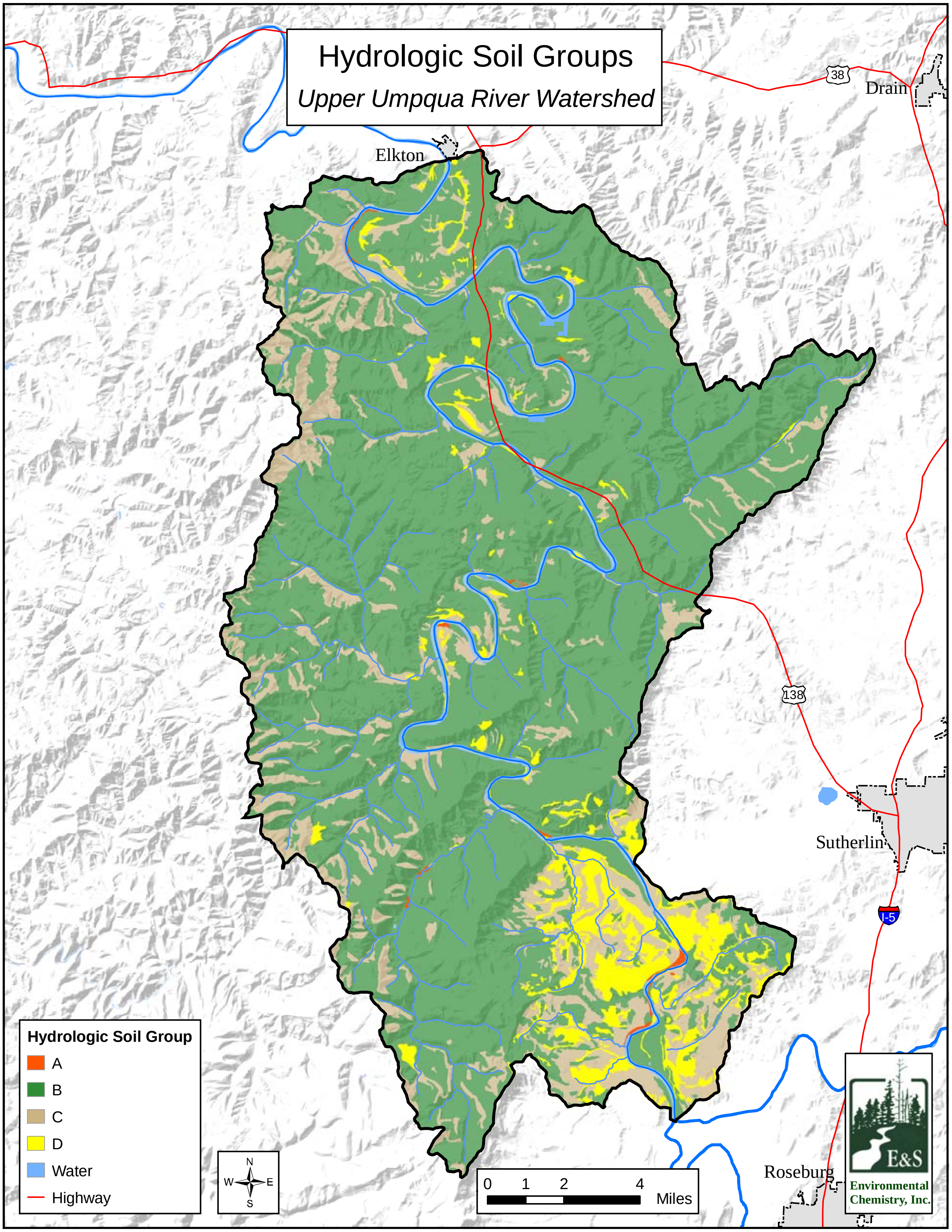
Table 3.17. Soil erodibility in the Upper Umpqua River Watershed.		
K-Factor	**Area (acres)**	**Percent[1]**
0.00	57,396	27.3
0.02	630	0.3
0.05	2,426	1.2
0.10	23,166	11.0
0.15	12,325	5.9
0.17	4,981	2.4
0.20	42,281	20.1
0.24	27,426	13.1
0.28	7,706	3.7
0.32	21,550	10.3
0.37	4,822	2.3
0.43	2,394	1.1
0.49	3,050	1.5

[1] Percents do not equal 100 due to rounding.

of soils influence the likelihood of erosion. With greater amounts of runoff, more erosion and higher peak flows are likely to occur, with the possibility of large pulses of sediment to streams.

Table 3.18 provides descriptions of the hydrologic soil groups present in the watershed. Map 3.16 and Table 3.19 show the distribution of hydrologic soils in the Upper Umpqua River Watershed. More than three-fourths of the Upper Umpqua River Watershed has soils in the B hydrologic soils group (see Map 3.16), which has low runoff rates. Soils with lower infiltration rates and higher runoff potential are scattered throughout the watershed. These areas may be more prone to delivering sediment and faster runoff than other areas.

Table 3.18. Hydrologic soil group descriptions.	
HSG	**Soil Description**
A	Have low runoff potential and high infiltration rates even when thoroughly wetted; consist chiefly of deep, well to excessively drained sand or gravel and have a high rate of water transmission (greater than 0.30 in/hr).
B	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; have a moderate rate of water transmission (0.15-0.30 in/hr).
C	Have low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine texture; have a low rate of water transmission (0.05-0.15 in/hr).
D	Have high runoff potential; 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; have a very low rate of water transmission (0-0.05 in/hr).



Map 3.16. Hydrologic soils map of the Upper Umpqua River Watershed.

Table 3.19. Summary of hydrologic soil group statistics for the Upper Umpqua River Watershed.

Hydrologic Soil Group (HSG)	Amount in Watershed	
	Square Miles	Percent
A	0.6	0.2
B	204.3	78.5
C	41.1	15.8
D	14.2	5.5
Total	260.2	100.0

3.3.10. Water Quality Key Findings and Action Recommendations

3.3.10.1. Temperature Key Findings

- Much of the mainstem Umpqua River within the watershed is 303(d) listed for temperature.
- Mehl and McGee creeks seldom exceed the water temperature standard for salmonids rearing and migration.
- Tributary streams tend to be about 10^{o}F cooler than the mainstem river.

3.3.10.2. Surface water pH, Dissolved Oxygen, Nutrients, Bacteria, and Toxics Key Findings

- Bacteria concentrations within the Upper Umpqua River Watershed exceed water quality standards, although recent data collection appears to indicate improvement. More study of bacteria conditions in the Umpqua River will be required. ODEQ has conducted a TMDL analysis to assist in the process of reducing bacterial contamination of the Umpqua River.
- High bacteria concentrations in the mainstem Umpqua River are due mainly to diffuse nonpoint sources of pollution, such as livestock, wildlife, and residential septic systems.
- The levels of pH, nutrients, and dissolved oxygen can be interrelated. In the Upper Umpqua River Watershed, it is unlikely that nutrient and dissolved oxygen levels limit water quality in most locations. However, DO may be a water quality concern in Haines Creek, where DO levels have been found to be below the 8 mg/L DO standard.
- We found no data regarding toxics in this watershed. Insecticides, herbicides, and fungicides are used on some agricultural and forest lands in the watershed, but we are unaware of information regarding the extent of use or impact of these substances in the Upper Umpqua River Watershed.

3.3.10.3. Sedimentation and Turbidity Key Findings

- Turbidity data indicate that usual turbidity levels in the Upper Umpqua River Watershed should not affect sight-feeding fish like salmonids.

- The majority of the soils in the Upper Umpqua River Watershed have low to moderate erodibility. Highly erodible soils are found in the upper elevations in a few tributaries, but represent a small portion of the watershed.
- Steep to moderately steep slopes are found through much of the watershed. Particularly steep slopes exist in the eastern portions of the watershed.
- The combination of steep slope and erosion-inducing human modifications such as roads, timber harvesting, and agriculture can make some areas prone to increased erosion.
- Runoff from impervious surfaces, including roads and roofs, can increase sediment loads to streams.

3.3.10.4. Water Quality Action Recommendations

- Continue monitoring the Upper Umpqua River Watershed for water quality conditions, especially bacteria in the mainstem Umpqua River. Expand monitoring efforts to include more monitoring of 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, when appropriate, improve in-stream 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 development of riparian buffers and managing for full stream canopy coverage.
- Encourage landowner practices that will reduce the bacteria levels:
    - Limit livestock stream access by providing stock water systems and shade trees outside of the stream channel and riparian zones. Fence riparian areas as appropriate.
    - Relocate structures and situations that concentrate domestic animals near streams, such as barns, feedlots, and kennels. Where these structures cannot be relocated, establish dense riparian vegetation zones to filter fecal material.
    - Repair failing septic tanks and drain fields.
- In areas with high debris flow hazards and/or with soils that have high K-factor values and are in the C or D hydrologic group, encourage landowners to identify the specific soil types on their properties and include soils information in their land management plans.

3.4. Water Quantity

This section analyzes hydrology, water use and availability in the Upper Umpqua River Watershed. Background information for this chapter was compiled from the *Oregon Watershed Assessment Manual* (Watershed Professionals Network 1999) and the *South Umpqua River Watershed Assessment and Action Plan* (Geyer 2003). Additional information and data are from the following groups' documents, websites, and specialists: the Oregon Water Resources Department (OWRD) and the Bureau of Land Management (BLM).

3.4.1. Human Impacts on Hydrology

Human activities in a watershed can alter the natural hydrologic cycle, potentially causing changes in water quantity and availability. Water is withdrawn from the stream system for municipal and industrial use, agriculture, and for other purposes. In addition, changes in the landscape can increase or decrease the volume, size, and timing of runoff events and affect low flows by changing groundwater recharge. Important examples of human activities that have affected hydrology in the Upper Umpqua River Watershed are water withdrawal for domestic, industrial, and agricultural use, timber harvesting, conversion of forested land to agriculture, and construction of road networks. The focus of the hydrologic analysis component of this assessment is to evaluate the potential impacts from land and water use on the hydrology of the watershed. It is important to note, however, that this assessment only provides a screening for potential hydrologic impacts based on current water and land use activities in the watershed. Quantifying those impacts would require a more in-depth analysis and is beyond the scope of this assessment.

The two principal land use activities that can affect the hydrology of upland portions of this watershed are forestry and forest roads. In lowland areas, agriculture and urban or residential development can also be important. Increased peak flows in response to management are a concern because they can have deleterious effects on aquatic habitats by increasing streambank erosion and scouring. High peak flows can cause downcutting of channels, resulting in channelization and a disconnection of the stream from the floodplain. Once a stream is disconnected from its floodplain, the downcutting can be made worse by the increased flow velocities that result from channelization.

The Upper Umpqua River Watershed has relatively limited areas of agricultural and urban land use. Land cover adjacent to the mainstem river and in tributary lowland areas changed significantly following Euro-American settlement. It is likely that agricultural practices and urbanization changed the infiltration rates of the higher, well-drained soils in these areas. Some agricultural areas in the watershed have been drained by subsurface tile drains. These installations reduce water storage and increase peak flows in lowland areas, but quantitative data are lacking. Loss of historical floodplain acreage and land cover (such as wetlands and forested valley bottoms) have likely had impacts on hydrologic conditions. Disconnecting the floodplain from the river may have contributed to a reduction in flood attenuation[31] capacity, increased peak flows, downcutting of channels, and increased flow velocities in the lower watershed.

[31] Flood attenuation refers to the provision of temporary water storage during flood events, either naturally or through human intervention, for the purpose of reducing the impact of the peak flow.

Forestry practices have the potential to influence the magnitude of flooding, but it is difficult to quantify such effects because of the large natural variability in discharge. However, elevated peak flows and "flashiness" for small to moderate storm events might result from timber harvesting and road building activities. Potential effects include reduced evapotranspiration, decreased infiltration and subsurface flow, and increased runoff. Such changes may result in modified peak- and low-flow regimes and subsequent effects on in-stream aquatic habitat quality. However, quantitative information is not available regarding the magnitude of the changes in hydrology of the Upper Umpqua River that might be attributable to forestry or any other land use. In addition, it is likely the land use changes would have to be made on a very large scale, in order to have an appreciable effect on river flows.

Past fires were associated with changes in the hydrologic regime. In general, a large proportion of the trees must be removed from a watershed before significant increases in peak flows are observed. The effects of fire on peak flows generally persist until vegetation is re-established, which is usually within a decade following the fire. Fires in the past several decades have not burned large areas of the Upper Umpqua River Watershed, so we do not expect that there are significant effects of fire on hydrology in the watershed today.

3.4.2. Water Availability

Data from OWRD have been used to determine water availability in the Upper Umpqua River Watershed. Availability is based on streamflow, consumptive use, and in-stream water rights. The amount of water available for issuance of new water rights is determined by subtracting consumptive use and the in-stream water rights from streamflow. In most of the Umpqua Basin, there is little water available for new water rights from "natural" streamflow during the summer.[32]

To analyze water availability, OWRD has divided the Umpqua Basin into water availability basins, or WABs. The Upper Umpqua River Watershed consists of five WABs: Umpqua River above Wolf Creek (301), Hubbard Creek (315), Mehl Creek (325), Wolf Creek (377), and Yellow Creek (378). Figures 3.4 and 3.5 show surface water availability for the Umpqua River above Wolf Creek and for the Mehl Creek WABs, respectively. Appendix A shows surface water availability for the other WABs.

The shaded bars on Figures 3.4 and 3.5 represent the 50% exceedence, or average, streamflow in cubic feet per second (cfs). The dark blue diamonds represent the cfs for in-stream water rights, and the red triangles and corresponding numbers are the estimated consumptive use values. The red x's represent the expected streamflow, which is calculated by subtracting consumptive use from the average streamflow. In the Umpqua River above Wolf Creek WAB, in-stream water rights are consistently below average streamflow during all months except during August and September when they are only slightly above average streamflow. During August and September, in-stream water rights are approximately equal to average streamflow, indicating that the available water is fully allocated based on average flow conditions. Expected streamflow is close to average streamflow all year.

[32] In some circumstances, domestic water rights can be obtained if there is no other source of water on a property. Contact the Oregon Water Resources Department for more information.

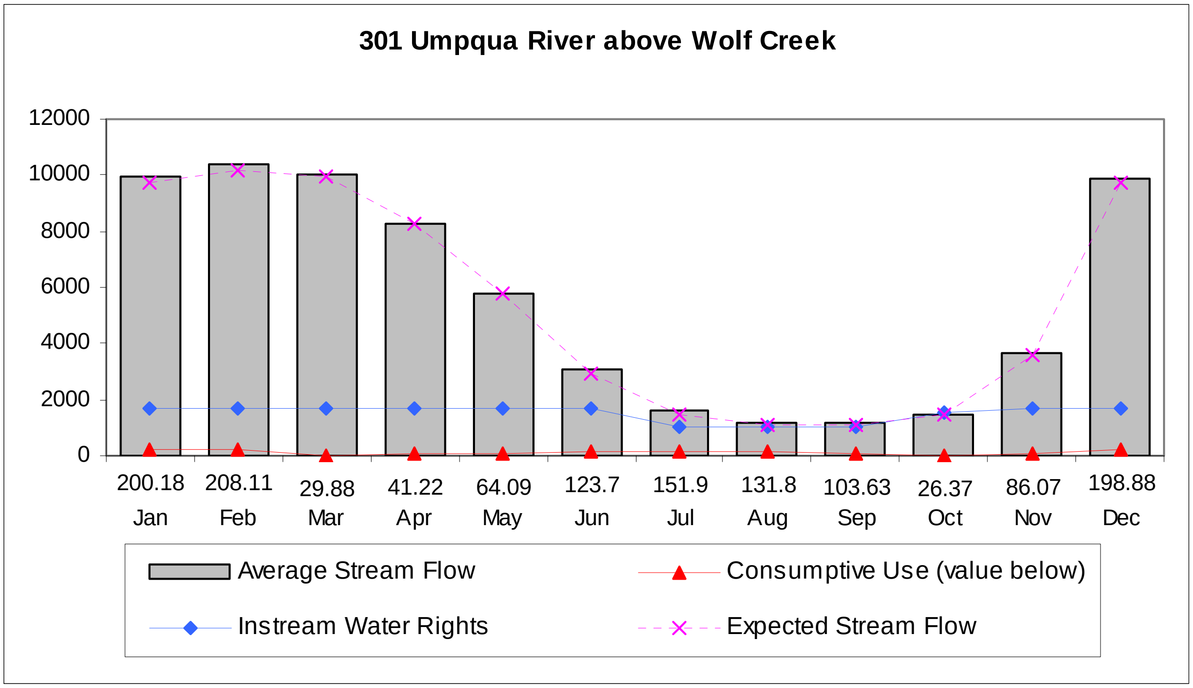


Figure 3.4 Water availability in the mainstem Umpqua River (WAB #301).

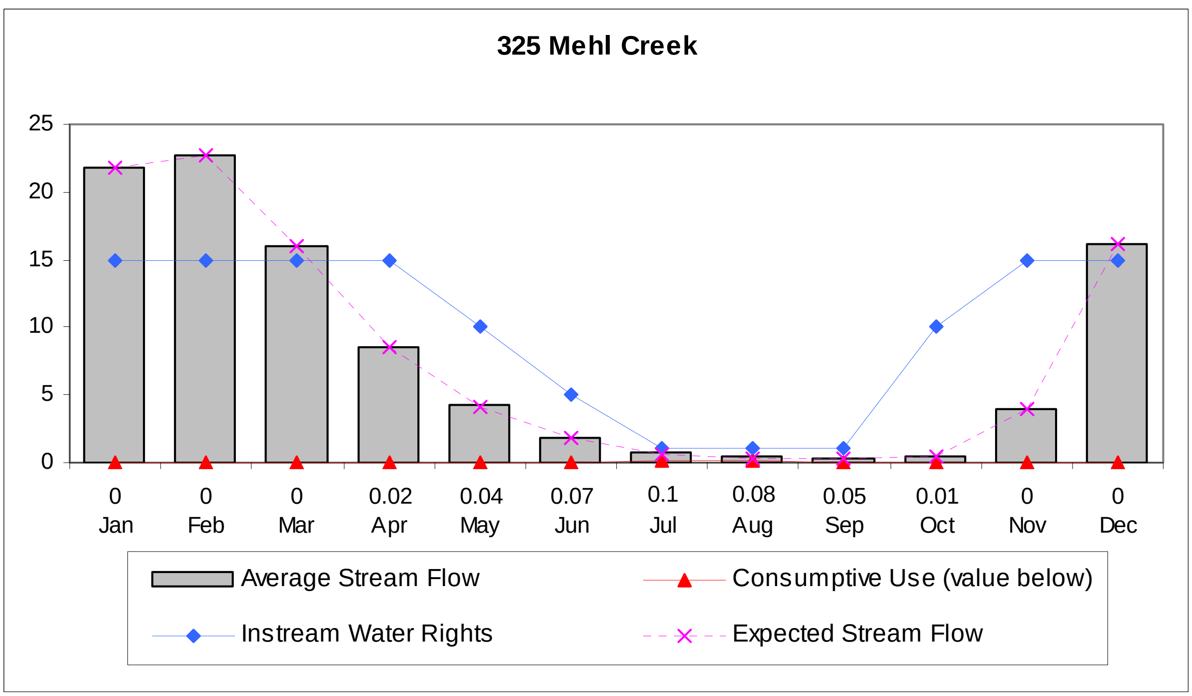


Figure 3.5. Water availability in Mehl Creek (WAB #325), the most over-allocated of the tributary stream WABs.

Conditions are quite different in the tributary stream WABs. During the period April through November, in-stream water rights in each of the four tributary WABs exceed average streamflow for at least some months, most commonly October (Figures 3.4 and 3.5, Appendix A). Water right exceedences (amount above average monthly flow) are most pronounced for the Mehl Creek WAB (which has eight months of exceedence).

Oregon law provides a mechanism for temporarily changing the type and place of use for a certified water right by leasing the right to an in-stream 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 in-stream use counts as use under the right for purposes of precluding forfeiture. The Oregon forfeiture statute states that if an owner of a water right "ceases or fails to use all or part of the water appropriated for a period of five successive years, the failure to use shall establish a rebuttable presumption of forfeiture of all or part of the water right."

3.4.3. Water Rights by Use

Figure 3.6 shows consumptive use by category for the Upper Umpqua River Watershed. Included in the figure are all uncanceled water rights. Therefore these data do not indicate exact water consumption.[33]

Irrigation is the largest (75.6% of total) use of water for the watershed, followed by agricultural water use (19.5%). Less than 1% of water rights in the Upper Umpqua River Watershed are secured for recreation, fish, or wildlife uses.

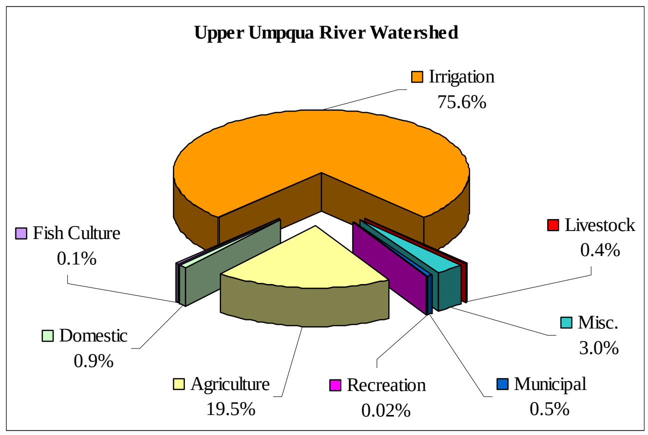


Figure 3.6. Upper Umpqua River Watershed consumptive use.

3.4.4. Streamflow and Flood Potential

Figure 3.7 shows the average, minimum, and maximum Umpqua River annual flow values near Elkton for each year from 1905 to 2003. The average annual flow for all years was 7,415 cfs. The highest average annual flow, in 1996, was nearly double the long-term average. Maximum annual flow values exceeded 40,000 cfs in 1955, 1964, and 1996. The distribution of streamflow across the year is shown in Figure 3.8. The highest average and maximum flow occur during the months of December, January, and February.

No historical gaging information is available for tributary drainages within the watershed. The nearest USGS Coast Range gaging station suitable for showing the general Coast Range tributary

[33] 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 because of non-use. For more information about water rights, contact the Oregon Water Resources Department.

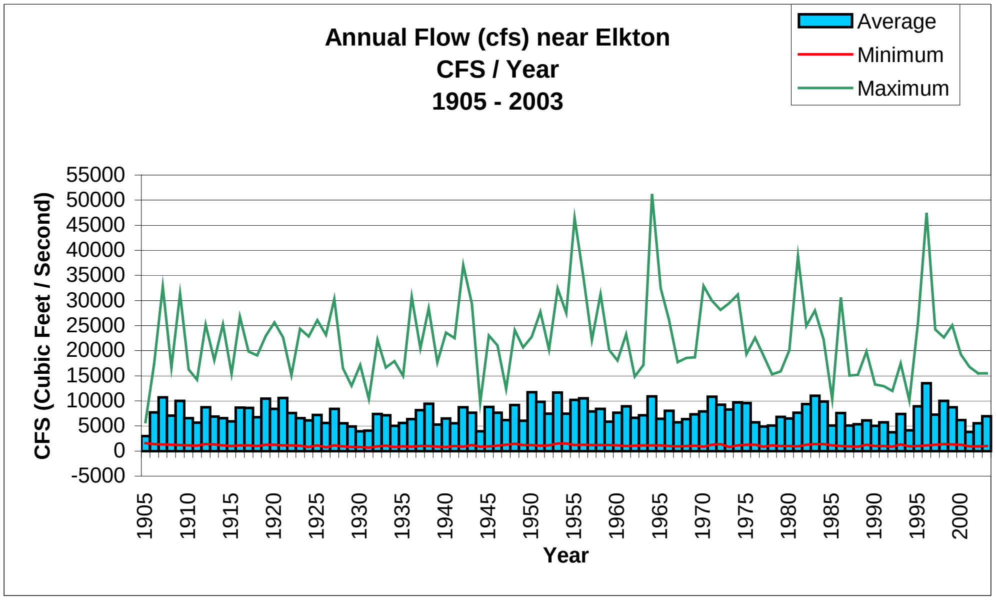


Figure 3.7. Annual flows of the Umpqua River at Elton between 1905 and 2003, depicted as average, minimum, and maximum annual flow values.

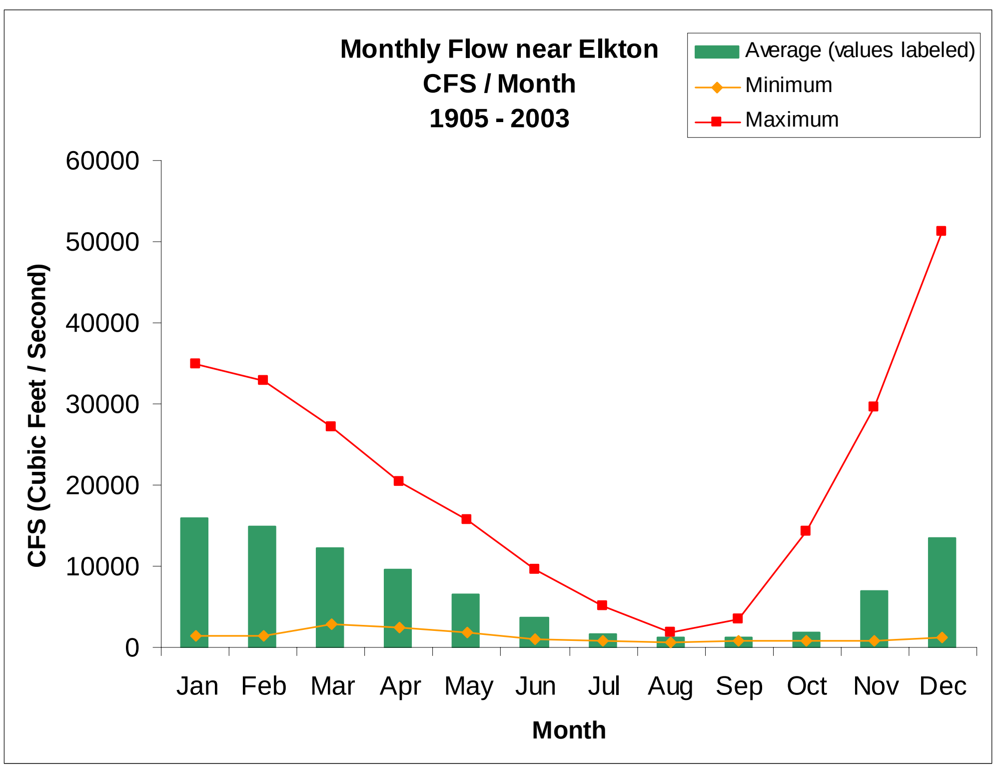


Figure 3.8. Distribution of monthly streamflow values for the Umpqua River at Elkton across the year.

seasonal flow patterns in the vicinity of the Upper Umpqua River Watershed is the discontinued station on Elk Creek near Drain. Station 14322000 measured discharge from a 104 square mile drainage during the periods 1955 through 1973 and 1978 through 1979. Daily mean discharges ranged between 0 and 19,000 cfs.

The average annual yield at the Elk Creek gaging station expressed as a uniform depth of water over the contributing watershed is 28.4 inches. This compares to 27.3 inches at the Umpqua River gaging station on the mainstem river near Elkton. January produces the highest mean monthly runoff on both the Umpqua River and Elk Creek, with approximately 50% and 63%, respectively, of the annual runoff occurring in the months of December, January, and February (Figure 3.9). The period from May through September contributes 16% of the annual runoff in the Umpqua River and only 6% in Elk Creek. Early dry season discharge is comparatively greater in the Umpqua River, as compared with the tributary stream, because snowmelt in the Cascades contributes to spring runoff carried in the mainstem river.

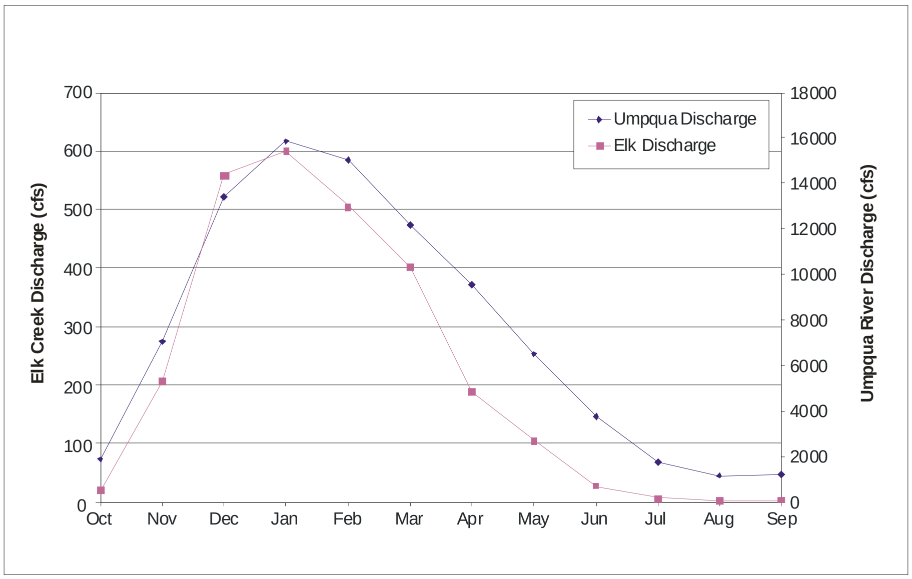


Figure 3.9. Mean monthly streamflow of Elk Creek near Drain, OR and Umpqua River near Elkton, OR. (Source: BLM 2004)

3.4.5. Minimum Flow

Because rain is infrequent in the summer, stream flows become low in late summer along the Umpqua River and tributary streams in the Upper Umpqua River Watershed. Many headwater (first order) streams in the watershed dry up as the summer progresses. Streams that originate from seeps and drain fine-textured, deep, high porosity soil types have a very low, constant flow, but may have dry spots in later summer. Some of the higher order tributary channels may have pools in late summer, but little flow. Low-flow conditions can be stressful to fish and other aquatic life, partly because low flows are often accompanied by high water temperature, low dissolved oxygen, and minimal protective cover to avoid predation.

Table 3.20 shows the probability, or return frequency, that the average daily discharge for a given period (n-day discharge) will be less than a particular value. For example, there is a 10% chance in any year that the daily flow averaged over 7 days will be less than 803 cfs. Another

Table 3.20. Magnitude and probability of annual low flow in the mainstem Umpqua River at Elkton, based on the period of record from 1907 to 1987.[1] (Source: Wellman et al. 1993)

Period (consecutive days)	Discharge (cfs) for Indicated Recurrence Interval, and the Annual Non-exceedence Probability (%)					
	2 yr	5 yr	10 yr	20 yr	50 yr	100 yr
	50%	20%	10%	5%	2%	1%
1	971	845	782	732	678	643
3	986	857	791	739	682	646
7	1,000	869	803	749	691	654
14	1,020	882	815	762	704	667
30	1,050	906	835	778	717	678
60	1,110	954	876	814	747	704
90	1,180	1,010	918	847	771	723
120	1,300	1,080	979	900	816	764
183	2,070	1,560	1,340	1,170	1,010	915

[1] Eighty-one values were used to compute statistics. Non-exceedence probability is the probability, or chance, expressed as a percentage, that the annual minimum flow will be less than the stated magnitude in any given year.

way to state this is that the estimated frequency of occurrence of 7-day average flow less than 803 cfs is once in 10 years. One-day 10-year and greater interval low flows occurred in 1924, 1926, 1930, 1931, 1934, 1936, 1940, 1968, 1973, 1977, and 1988. Low flows in these years occurred July through October, with most events occurring in August and September. Flows lower than the seven-consecutive-day 10-year value of 803 cfs occurred in August of 1924, 1930, 1934, and 1940, and flows lower than the seven-day 20-year and 50-year values occurred in August, 1926 and September, 1931, respectively. Fourteen-day flows lower than the 10-year value and equal to the 20-year value were recorded in September, 1929 and September, 1934, respectively.

3.4.6. Peak Flows

Peak flow or peak discharge is the instantaneous maximum discharge generated by an individual storm or snowmelt event. Peak flows are dependent on the duration, intensity, and distribution of winter rainfall. Frequent peak flows (those flows that occur several times each winter, but are less than the annual peak flow), and bankfull flows (return period of 1.5 to 2 years) are responsible for maintaining channel dimensions and moving most of the sediment load. Major channel adjustments result from infrequent, extreme flood flows.

Table 3.21 shows the probability, or return frequency, that the average daily discharge for a given period (n-day discharge) will be greater than a particular value. For example, there is a 10% chance in any year that the daily flow averaged over 7 days will be less than 74,200 cfs. Another way to state this is that the estimated frequency of occurrence of 7-day average flow less than 74,200 cfs is once in 10 years. Flows greater than the one-day, 10-year value of 145,700 cfs were recorded in 1927, 1942, 1945, 1950, 1953, 1971, and 1996. Flows in excess of the one-day, 25-year value of 173,100 cfs occurred in 1955, 1964, and 1974, and a mean daily discharge in excess of the one-day, 100-year value occurred in 1964. Ten-year and larger high flow events

Table 3.21. Magnitude and probability of annual high flow in the mainstem Umpqua River at Elkton, based on the period of record from 1906 to 1987.[1] (Source: Wellman et al. 1993)

Period (consecutive days)	Discharge (cfs) for Indicated Recurrence Interval, and the Annual Non-exceedence Probability (%)					
	2 yr	5 yr	10 yr	25 yr	50 yr	100 yr
	50%	20%	10%	5%	2%	1%
1	83,200	122,100	145,700	173,100	191,800	209,200
3	63,300	91,900	109,100	129,100	142,700	155,300
7	45,400	63,500	74,200	86,300	94,300	101,700
15	32,200	43,500	49,700	56,600	61,000	64,900
30	24,600	32,400	36,500	40,800	43,500	45,800
60	19,400	25,500	28,800	32,300	34,600	36,600
90	16,900	22,100	25,000	28,300	30,500	32,400

[1] Eighty-two values were used to compute statistics. Non-exceedence probability is the probability, or chance, expressed as a percentage, that the annual maximum flow will be less than the stated magnitude in any given year.

at Elkton on the Umpqua River have occurred in the months of October through February with more of these events occurring in December than in any other month. Figure 3.8 illustrates the high amount of variability from year-to-year in the annual peak flows at the Umpqua River near Elkton. In a river basin as large and diverse as the Umpqua Basin, different runoff-generating mechanisms (rain, rain-on-snow, and snow) may operate concurrently to produce peak flows at different times.

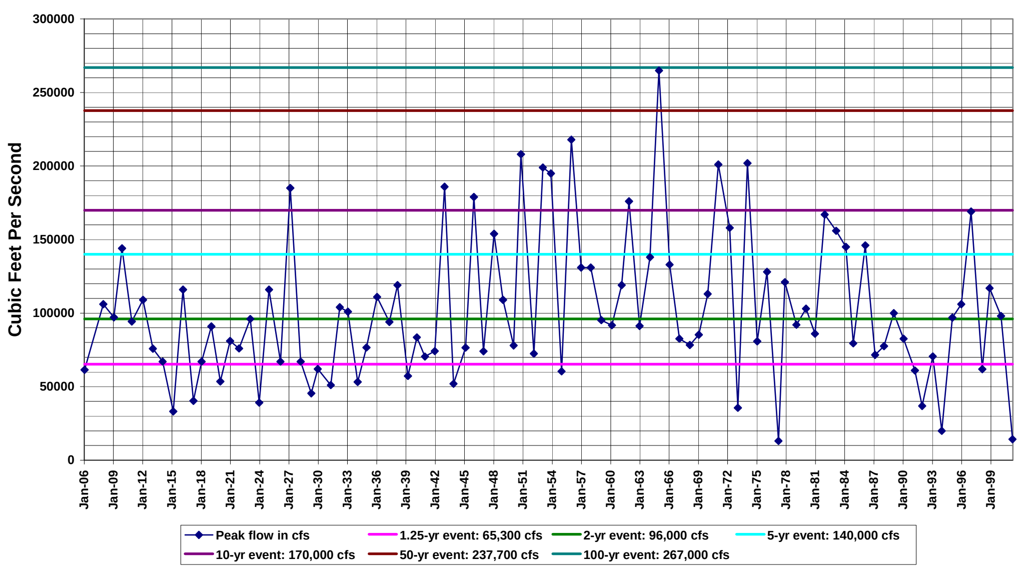


Figure 3.10. Peak discharge of the Umpqua River at Elkton for water years 1906 through 2001. (Source: BLM 2004)[34]

[34] The 1964 flood is shown in year 1965, because years in this figure are represented as "water years." A water year, October 1st to September 30th, is defined such that the flood season is not split between consecutive years. Water year 1965, for example, would end on September 30, 1965.

The earliest documented major flood in the Umpqua Basin was in 1861. Information provided by local residents indicated that the 1861 flood peaked at about 45.5 feet gage height at Elkton. The River did not reach that height again until December 22, 1955, when the river peaked at 45.6 feet gage height. The peak flow for both the 1861 and 1955 events was 218,000 cfs (Hulsing and Kallio 1964). The 1861 flood was a regional event, which among other things, produced the largest flood event recorded for the Willamette River. Summarized accounts in newspapers and letters of the time show that this was part of a series of regional-scale events that began with heavy snowfall in early November, 1861. In western Oregon, this was followed by very heavy rainfall throughout December. Heavy precipitation continued until March 1, 1862. Between 75% and 80% of all livestock in the Northwest either froze to death, starved, or were lost in the December floods. Many farmhouses, most bridges, and some whole communities were washed away (Meteorology Committee Pacific Northwest River Basins Commission 1969). Other large storms are listed in Table 3.22.

The highest peak flow for the period of record at the Elkton stream gage was 265,000 cfs on December 23, 1964. The Umpqua River reached 51.9 feet gage height based on flood marks. Large storms that produce peak flows like these do exhibit variation across the affected area. For example, the 1964 storm caused a 50- to 100-year flood event in many watersheds, including the South Fork Coquille where it is the flood of record. However, the 1964 flood was not a high magnitude event at the Millicoma gage station in the Coos River Basin.

Table 3.22. Major rainstorms affecting the Oregon Coast that likely resulted in high rainfall and possible flooding in the Upper Umpqua River Watershed. (Source: Meteorology Committee, Pacific Northwest River Basins Commission 1969)

January 28 to February 3, 1890	Very heavy rainfall affected all of western Oregon. The 7-day totals for the Oregon Coast ranged from 15 to 20 inches of rainfall.
November 12 to 17, 1896	Heavy precipitation along the entire Oregon Coast dropped 15 to 20 inches on the coast and 5 to 10 inches inland. Maximum 24-hour totals of 5 to 7 inches observed at a number of coastal sites.
November 18 to 24, 1909	Two storms in rapid succession dropped 10 to 20 inches of rain on the coast and 4 to 6 inches on the inland valleys. On the coast and in the upper Cascades, 24-hour totals of 4.50 to 5.50 inches were common.
December 26 to 29, 1945	During the peak of the storm, 24-hour totals of 3 to 5 inches were common.
October 26 to 29, 1950	Storm totals ranged from 10 to 12 inches on the extreme south of the state and decreased to 4 to 5 inches on the state's north border.
January 16 to 19, 1953	Precipitation was heaviest on the south coast with storm totals of 15 to 20 inches, and 1-day totals of 4 to 8 inches. Reedsport had a 1-day total of 4.11 inches.
November 22 to 24, 1953	The most intense part of the storm centered on the south coast. South coast observing stations reported 1-day totals of 4 to 7 inches and 72-hour totals of 6 to 10 inches. Reedsport reported a 4.45 inch 1-day total and a 7.34 inch total.
December 20-24, 1964	This is the most severe rainstorm on the Oregon coast since the start of regular weather data collection. The rainfall total in Reedsport for the month of December 1964 was 22.01 inches. The average rainfall for December in Reedsport is 11.94 inches.

The most recent major storms hit in mid-December, 1995, February 6 through 9, 1996, November 18 through 20, 1996, December, 10 through 12, 1996, and November 24 through 26, 1999. The *Register Guard* Newspaper (March 1, 1996) reported the December, 1995 storm as a 1 in 5-year windstorm, a 1 in 10-precipitation event and a 1 in 25-year flood event. The 24-hour rainfall, on November 18, 1996, was 6.7 inches at the North Bend Airport.

3.4.7. Water Quantity Key Findings and Action Recommendations

3.4.7.1. Water Availability and Water Rights by Use Key Findings

- In the Umpqua River above Wolf Creek WAB, in-stream water rights are less than or approximately equal to average streamflow during all months of the year.
- In each of the four tributary stream WABs, in-stream water rights equal or exceed average streamflow throughout most summer and fall months. In particular, water rights exceed average flow in the Mehl Creek WAB for an eight-month period.
- During the summer and fall, there is little or no "natural" streamflow available for new water rights, and water is often over-allocated in the tributary systems.
- Irrigation is the largest use of water in the watershed, accounting for 75.6% of consumptive use. Agriculture (19.5% of total) is the only other water use in the watershed that accounts for more than 1% of the total consumptive use.

3.4.7.2. Streamflow and Flood Potential Key Findings

- Flows lower than the seven-consecutive-day 10-year value of 803 cfs occurred in August of 1924, 1930, 1934, and 1940.
- Major floods during the last century occurred in 1909, 1945, 1950, 1953, 1964, and 1996.
- The degree to which land use influences flood potential in the Upper Umpqua River Watershed is unknown at this time, but is not expected to be substantial.

3.4.7.3. Water Quantity Action Recommendations

- Educate landowners about proper irrigation methods and the benefits of improved irrigation efficiency.
- Educate citizens about the benefits of domestic water conservation and the effects of low flows on the watershed.
- Educate landowners about the implications of water quality listings that do not require a TMDL, such as flow modification.

3.5. Fish

This section examines the presence, distribution, and abundance of fish species in the Upper Umpqua River Watershed. Background information for this chapter was compiled from the *Oregon Watershed Assessment Manual* (Watershed Professionals Network 1999) and the *South Umpqua River Watershed Assessment and Action Plan* (Geyer 2003). Additional information and data are from the following groups' documents, websites, and specialists: the Oregon Department of Fish and Wildlife (ODFW), the National Oceanic and Atmospheric Administration Fisheries Service (NOAA Fisheries), the US Fish and Wildlife Service (USFWS), and the Bureau of Land Management (BLM).

3.5.1. Fish Presence

The Upper Umpqua River Watershed is home to many fish species. Table 3.23 lists many common fish species in the watershed that have viable, reproducing populations. In addition to salmon and trout, many warm water fish, including largemouth bass (*Micropterus salmoides)*, yellow perch (*Perca flavescens*), and bluegill (*Lepomis macrochirus*) reside in the watershed. The Umpqua River is well known throughout Oregon and elsewhere for its excellent smallmouth bass (*Micropterus dolomieu*) fishing opportunities. These fish were introduced to portions of the Upper Umpqua River Watershed.

3.5.2. Listed Fish Species

Population levels have been so depressed that all salmonid species on the Oregon Coast have been considered for listing under the federal Endangered Species Act (Reeves et al. 2002). In 1998, NOAA Fisheries, formerly the National Marine Fisheries Service, designated the Oregon coastal coho salmon (*Oncorhynchus kisutch*) as a threatened species under the Endangered Species Act (ESA). However, in recent years the population has increased substantially, probably because of improvement in ocean conditions, habitat restoration efforts, and reduced fishing pressure. In January, 2006, a status review conducted by NOAA Fisheries concluded that listing was no longer warranted, and the Oregon coastal coho salmon was delisted.

The Umpqua River population of the coastal cutthroat trout (*Oncorhynchus clarkii clarkii*) was listed as endangered in 1996. NOAA Fisheries Service delisted the species on April 19, 2000, with concurrence from the USFWS. The delisting was based on the determination that the population was not a distinct "evolutionarily significant unit" (ESU), but a part of the larger Oregon Coast ESU.[35] The USFWS and NOAA Fisheries have listed Oregon's coastal cutthroat trout as a candidate species under the ESA, and transferred jurisdiction on any final listing and responsibilities for consultation to the USFWS.

NOAA Fisheries reviewed the status of the Oregon Coast steelhead trout (*Oncorhynchus mykiss*) population to determine whether listing as a threatened species under the ESA was warranted. As of preparation of this report, NOAA has not found that a listing is warranted. In January, 2003, various groups petitioned to protect the Pacific lamprey (*Lampetra tridentata*) and western

[35] An ESU is defined as a population that 1) is substantially reproductively isolated from conspecific populations and 2) represents an important component in the evolutionary legacy of the species. Consequently, an ESU is an evolutionarily distinct population that is irreplaceable.

Table 3.23. Fish with established populations or runs within the Upper Umpqua River Watershed. (Source: ODFW 2004)

Category	Common Name	Scientific Name
Native Salmonid Species	Coho salmon	*Oncorhynchus kisutch*
	Chinook salmon (spring and fall)	*Oncorhynchus tshawytscha*
	Steelhead (winter and summer)/ Rainbow trout	*Oncorhynchus mykiss*
	Coastal cutthroat trout	*Oncorhynchus clarkii clarkii*
Other Native Fish Species	Pacific lamprey	*Lampetra tridentata*
	Western brook lamprey	*Lampetra richardsoni*
	River lamprey	*Lampetra ayresi*
	Umpqua chub	*Oregonichthuys kalawatseti*
	Three-spined stickleback	*Gasterosteus aculeatus*
	Sculpin (various sp.)	*Cottus species*
	Redside shiner	*Richardsonius balteatus*
	Umpqua dace	*Rhinicthys cataractae*
	Speckled dace	*Rhinicthys osculus*
	Long nose dace	*Rhinicthys cataracatae*
	Umpqua pikeminnow	*Ptychocheilus umpquae*
	Largescale sucker	*Catostomus macrocheilus*
	Green sturgeon	*Acipenser medirostris*
	White sturgeon	*Acipenser transmontanus*
Non-Native Fish Species	Smallmouth bass	*Micropterus dolomieu*
	Largemouth bass	*Micropterus salmoides*
	Striped bass	*Morone saxatilis*
	Crappie	*Pomoxis* spp.
	Yellow perch	*Perca flavescens*
	Mosquito fish	*Gambusia affinis*
	Fathead minnow	*Pimephales promelas*
	Bluegill	*Lepomis macrochirus*
	American shad	*Alusa sapidissima*
	Brown bullhead	*Ameiurus nebulosus*

brook lamprey (*L. richardsoni*), as well as two other lamprey species, under the ESA. The green sturgeon (*Acipenser medirostris*) was also petitioned for listing under the ESA, but in 1993 listing was determined to be unwarranted. Currently, there are no other ESA-listed threatened or endangered aquatic species in the Upper Umpqua River Watershed. A number of amphibians are listed by the State of Oregon as species of special concern due to declines in abundance, including the northern red-legged frog (*Rana aurora aurora*), tailed frog (*Ascaphus truei*), and Columbia torrent salamander (*Rhyacotriton kezeri*). Like fish, these species depend on healthy aquatic ecosystems.

3.5.3. Fish Distribution and Abundance

Information on fish distribution and abundance within the Upper Umpqua River Watershed is mainly limited to salmonids. Although non-salmonid fish species are important as well, there is little information available on these types.

A typical life cycle of an anadromous salmonid consists of several stages, each with different habitat requirements. Habitat features that affect migrating salmonids are water depth and velocities, water quality, cover from predators, and the presence of full or partial migration barriers. Substrate composition, cover, water quality, and water quantity are important habitat elements for salmonids before and during spawning. Important elements for rearing habitat for newly emerged fry and juvenile salmonids are quantity and quality of suitable habitat (overhanging vegetation, undercut banks, submerged boulders and vegetation, etc.), abundance and composition of food (primarily macroinvertebrates, such as aquatic insects), and water temperature.

Salmon population abundance has declined significantly over the past 150 years along the Oregon Coast. This decline is attributed to many factors, including degradation of habitat quality and availability, ocean conditions, impacts of non-native fish, fishing pressure, and predation. The effect of predation has been an issue of concern for many local residents. Increases in the seal and sea lion populations over the past several decades has led to rising predation pressure near the river mouth. Several studies have investigated the effect of seal and sea lion predation on the Oregon Coast, and have concluded that the impact to the salmon population is relatively minor, although it may be significant to local threatened populations. ODFW data indicate that seal and sea lion populations have stabilized over the past decade, but the agency is in favor of specific changes to the Marine Mammal Protection Act that would allow it to deal more efficiently with acute local problems or rogue animals.[36]

The ODFW has developed anadromous salmonid distribution maps based on fish observations, assumed fish presence, and habitat conditions. Fish observations are the most accurate because agency biologists have recorded fish presence in the stream. With “assumed fish presence,” stream reaches are included in the distribution map because of their proximity to known fish-bearing stream reaches or the observed presence of adequate habitat. As of January, 2003, ODFW has been revising the salmonid distribution maps to distinguish observed fish-bearing streams from the others. The maps included here include those changes.

Stream gradient is a useful indicator of potential fish habitat. In order to get a general sense of the amount of potentially suitable fish habitat in the watershed, we have mapped streams in three gradient classes: 0% to 4%, 4% to 15%, and greater than 15%. Anadromous salmonids generally use streams having a gradient of less than 4%, whereas resident cutthroat inhabit streams in the 4% to 15% gradient class.

A comparison of the length of streams identified by ODFW as salmonid habitat with the number of streams that are less than 4% gradient provides a rough estimate of the percentage of potential anadromous salmonid habitat that is currently being utilized. Map 3.17 shows the distribution of anadromous salmonids and resident cutthroat trout within the watershed. There are about 240 stream miles of potential anadromous salmonid habitat within the Upper Umpqua River

[36] For more information, see http://resourcescommittee.house.gov/108cong/fish/2003aug19/brown.htm.

Watershed. Winter steelhead and coho each use more than two-thirds of the potentially available habitat.[37] Summer steelhead, spring chinook, and fall chinook use 26% or less (Table 3.24). Summer steelhead and spring chinook only use the mainstem as a migration corridor. The total of all stream miles with anadromous salmonids given in Table 3.24 does not equal the sum of miles used by all species collectively because the distributions of many species overlap. Coho and steelhead use many of the same stream reaches but at different times of the year. Potential habitat may not be utilized because of a passage barrier, or because other habitat conditions are unsuitable, such as insufficient spawning substrate, low flows, or unfavorable water temperature conditions.

Table 3.24. Miles of stream potentially supporting anadromous salmonids in the Upper Umpqua River Watershed, based on mapping at a scale of 1:100,000 by ODFW.

Species	Fish Utilization (miles)	Potential Habitat Utilized (percent)
Coho	165	69
Fall Chinook	63	26
Winter Steelhead	217	90

Early settlers, timber companies, and governmental agencies removed debris jams and woody debris from channels and straightened channels to improve navigation and to allow timber to be transported downstream to mills during log drives. Once the debris jams were cleared, the frequency of localized flooding was reduced, and "structures could safely be built closer to the river" (Farnell 1980). The presence of wood jams in the lowland portion of the Upper Umpqua River Watershed had functioned historically to increase the frequency and timing of overbank flooding, creating hydrological connections between riverine, estuarine, and terrestrial areas.

3.5.3.1. Cutthroat Trout

Coastal cutthroat trout exhibit diverse patterns in life history and migration behavior. Populations of coastal cutthroat trout show marked differences in their preferred rearing environment (river, lake, estuary, or ocean), size and age at migration, timing of migrations, age at maturity, and frequency of repeat spawning. Both sea-run and resident cutthroat trout utilize smaller streams for spawning and rearing than do salmon and steelhead (ODFW 1993). Anadromous populations migrate to the ocean (or estuary) for usually less than a year before returning to fresh water. Anadromous cutthroat trout either spawn during the first winter or spring after their return and may migrate between the ocean and fresh water many times for spawning. Anadromous cutthroat are present in most coastal rivers. Resident populations of coastal cutthroat trout occur in small headwater streams and may migrate within the fresh water of the river network (i.e. potadromous migration). They generally are smaller, become sexually mature at a younger age, and may have a shorter life span than many anadromous cutthroat trout populations. Resident cutthroat trout populations are often isolated and restricted above complete barriers to fish passage, such as waterfalls or dams, but may also coexist with other life history types.

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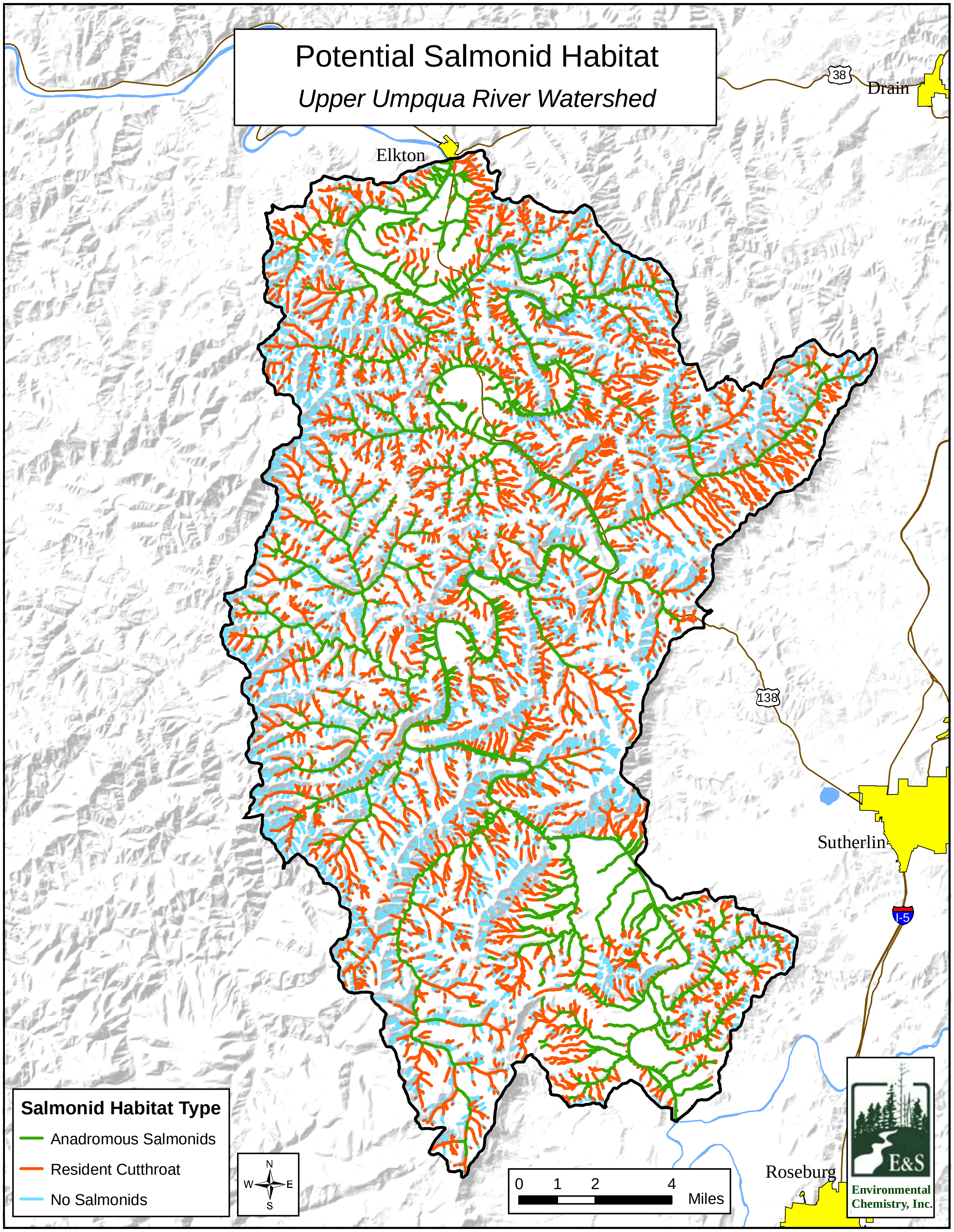
[37] Maps are available from the ODFW website http://www.streamnet.org/online-data/GISData.html.



Map 3.17. Potential anadromous and resident salmonid distribution within the Upper Umpqua River Watershed.

Less is known about the present status of sea-run cutthroat trout than the other anadromous salmonid species in the Upper Umpqua River Watershed, and their distribution is not well known. The smallest of the anadromous salmonids present in the watershed, they have not been fished commercially. Although sea-run cutthroat trout are harvested in the recreational fishery, their numbers are not recorded on salmon/steelhead report tags. Therefore, abundance trends cannot be determined using catch data.

There are no comprehensive data on resident cutthroat distribution in the Umpqua Basin. ODFW has compiled regional data and developed maps indicating expected fish presence by stream. Resident cutthroat are generally limited to small tributaries above the ranges of anadromous fish (Map 3.17).

3.5.3.2. Coho Salmon

Coho distribution within the watershed is shown in Map 3.18. All of the major tributary streams within the watershed provide spawning habitat for coho. The mainstem Umpqua River provides important coho migration habitat. ODFW conducts coho spawning surveys throughout the Umpqua Basin.[38] 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.

Annual estimates of wild coho spawner abundance have been made by ODFW in coastal basins throughout the Oregon Coastal ESU. Data are available for the period 1990 through 2004 for the mainstem Umpqua River during the spawning season (Figure 3.11). The numbers of adult wild coho in the mainstem Umpqua River during the spawning season (called “spawners”) increased 10-fold starting in 2001, as compared with the average number of spawners in the 1990s. Spawner population estimates over the past four years have ranged from 5,309 in 2004 to 9,188 in 2002. Similar patterns were observed throughout the Oregon Coastal ESU for coho.

Coho population estimates for specific tributaries within the Upper Umpqua River Watershed are less complete than the Umpqua River sub-basin data depicted in Figure 3.11. There are limited coho spawning data for the Upper Umpqua River Watershed from 1996 through 2000. Available data from ODFW are shown in Table 3.25 for many of the tributary streams within the watershed. Year-to-year variability was high in the streams that were surveyed multiple times.

Coho spawner abundance was estimated coast-wide in 2004 using statistically-based protocols of EPA’s Environmental Monitoring and Assessment Program (EMAP). Results are shown in Table 3.26, including estimates of total and wild coho as well as 95% confidence intervals associated with those estimates.[39] It is important to note that the Umpqua River system accounted for more total and wild coho spawners than any other river in Oregon, and the Umpqua River system represented about 15% of the estimated coho spawners coast-wide. Only the Coos, Coquille, and Nehalem rivers were close to the number of spawning coho estimated for the Umpqua system.

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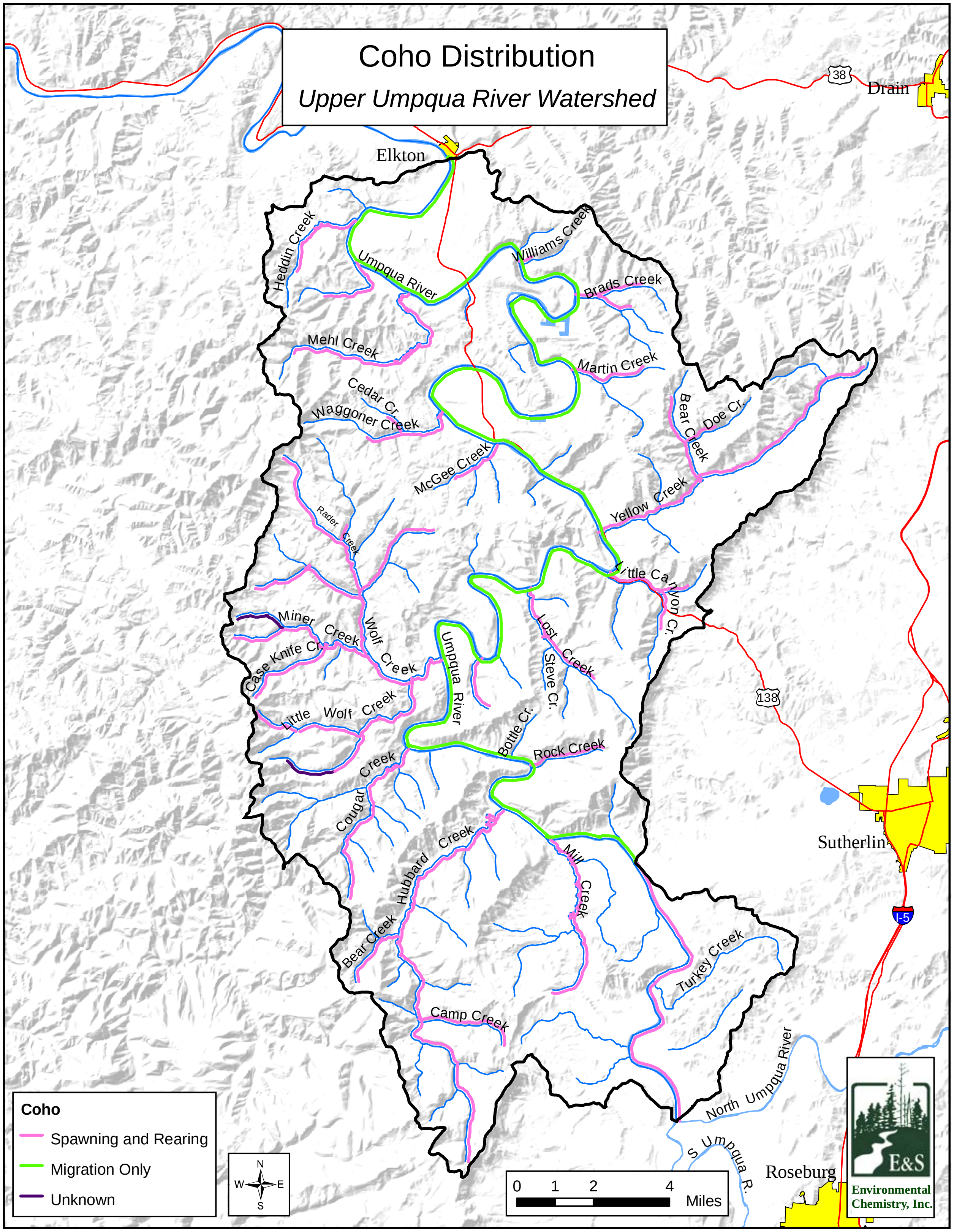
[38] Coho spawning survey data can be requested from the ODFW Corvallis Research Laboratory.
[39] A 95% confidence interval is the range of values within which there is 95% certainty that the exact population value lies. The “estimate” represents the most likely correct population value, based on the data. (see Table 3.26).



Map 3.18. Coho salmon distribution within the Upper Umpqua River Watershed.

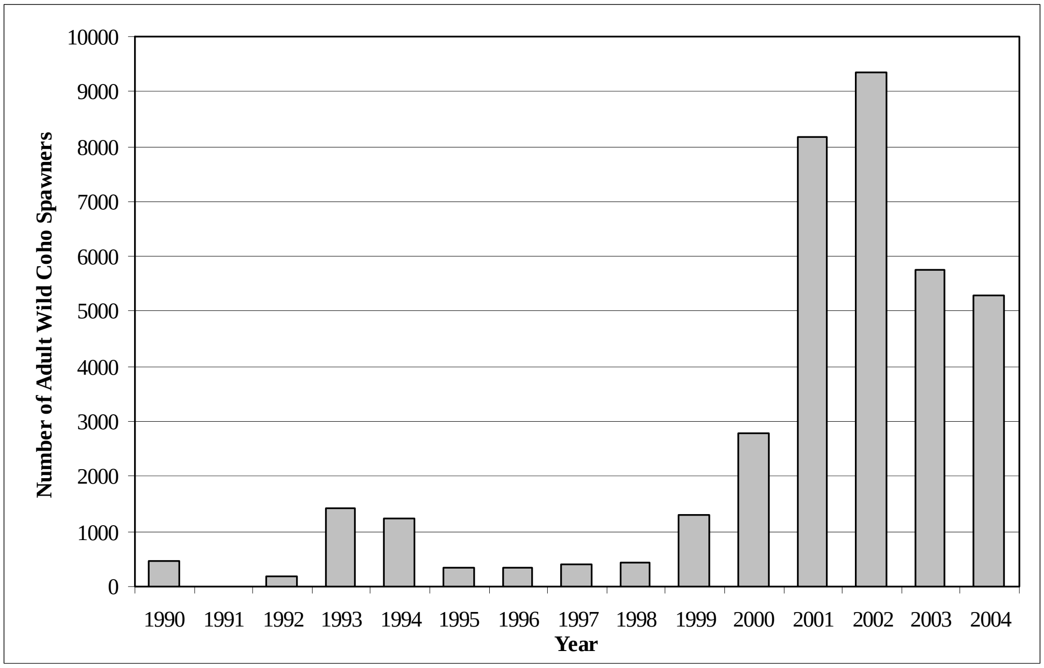


Figure 3.11. Estimates of annual adult wild coho spawner abundance in the mainstem Umpqua River for the period 1990 through 2004. No coho were observed in 1991. Estimates were prepared by ODFW, based on results from randomly-selected spawning surveys.

Table 3.25. Coho spawning counts (live fish) within the Upper Umpqua River Watershed. (Source: ODFW)

Year	Heddin Creek	Hubbard Creek	Little Wolf Creek, Tributary to Wolf Creek	Lost Creek	McGee Creek	Mehl Creek	Rader Creek, Tributary to Wolf Creek	Unnamed Stream [1236126434147], Tributary to Little Wolf Creek	Wolf Creek	Yellow Creek
1996	0	0				1				
1997			5	2		6	0			2
1998		1	9	7	0	13		8	0	
1999		27							0	
2000										
Total	0	28	14	9	0	20	0	8	0	2

Table 3.26. Estimated coho spawner abundance during the 2004 spawning season, based on statistical protocols of EPA's Environmental Monitoring and Assessment Program (EMAP). [40]

Monitoring Area, Basin	Spawning Miles	Survey Effort		Adult Coho Spawner Abundance			
				Total		Wild	
		Number of Surveys	Miles	Estimate	95% Confidence Interval	Estimate	95% Confidence Interval
Coast Wide	4,124	482	449.0	181,376	18,245	176,576	17,969
North Coast	920	113	109.5	34,167	5,959	33,063	5,819
Necanicum R., Ecola Cr., and Midsize Ocean Tributaries	65	8	7.7	3,301	1,238	3,142	1,178
Nehalem R.	505	62	63.1	21,579	4,807	21,479	4,785
Tillamook Bay	187	23	20.9	3,039	1,707	2,290	1,286
Nestucca R.	155	19	17.5	6,248	1,879	6,152	1,850
Sand Lake and Neskowin Cr.	8	1	0.3	0		0	
Mid Coast	1,164	108	102.3	43,214	9,601	40,393	9,246
Salmon R.	75	7	7.7	5,094	3,141	2,374	1,464
Siletz R.	194	18	14.9	6,399	3,041	6,399	3,041
Yaquina R.	108	10	9.3	5,091	3,964	4,989	3,885
Devils Lake, Beaver Cr., and Midsize Ocean Tributaries	54	5	5.4	7,179	4,262	7,179	4,262
Alsea R.	259	24	22.4	6,005	2,291	6,005	2,291
Small Ocean Tributaries	11	1	0.6	49		49	
Yachats R.	22	2	1.1	641	488	641	488
Siuslaw R.	399	37	35.8	8,443	2,658	8,443	2,658
Mid-Small Ocean Tributaries	43	4	5.2	4,315	8,457	4,315	8,457
Mid-South Coast	583	93	83.2	66,704	12,670	66,545	12,652
Siltcoos and Tahkenitch Lakes	50	8	5.2	14,655	10,871	14,655	10,871
Coos R.	213	34	31.8	24,232	7,482	24,116	7,446
Coquille R.	288	46	42.8	22,318	8,077	22,276	8,062
Tenmile Lakes	6	1	0.6	0		0	
Floras Cr., New R., and Sixes R.	25	4	2.8	5,498	5,627	5,498	5,627
Umpqua	1,031	115	104.0	28,139	6,112	27,639	6,028
Lower Umpqua and Smith R.	229	43	39.6	8,046	2,796	8,046	2,796
Mainstem Umpqua R.	223	20	18.9	5,432	2,967	5,309	2,899
Elk Cr. and Calapooya Cr.	134	12	11.8	2,667	856	2,602	836
Cow Cr.	201	18	13.7	2,555	1,208	2,351	1,111
South Umpqua R.	245	22	19.9	9,440	6,281	9,333	6,209
South Coast	426	53	50.0	9,152	2,703	8,936	2,670
Elk R.	8	1	0.5	0		0	
Lower Rogue R.	8	1	0.7	0		0	
Applegate R.	96	12	10.7	2,511	1,279	2,374	1,209
Illinois R.	72	9	7.2	3,181	2,362	3,162	2,348
Mainstream Tributaries	129	16	17.1	844	552	783	513
Little Butte Cr.	48	6	5.7	547	504	547	504
Evans Cr.	64	8	8.2	2,069	1,515	2,069	1,515

[40] Source: http://oregonstate.edu/Dept/ODFW/ spawn/pdf%20files/coho/2004PopEstCoastwide.pdf

Recently, the Oregon Watershed Enhancement Board (OWEB) and ODFW synthesized available information on the status of coho relative to viability criteria and conservation efforts to address factors responsible for decline in Oregon coho populations. Nicholas et al. (2005) concluded that the most important limiting factors affecting coho populations in the Umpqua River sub-basin are stream complexity, water quantity, and water quality. It appears that during the winter months, stream complexity and associated off-channel habitat availability are more important limiting factors than water quality throughout the ESU. However, during periods of good ocean conditions, it appears that Umpqua River coho populations are also limited by summer rearing capacity, which is associated with water quantity and water quality.

3.5.3.3. Chinook Salmon

Within the Upper Umpqua River Watershed, the only known spawning and rearing habitat for chinook salmon is found along the mainstem river. Spring chinook spawn in the uppermost section of the mainstem, within about eight miles of the confluence with the North Umpqua and South Umpqua rivers. Spawning and rearing habitat for fall chinook is found above the confluence with Little Canyon Creek. (Map 3.19). Most of the fall chinook salmon (perhaps 85 to 90%) in the Umpqua Basin spawn in the South Umpqua/Cow Creek portion of the Umpqua system. However, recent data collected using radio telemetry suggest that there may also be substantial numbers of fall chinook spawning in portions of the Umpqua River sub-basin (Moyers et al. 2003). Fall chinook spawner escapement estimates for the entire Umpqua Basin are available for 2001 and 2002. A total of 116 adults and 53 jack chinook were captured and tagged in the Umpqua River sub-basin between July 31 and October 2, 2001. Spawning surveys were conducted from October 14 through November 24, 2001 from catarafts. The estimated spawner abundance in 2001 was 6,612 fish. Data collected in 2002 suggested a total spawner abundance of 13,064 fish (Moyers et al. 2003). The increase in estimated spawner abundance observed in 2002 agreed with data from other basins studied by ODFW. There are also data available on recreational harvest of fall chinook in the Umpqua River and Winchester Bay, based on angler catch cards and limited creel surveys. The annual catch has been relatively stable since 1991, at about 1,000 to 3,000 fish per year (Figure 3.12).

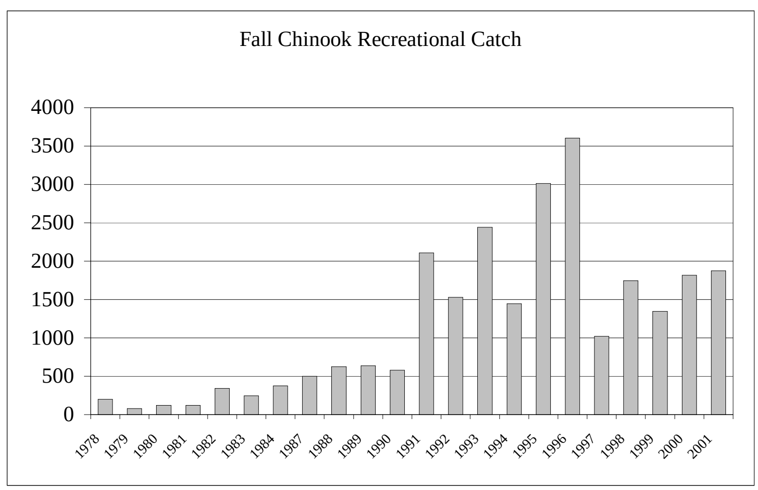
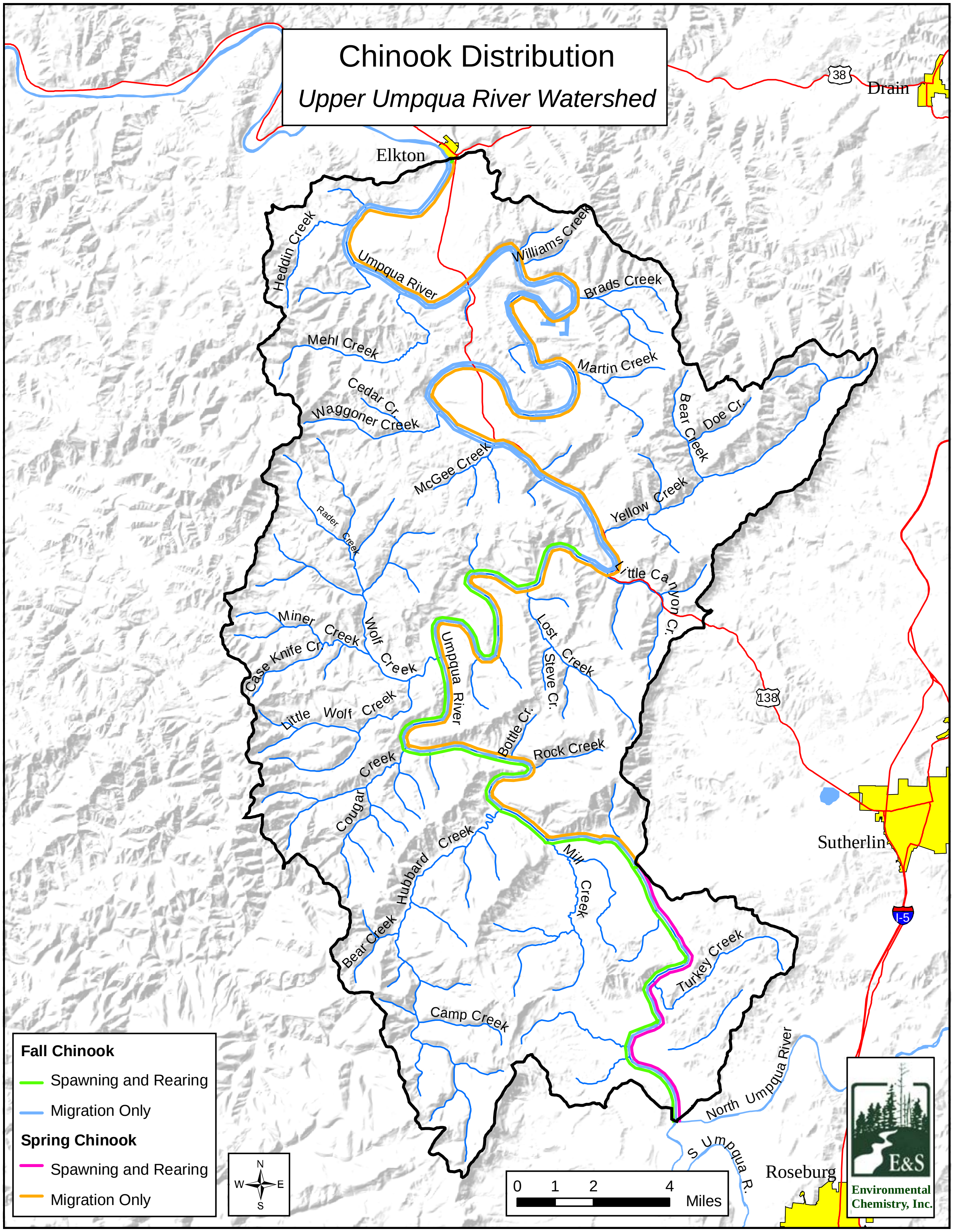


Figure 3.12. Estimated recreational catch of fall chinook salmon in the Umpqua River and Winchester Bay. Data were not collected in 1985 and 1986. (Source: Moyers et al. 2003)

3.5.3.4. Steelhead Trout

Steelhead trout include a resident phenotype (rainbow trout) and an anadromous phenotype (steelhead). Steelhead have a range of life histories, including various freshwater and saltwater rearing strategies and various adult spawning and migration strategies. Juvenile steelhead may rear one to four years in fresh water prior to their first migration to saltwater. Saltwater



Map 3.19. Distribution of chinook salmon within the Upper Umpqua River Watershed.

residency may last one to three years. Adult steelhead may enter freshwater on spawning migrations year round if habitat is available for them, but generally spawn in the winter and spring. Both rainbow and steelhead may spawn more than once. Steelhead return to saltwater between spawning runs. Summer steelhead are not known to spawn in the Upper Umpqua River Watershed, but migrate along the length of the mainstem Umpqua River tospawning areas further upstream. Winter steelhead are widely distributed throughout the Upper Umpqua River Watershed. Winter steelhead generally enter streams from November through March and spawn soon after entering freshwater. Age at the time of spawning ranges from two to seven years, with the majority returning at ages four and five (Emmett et al. 1991). Most of themain tributary streams within the watershed are used for winter steelhead spawning (Map 3.20). The mainstem Umpqua River is used as a winter steelhead migration corridor.

Several studies have been conducted to determine an Umpqua-Basin-wide population estimate for winter steelhead. These studies consisted of 1) using radio telemetry and Winchester Dam counts as a basis for the basin-wide estimate, 2) a Peterson mark/recapture estimate, and 3) population estimates utilizing Area Under the Curve (AUC) methodology.[41]

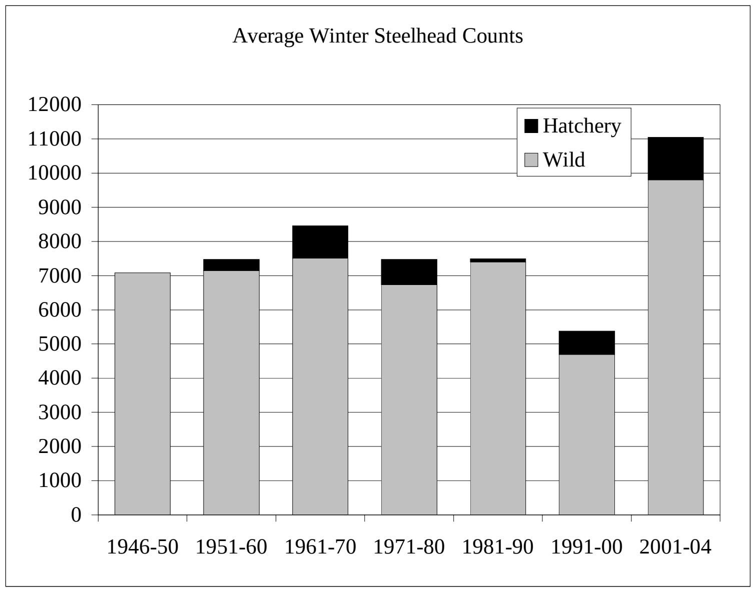
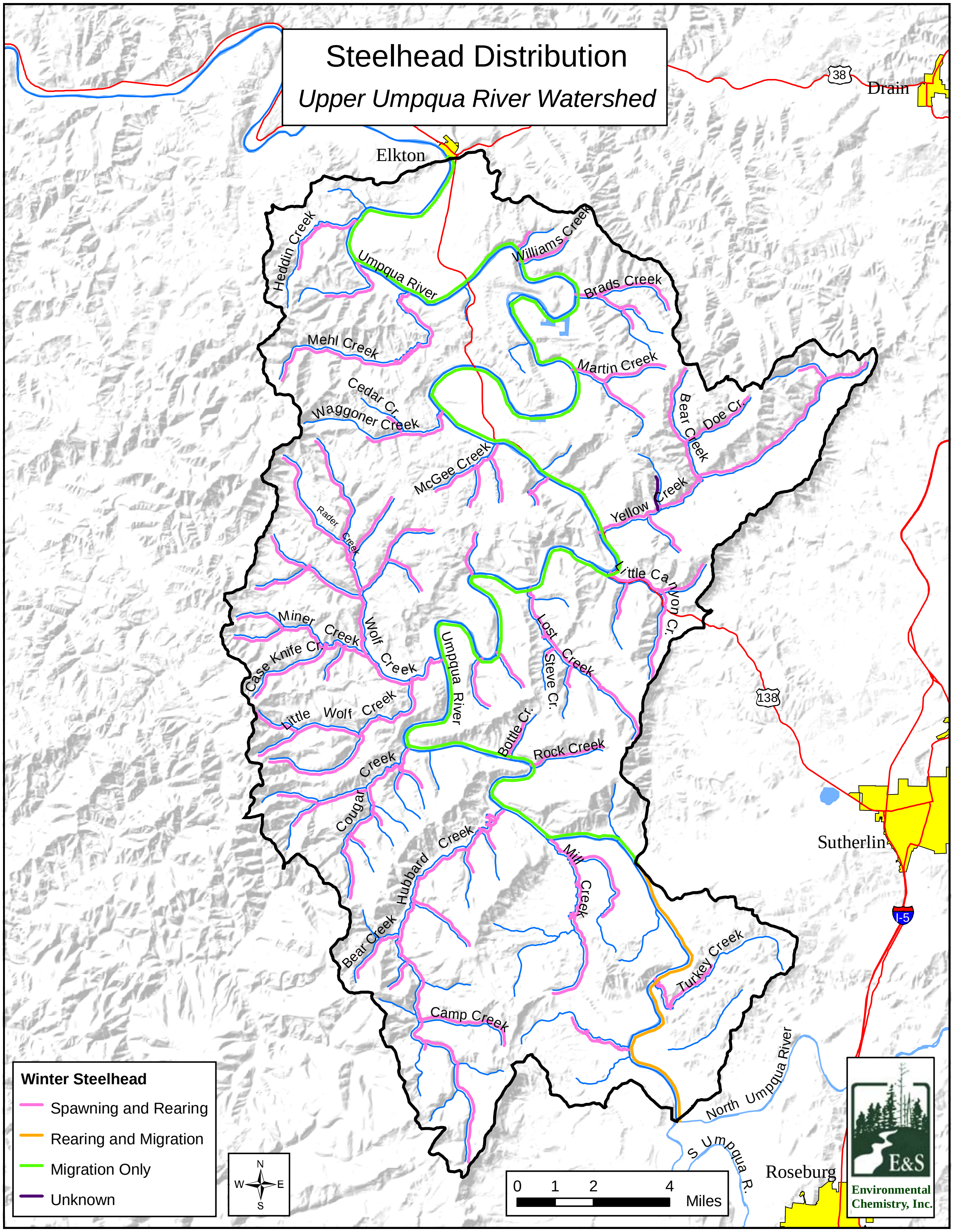


Figure 3.13. Average winter steelhead counts at Winchester Dam Fishway on the North Umpqua River. (Source: ODFW 2005)

ODFW has maintained a long-term fish counting station at Winchester Dam since 1946 (Figure 3.13). Winchester Dam is located on the North Umpqua River at river mile seven. The wild winter steelhead counts for each return year have ranged from a low of 3,928 in 1990/1991 to a high of 12,888 in 2003/2004. The average wild winter steelhead count from 1946 through 2004 was 6,948. Over the last 10 years the average steelhead return passing over Winchester Dam was 6,945 fish.

The distribution of radio tagged fish per year was fairly consistent over the ODFW study period. The three-year average indicated that 54% of the winter steelhead spawned in the mainstem Umpqua River and its tributaries, 24% of the fish entered the North Umpqua River, and 22% of the fish migrated up the South Umpqua River. Winchester Dam counts were then utilized as an index, based on a 24% return rate, to estimate the Umpqua Basin population (Figure 3.14). The population estimate for the Umpqua Basin in 2002/2003 was 35,313 (pre-harvest).

[41] For more information, see *Handbook of Fisheries and Fish Biology* by P.J. Hart. and J.D. Reynolds, 2002.



Map 3.20. Steelhead distribution within the Upper Umpqua River Watershed.

Estimated Umpqua BasinWinter Steelhead Population

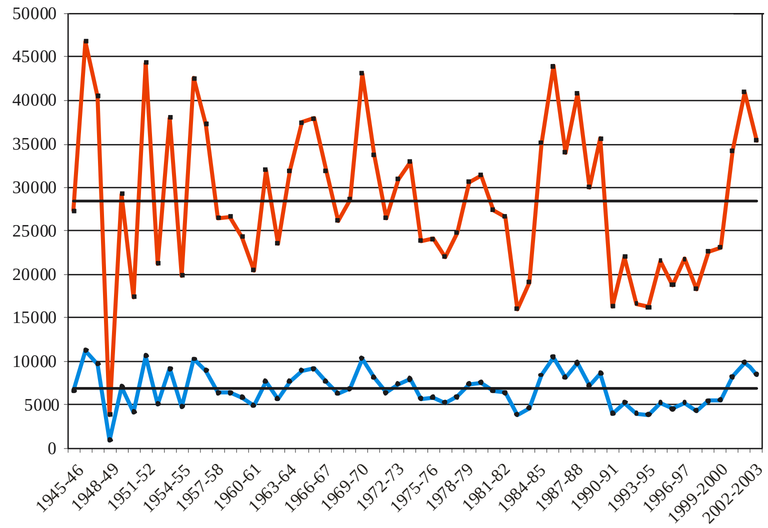


Figure 3.14. Umpqua Basin (red) and North Umpqua River sub-basin (blue) winter steelhead population estimates (excluding Smith River). (Source: ODFW 2005)

Steelhead population data specific to individual tributaries within the Upper Umpqua River Watershed are not as readily available as population estimates for the entire Umpqua Basin. Nevertheless, some tributary steelhead data are available. ODFW surveyed six tributary streams within the watershed in 2004, and the data are summarized in Table 3.27. Density of spawning redds was high (20 redds or more per mile) in Wolf, Little Canyon, and McGee creeks.

Table 3.28 compares the population estimates for the various study designs conducted on the Umpqua Basin. The estimates for the population in run year 2002/2003 are statistically similar. The sample sizes for the telemetry and Peterson mark/recapture studies were limited due to

Table 3.27 Summary of 2004 winter steelhead spawning surveys within the watershed.

Stream	Downstream Reach Boundary	Upstream Reach Boundary	Times Surveyed	Survey Length (miles)	Live Counts	Redds/ Mile
Lutsinger Creek Tributary B	Mouth	Headwaters	11	0.99	5	3
McGee Creek	Mouth	Headwaters	6	1.00	8	20
Little Canyon Creek	Little Canyon Creek Tributary A	Galagher Canyon	8	1.20	2	24
Little Wolf Creek Tributary C	Mouth	Headwaters	8	0.80	0	0
Wolf Creek	Little Wolf Creek	Miner Creek	8	1.65	9	31
Wolf Creek	Miner Creek	Rader Creek	10	1.03	5	341
Bottle Creek	Mouth	Headwaters	9	0.94	3	5

Table 3.28. Comparison of the various winter steelhead population estimates for run year 2002/2003. (Source: ODFW 2005)

Study Method	Population Estimate for the Umpqua Basin	95 % Confidence Interval
Telemetry	35,313 (pre-harvest)	30,268 to 47,083
Peterson Mark/Recapture	36,931 (pre-harvest)	18,244 to 55,618
AUC Spawning Surveys	(24,739 post harvest) + (3198 average harvest) = 27,812 (pre-harvest)	22,155 to 33,469

budget constraints. Studies such as these should be conducted over several years and with larger samples. ODFW has the most confidence in the AUC spawning survey methodology. Whatever the study method, the counts at Winchester Dam are real time and accurate. The telemetry and Peterson mark/recapture are reflective of Winchester Dam counts and therefore add further validity to these population estimates.

The Umpqua River was surveyed for winter steelhead spawning from 2002 through 2005. Counts ranged from 345 spawners in 2005 to 962 spawners in 2004 (Figure 3.15). However, the elusive behavior of adult steelhead pose difficulties in conducting spawning surveys for this species. Therefore, these numbers should be considered only rough estimates.

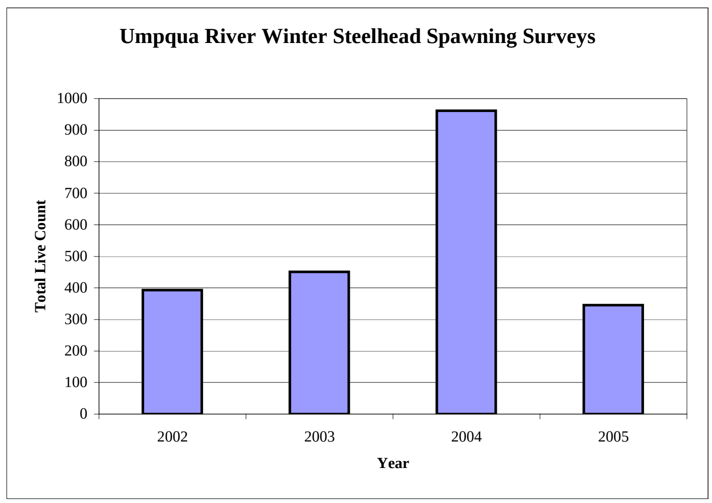


Figure 3.15. Winter steelhead spawning surveys for the Umpqua River.

3.5.3.5. Other Selected Native Fish Species

Both green sturgeon and white sturgeon (*Acipenser transmontanus)* reside in the Umpqua River. They are a primitive, bottom-dwelling fish. White sturgeon can live to over 100 years old, can grow to over 20 feet in length, and may weigh up to 1,500 pounds. Green sturgeon are smaller, reaching up to seven feet in length and 350 pounds in weight. They are anadromous, and prefer to spawn in the lower reaches of swift-flowing rivers with cobble-lined streambeds. The juveniles live in freshwater, feeding on algae and invertebrates, before migrating downstream to the estuary and entering the ocean. They can spawn multiple times, entering the streams every 4 to 11 years. Sturgeon are fished recreationally, although not as intensively as salmon. Very little is known about their population sizes or distributions in the Umpqua River.

Lamprey are among the oldest vertebrates in the world. Four species are recognized in Oregon, three of which are believed to occur in the Umpqua River, although presence of the river lamprey (*Lampetra ayresi*) is uncertain. The Pacific lamprey and river lamprey are anadromous,

and are parasitic during their adult phase, attaching themselves to larger fish, including salmon. The western brook lamprey is not anadromous, living exclusively in fresh water. Juvenile lamprey are referred to as ammocetes or larva. They look similar to worms, are eyeless, and burrow in silt and mud.
After spawning, lamprey bury their eggs beneath sand and gravel. Incubation lasts from 10 to 20 days. A week to a month after hatching, the larva move downstream and construct U-shaped burrows in areas of fine silt, where they remain for three to seven years. As ammocetes, they are filter feeders, gathering their food by straining organic material from the water.

Very little is known about lamprey in Oregon. An estimate of the population size has not been calculated due to insufficient data. There is an on-going study of lamprey at Smith River Falls, but findings are not yet available. The only long-term records of lamprey abundance in the Umpqua Basin are from counts of Pacific Lamprey at Winchester Dam in the North Umpqua sub-basin (Figure 3.16). Pacific lamprey is listed as vulnerable on Oregon's sensitive species list (Kostow 2002). Lamprey redd counts are now being conducted throughout the Umpqua Basin, but results are not yet available.

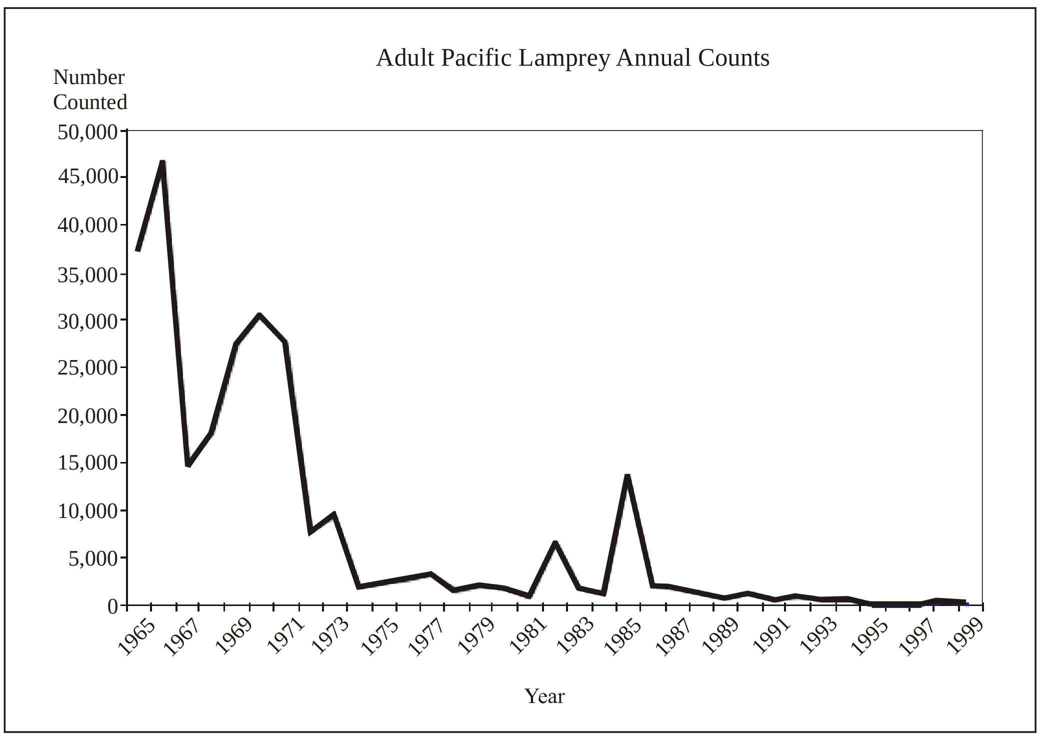


Figure 3.16. Annual counts of Pacific lamprey at Winchester Dam on the North Umpqua River, 1965 through 1999.

3.5.4. Population Trends

The decline in suitable aquatic habitat is frequently cited as an important reason (along with ocean conditions and over-harvest) for the general decline in fish populations over a period of many decades. High-quality aquatic habitat was abundant in the Upper Umpqua River Watershed prior to Euro-American settlement, both in the stream channel and in backwater and wetland areas. The diversity of habitat conditions for fish and other aquatic species was provided by the widespread presence of beavers and the historical array of physical elements in the stream channel, including logs, woody debris, boulders, and gravel.

Adult salmonid returns throughout the Umpqua Basin generally increased over the past five to seven years. Based on spawning survey results, fall chinook populations in the region have generally increased in recent years (Jacobs et al. 2002). This trend may have been due, at least in part, 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 favored 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 storm events. Activities that improve freshwater conditions for salmonids will also help increase fish runs. These activities include removing barriers to fish passage, increasing in-stream flows, and improving critical habitat in streams and estuaries.

Angler harvest reporting data suggested that most coastal steelhead runs were below long-term average levels during the 1970s and 1980s (Nickelson et al. 1992). However, newer restrictions on the harvest of wild steelhead have made it difficult to continue monitoring abundance levels using data from angler harvest reporting. In 2003, ODFW began implementing a coast-wide survey method for estimating winter steelhead spawning by counting redds.

Coastal populations of coho salmon historically have been variable. Recent spawner abundance was lowest in 1997 and highest in 2001 and 2002 (Jacobs et al. 2002). Between 1990 and 2002, coho spawner abundance in Oregon was highest in the mid-south coast monitoring area, which extends from the Umpqua Basin south to Sixes River. The return of coho adults is heavily influenced by conditions in the ocean (productivity and fish harvest). Since about 1998, ocean conditions for coho have generally been good.

Relatively little is known about population trends of Pacific lamprey (anadromous) or brook lamprey (resident), although available evidence suggests that lamprey numbers have declined significantly (Figure 3.16). Fish biologists believe that more lamprey are passing over Winchester Dam than are counted, however. More research is needed to better understand the status of the Pacific lamprey population. A lack of historical population information makes it difficult to assess the relative abundance of current populations. However, anecdotal evidence indicates that lamprey were very abundant, and were a significant food source for native Americans. The Winchester Dam counts indicate a precipitous decline in the population of Pacific lamprey in the Umpqua Basin since 1965 (Kostow 2002).

3.5.5. Fish Populations Key Findings And Action Recommendations

3.5.5.1. Fish Populations Key Findings

- The anadromous fish species in the Upper Umpqua River Watershed with annual runs are coho, winter steelhead, fall chinook, sea run cutthroat, and Pacific lamprey. Cutthroat trout is the only resident salmonid species. Summer steelhead and spring chinook migrate through the watershed to upstream spawning areas.

- Although many medium and large tributaries within the Upper Umpqua River Watershed are known to be used by one or more salmonid species, salmonid ranges have not been verified for each tributary.
- More quantitative data are needed to evaluate salmonid abundance and the distribution and abundance of non-salmonid fish in the watershed.
- Although watershed-specific data show tremendous fluctuation in annual salmonid abundance, Umpqua Basin-wide data indicate that salmonid returns have improved. Ocean conditions are a strong determinant of salmonid run size; however, improving freshwater conditions will also help increase salmonid fish populations.
- A coast-wide EPA study in 2004 found that the Umpqua Basin accounted for more total and wild coho salmon spawners than any other river in Oregon. Many of the coho that comprise the Umpqua Basin population use the Upper Umpqua River Watershed for migration, rearing, and/or spawning.
- In-stream complexity and water quality are the most important limiting factors for coho in the Upper Umpqua River Watershed.
- Very little information exists regarding lamprey and sturgeon, but limited data suggest that population levels are low.

3.5.5.2. Fish Populations Action Recommendations

- Work with local specialists and landowners to verify the current and historical distribution of salmonids in tributaries within the watershed.
- 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. Smaller timber and agricultural interests are concerned about the global market's effect on the sale of local commodities. These groups also struggle 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 Perspectives[42]

4.2.1. Population and Economic Growth

There are no incorporated towns or cities in the Upper Umpqua River Watershed. The community of Umpqua maintains an informal community center in the old school. The watershed is sparsely populated by ranchers, farmers, loggers, hobby farmers, and retirees. The population of the Umpqua community was reported to be 682 in the 2000 census. Information regarding economic growth is unavailable, but trends in the Upper Umpqua River Watershed are probably similar to Douglas County in general.

4.2.2. Agricultural Landowners[43]

Farmers in the Upper Umpqua River Watershed produce a variety of agricultural goods, including hay, berries, fruit, and Christmas trees. Prune orchards were once very common throughout the valley. Several vineyards are also located in the watershed. Livestock operations mostly raise beef cattle and sheep.[44] Almost all agricultural lands are privately held, and most

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[42] 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.

[43] The following information is primarily from interviews with Tom Hatfield, the former 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.

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

are located in valleys and lowlands.[45] Throughout the Umpqua Basin, the agricultural community could potentially have the greatest influence on fish habitat and water quality restoration. Barriers to farmer and rancher participation in fish habitat and water quality activities are limited time, limited money, and in many cases limited awareness or understanding of restoration project requirements, benefits, and funding opportunities.

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 producers are continuing to expand their operations. At the same time, smaller operators who hold outside jobs and agricultural hobbyists are becoming more common.

4.2.2.1. 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.[46] 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 are invested for weed management, reducing profits and possibly driving smaller operators out of business.

4.2.2.2. 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

[45] Many farmers and ranchers are also forestland owners (see section 4.2.3).
[46] Tansy ragwort is less common today than ten years ago, the result of the introduction of successful biological control methods.

killing and maiming livestock.[47] Prior to the 1960s, the US Department of Agriculture (USDA) handled all predator management in Douglas County. The county took over all predator control programs in the 1960s through 1999. Now, the USDA once again handles all predator management.

The populations of cougar and bear appear to be on the rise because of changes in predator control regulations.[48] 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, 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, indicating 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.

4.2.2.3. 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 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.

4.2.2.4. 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 limited 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

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[47] 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.
[48] Cougar populations have been increasing since protection laws were passed beginning in the 1960s. A law was passed in 1994 banning the use of dogs when hunting cougar. Coyote, fox, bobcat, and other predator populations appear to be stable.

US producers must sell their goods at prices barely above production costs. As a result, it is very difficult for small producers to compete with large producers and importers of foreign agricultural goods, unless they are able to circumvent the open market by selling their goods directly to local or regional buyers ("niche" marketing).

4.2.2.5. 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 become increasingly common and profitable family farms and ranches will continue to decline in number.

4.2.3. Family Forestland Owners[49]

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 169,676 acres in the Upper Umpqua River Watershed, approximately 65% are private, most of which are forestlands. Family forestlands most likely constitute a slightly smaller percent of the private non-industrial forests.

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 properties 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, providing critical spawning habitat for salmonids. As such, issues affecting family forestland property management may impact fish habitat and water quality restoration efforts.

Who are Douglas County's family forestland owners? In Oregon, most family forestland owners are older; nearly one in three is 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

[49] 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).

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.

4.2.3.1. 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 re-evaluate 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; hence 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. Many family forestland owners follow the Oregon Forest Practices Act and 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.[50] Should the market for livestock remain low, it is likely that more pastureland will be converted to timber.

4.2.3.2. 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.

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[50] 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.

4.2.3.3. 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.

4.2.3.4. Succession Inheritance

Succession is a concern of many family forestland owners. It appears that most forestland owners would prefer to keep the 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.

4.2.4. Industrial Timber Companies[51]

Most industrial timberlands are located in areas that favor Douglas-fir, tending to be hillsides and higher elevations.[52] 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 Upper Umpqua River Watershed, 65% of the land base is privately owned, the majority of which belongs to industrial timber companies. 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.[53] 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, modified over time 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.

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[51] 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.

[52] Hillsides and higher elevations are often a checkerboard ownership of Bureau of Land Management administered lands (see section 4.2.5) and industrial timberlands.

[53] 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.

4.2.4.1. 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.

4.2.4.2. 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, adding 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.

4.2.4.3. 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 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.

4.2.4.4. 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, and failing culverts are replaced 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.

4.2.4.5. Community Outreach

The population of Douglas County is growing. 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.

4.2.4.6. Regulations

Increased regulations will probably 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 be forced to move their businesses elsewhere, potentially converting their forestlands to other uses.

4.2.5. The Bureau of Land Management

The Roseburg District Office of the Bureau of Land Management (BLM) administers approximately 57,000 acres in the Upper Umpqua River Watershed. The BLM 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. The plan outlines the on-going resource management goals and objectives for lands administered by the BLM. However, shortly after the completion of the Northwest Forest Plan, the American Forest Resource Council filed a lawsuit against the BLM. The major issues concerned the alleged inappropriate application of reserves and wildlife viability standards to Oregon and California Railroad lands (O&C lands). In part because of this lawsuit, the BLM is currently revising its land use plans in western Oregon. During this process, the BLM will develop alternatives that address a variety of issues, including at least one that will propose eliminating reserves on O&C lands, except where threatened or endangered species would be put at risk. The public will have opportunities to review and comment on the revision of the plan at multiple points throughout the process. [54]

4.2.6. Oregon Department of Environmental Quality[55]

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 by:

- 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.

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[54] For more information, contact the Bureau of Land Management Roseburg District Office at 777 Northwest Garden Valley Road, Roseburg, Oregon 97470.
[55] The following information is primarily from an interview with Paul Heberling, a water quality specialist for the Oregon Department of Environmental Quality in Roseburg.

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.

4.2.6.1. 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. Buffers also help downstream water quality by trapping nutrients and preventing stream warming, which can lead to excessive algae growth and interfere with water contact recreation.

4.2.6.2. 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 costs are 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.

4.2.6.3. Current and Potential Future Water Quality Trends

ODEQ's Oregon Water Quality Index (OWQI) program rates water quality, and trends in water quality, based on an established network of 144 monitoring sites throughout the state (ODEQ 2005). The monitored water quality variables include temperature, dissolved oxygen, biochemical oxygen demand, pH, total solids, ammonia and nitrate nitrogen, total phosphorus, and bacteria. Trend analysis was conducted by ODEQ, using the non-parametric Seasonal-

Kendall test, to account for normal seasonal variation. A minimum of thirty data points is required to detect a statistically significant trend (ODEQ 2005).

The only OWQI station in the Upper Umpqua River Watershed is near the unincorporated town of Umpqua. Water quality is generally rated as “good” at this location. The trend in water quality has been stable, neither improving nor declining significantly during the monitoring period from 1986 to 1995 (ODEQ 2005). The monitoring station is located immediately downstream of the confluence of Calapooya Creek, which has been rated as “poor” during the summer, and “fair” during the fall, winter and spring. High levels of fecal coliform, total phosphates, total solids, and biochemical oxygen demand impact water quality in Calapooya Creek. Water quality in Calapooya Creek has exhibited a declining trend. Sources of pollution include agriculture, livestock, and sewage treatment plants at Oakland and Sutherlin that discharge into Calapooya Creek. The Umpqua River dilutes the poor water quality of Calapooya Creek at the confluence, although the water quality rating of the Umpqua River falls from a nearly “excellent” score to the lowest possible “good” score. Other than impacts for Calapooya Creek, water quality in the Umpqua River at Umpqua is generally “good” throughout the year (ODEQ 2005). At the next downstream monitoring station near the town of Elkton, which is just below the Upper Umpqua River Watershed, water quality is rated as “good”, and is slightly higher in quality than at the monitoring station near the town of Umpqua. Impacts of biochemical oxygen demand in the wet seasons, and high water temperature in the summer are still apparent at Elkton (ODEQ 2005).

5. Action Plan

5.1. 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 Umpqua Bay Watershed Council, 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.

5.2. Upper Umpqua River Watershed Key Findings and Action Recommendations

5.2.1. Stream Function

5.2.1.1. Stream Morphology Key Findings

- A wide variety of stream channel habitat types are found in the watershed, and several enhancement opportunities exist.
- Stream habitat surveys suggest that lack of large woody material, poor riffles, and poor or fair pools limit fish habitat in surveyed streams.

5.2.1.2. Stream Connectivity Key Findings

- Dams and culverts that are barriers and/or obstacles to fish reduce stream connectivity, affecting anadromous and resident fish productivity in the Upper Umpqua River Watershed. The density of road/stream crossings is high, providing many opportunities to block fish access. BLM has identified 32 culverts that are currently restricting access to anadromous fish habitat.

5.2.1.3. Channel Modification Key Findings

- There are few examples of permitted channel modification projects in the Upper Umpqua River Watershed.
- Many landowners may not understand the detrimental impacts of channel modification activities or may be unaware of active stream channel regulations.

5.2.1.4. Action Recommendations

- Where appropriate, improve pools and riffles while increasing in-stream 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.

- 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 area conditions.
- 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 high quality fish habitat.
- Increase landowner awareness and understanding of the effects and implications of channel modification activities through public outreach and education.

5.2.2. Riparian Zones and Wetlands

5.2.2.1. Riparian Zones Key Findings

- Conifers dominate 58% of the riparian zone, mainly along tributary streams.
- Few conifers occur along the mainstem river or along the lower reaches of tributaries in the southernmost portion of the watershed.
- Only two-thirds of the stream length in the watershed was classified as having high cover. There are good opportunities to increase stream shading, especially along the mainstem Umpqua River.

5.2.2.2. Wetlands Key Findings

- Historical settlement, development, and long-term agricultural use of the Upper Umpqua River Watershed have probably affected the original wetland hydrology and resulted in loss of wetland areas.
- Most of the remaining wetlands in the Upper Umpqua River Watershed are found on private land along the mainstem river.
- Landowner “buy-in” and voluntary participation must be fostered if wetland conservation is to be successful in the watershed.
- There are opportunities for enhancement and protection of wetlands, including an area of palustrine wetlands in the vicinity of Mill Creek, and riverine wetlands along the mainstem Umpqua River throughout the length of the watershed.

5.2.2.3. Riparian Zones and Wetlands Action Recommendations

- Where canopy cover is less than 50%, establish 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 grass and blackberry and convert these areas to native trees (preferably conifers) and/or shrubs, depending on local conditions.
- Where possible, maintain riparian zones that are two or more trees wide and provide more than 50% cover.
- Encourage best management practices that limit wetland damage, such as off-channel watering, hardened crossings, livestock exclusion (part or all of the year), and provide stream shade.
- Develop opportunities to increase awareness of what defines a wetland and its functions and benefits. This is a fundamental step in creating landowner interest and developing landowner appreciation for wetland conservation.
- Identify or establish various peer-related demonstration projects as opportunities to educate stakeholders.
- Establish an approachable clearinghouse to assist landowners in enrolling in programs that can benefit wetlands and meet landowner goals. A friendly and “non-governmental” atmosphere can reduce some of the previously-identified landowner concerns. A central site can identify and coordinate partners, streamline landowner paperwork, and facilitate securing funding and in-kind services often needed for a successful project. Combining local programs with national programs maximizes flexibility and funding. For example, a landowner could receive a tax exemption under the local Wildlife Habitat Conservation and Management Program, receive technical assistance in planning and cost share from the Natural Resources Conservation Service, and receive grant money from Partners for Wildlife and Ducks Unlimited. The watershed council could sponsor such programs, and provide essential networking services to landowners.

5.2.3. Water Quality

5.2.3.1. Temperature Key Findings

- Much of the mainstem Umpqua River within the watershed is 303(d) listed for temperature.
- Mehl and McGee creeks seldom exceed the water temperature standard for salmonids rearing and migration.
- Tributary streams tend to be about 10^{o}F cooler than the mainstem river.

5.2.3.2. Bacteria, Surface Water pH, Dissolved Oxygen, Nutrients, and Toxics Key Findings

- Bacteria concentrations within the Upper Umpqua River Watershed exceed water quality standards, although recent data collection appears to indicate improvement. More study of bacteria conditions in the Umpqua River will be required. ODEQ has conducted a TMDL analysis to assist in the process of reducing bacterial contamination of the Umpqua River.

- High bacteria concentrations in the mainstem Umpqua River are due mainly to diffuse nonpoint sources of pollution, such as livestock, wildlife, and residential septic systems.
- The levels of pH, nutrients, and dissolved oxygen can be interrelated. In the Upper Umpqua River Watershed, it is unlikely that nutrient and dissolved oxygen levels limit water quality in most locations. However, DO may be a water quality concern in Haines Creek, where DO levels have been found to be below the 8 mg/L DO standard.
- We found no data regarding toxics in this watershed. Insecticides, herbicides, and fungicides are used on some agricultural and forest lands in the watershed, but we are unaware of information regarding the extent of use or impact of these substances in the Upper Umpqua River Watershed.

5.2.3.3. Sedimentation and Turbidity Key Findings

- Turbidity data indicate that usual turbidity levels in the Upper Umpqua River Watershed should not affect sight-feeding fish like salmonids.
- The majority of the soils in the Upper Umpqua River Watershed have low to moderate erodibility. Highly erodible soils are found in the upper elevations in a few tributaries, but represent a small portion of the watershed.
- Steep to moderately steep slopes are found through much of the watershed. Particularly steep slopes exist in the eastern portions of the watershed.
- The combination of steep slope and erosion-inducing human modifications such as roads, timber harvesting, and agriculture can make some areas prone to increased erosion.
- Runoff from impervious surfaces, including roads and roofs, can increase sediment loads to streams.

5.2.3.4. Water Quality Action Recommendations

- Continue monitoring the Upper Umpqua River Watershed for water quality conditions, especially bacteria in the mainstem Umpqua River. Expand monitoring efforts to include more monitoring of 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, when appropriate, improve in-stream 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 development of riparian buffers and managing for full stream canopy coverage.
- Encourage landowner practices that will reduce the bacteria levels:
- Limit livestock stream access by providing stock water systems and shade trees outside of the stream channel and riparian zones. Fence riparian areas as appropriate.
- Relocate structures and situations that concentrate domestic animals near streams, such as barns, feedlots, and kennels. Where these structures cannot be relocated, establish dense riparian vegetation zones to filter fecal material.

- Repair failing septic tanks and drain fields.
- In areas with high debris flow hazards and/or with soils that have high K-factor values and are in the C or D hydrologic group, encourage landowners to identify the specific soil types on their properties and include soils information in their land management plans.

5.2.4. Water Quantity

5.2.4.1. Water Availability and Water Rights by Use Key Findings

- In the Umpqua River above Wolf Creek WAB, in-stream water rights are less than or approximately equal to average streamflow during all months of the year.
- In each of the four tributary stream WABs, in-stream water rights equal or exceed average streamflow throughout most summer and fall months. In particular, water rights exceed average flow in the Mehl Creek WAB for an eight-month period.
- During the summer and fall, there is little or no “natural” streamflow available for new water rights, and water is often over-allocated in the tributary systems.
- Irrigation is the largest use of water in the watershed, accounting for 75.6% of consumptive use. Agriculture (19.5% of total) is the only other water use in the watershed that accounts for more than 1% of the total consumptive use.

5.2.4.2. Streamflow and Flood Potential Key Findings

- Flows lower than the seven-consecutive-day 10-year value of 803 cfs occurred in August of 1924, 1930, 1934, and 1940.
- Major floods during the last century occurred in 1909, 1945, 1950, 1953, 1964, and 1996.
- The degree to which land use influences flood potential in the Upper Umpqua River Watershed is unknown at this time, but is not expected to be substantial.

5.2.4.3. Water Quantity Action Recommendations

- Educate landowners about proper irrigation methods and the benefits of improved irrigation efficiency.
- Educate citizens about the benefits of domestic water conservation and the effects of low flows on the watershed.
- Educate landowners about the implications of water quality listings that do not require a TMDL, such as flow modification.

5.2.5. Fish Populations

5.2.5.1. Fish Populations Key Findings

- The anadromous fish species in the Upper Umpqua River Watershed with annual runs are coho, winter steelhead, fall chinook, sea run cutthroat, and Pacific lamprey. Cutthroat trout is the only resident salmonid species. Summer steelhead and spring chinook migrate through the watershed to upstream spawning areas.

- Although many medium and large tributaries within the Upper Umpqua River Watershed are known to be used by one or more salmonid species, salmonid ranges have not been verified for each tributary.
- More quantitative data are needed to evaluate salmonid abundance and the distribution and abundance of non-salmonid fish in the watershed.
- Although watershed-specific data show tremendous fluctuation in annual salmonid abundance, Umpqua Basin-wide data indicate that salmonid returns have improved. Ocean conditions are a strong determinant of salmonid run size; however, improving freshwater conditions will also help increase salmonid fish populations.
- A coast-wide EPA study in 2004 found that the Umpqua Basin accounted for more total and wild coho salmon spawners than any other river in Oregon. Many of the coho that comprise the Umpqua Basin population use the Upper Umpqua River Watershed for migration, rearing, and/or spawning.
- In-stream complexity and water quality are the most important limiting factors for coho in the Upper Umpqua River Watershed.
- Very little information exists regarding lamprey and sturgeon, but limited data suggest that population levels are low.

5.2.5.2. Fish Populations Action Recommendations

- Work with local specialists and landowners to verify the current and historical distribution of salmonids in tributaries within the watershed.
- 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.

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